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JOURNAL OF THE TRANSACTIONS
OF
THE VICTORIA INSTITUTE.

VOL. XIII.

JOURNAL OF
THE TRANSACTIONS
OF
The Victoria Institute,
OR
Philosophical Society of Great Britain.

EDITED BY THE HONORARY SECRETARY,
CAPT. F. W. H. PETRIE, F.R.S.L., &c.

VOL. XIII.



LONDON :

(Published for the Institute)

E. STANFORD, CHARING CROSS, S.W.

EDINBURGH : R. GRANT & SON. DUBLIN : G. HERBERT.

PARIS : GALIGNANI & CO.

NEW YORK : ANSON, D. F. RANDOLPH & CO.

1880.

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WYMAN AND SONS, PRINTERS,
GREAT QUEEN-STREET, LINCOLN'S-INN-FIELDS,
LONDON, W.C.

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PREFACE.

THE Thirteenth Volume of the *Journal of the Transactions* of the VICTORIA INSTITUTE is now issued. It will be found to contain papers by Professor Birks, M.A. (Professor of Moral Philosophy at Cambridge University), Mr. R. Brown, F.S.A., Mr. T. K. Callard, F.G.S., Mr. J. E. Howard, F.R.S., F.L.S., Professor T. McK. Hughes, M.A. (Woodwardian Professor of Geology at Cambridge University), President Noah Porter, D.D. (President of Yale College, United States), the Rev. Principal Rigg, D.D., Dr. J. S. Southall, M.A., United States, and the Rev. J. P. Thompson, D.D., LL.D., United States. The discussions have been enriched by the addition of supplementary papers from His Grace the Duke of Argyll, K.G., Professor Boyd Dawkins, F.R.S., the Rev. J. M. Mello, M.A.—well-known in the Geological world for his investigations among the caves of Cresswell Crags,—and others. To all who have thus contributed to the success of the Institute's work, the best thanks of the Members and Associates will gladly be accorded.

It will be observed that papers upon geological questions held to have a bearing upon the statements of Scripture, form a special feature in the present volume. For some years the Institute has encouraged research bearing upon the question of the "Antiquity of Man," more especially because

the extreme views incautiously advanced by many, tended alike to injure the cause of Science and those higher interests with which the Society has also identified itself. In carrying out these geological researches the Institute has sought, in pursuance of its primary object, "to investigate fully and impartially." In the present state of the controversy we can only discern that cautious accurate inquiry, and an avoidance of imperfect generalizations and hasty conclusions, will promote the cause of *Truth*, and bring Science back into greater harmony with Revelation.*

Of late, men of science have often found reason to urge that there is a real necessity for the use of greater caution and an avoidance of hasty conclusion in regard to matters of Scientific investigation, and we venture to quote the following remarks in this direction made by Professor Virchow, when recently alluding to the Darwinian hypothesis:—

"We cannot pronounce it to be a conquest of science that man descends from the ape or from any other animal. We can only indicate it as an hypothesis, however probable it may seem. Let us hope the men of science in England will not fail to examine this most serious question—whether the authority of science will not be better served if it confines itself strictly to its own province, than if it undertakes to master the whole view of nature by the premature generalization of theoretical combinations. We must really acknowledge that there is a complete absence of any fossil type of a lower stage in the development of man. I am bound to declare that any positive advance which has been made in the province of pre-historic anthropology has actually removed us further from the proof of such connection—namely, with the rest of the animal kingdom."

The present Volume will also be found to indicate the first success of the new arrangements for securing the greater usefulness of the Journal of Transactions to country and foreign Members, and affording them facilities for contributing papers

* Volume XIV. will contain a paper upon this subject by one who now stands foremost in the scientific world.

and expressing their opinions upon the subjects brought before the Institute.

These new arrangements have not only tended to increase the value and usefulness of the Journal to country and colonial Members, but have, as a consequence, facilitated the extension of the Institute abroad, as will be evident when we mention that during the past two years nearly one-third of the new Members have been American or Colonial; that there is a necessity for such extension, and that the Society is welcomed in America and the Colonies, many have testified.

F. PETRIE,

Hon. Sec. and Editor.

31st December, 1879.

JOURNAL OF THE TRANSACTIONS
OF THE
VICTORIA INSTITUTE,
OR
PHILOSOPHICAL SOCIETY OF GREAT BRITAIN.

ORDINARY MEETING, APRIL 1, 1878.

C. BROOKE, Esq., M.D., F.R.S., V.P., IN THE CHAIR.

The Minutes of the last Meeting were read and confirmed, and the following Elections were announced :—

LIFE MEMBERS :—A. Gibbs, Esq., M.A., Somerset ; Rev. F. A. Wigram, M.A., Southampton.

ASSOCIATES :—The Rt. Rev. the Bishop of Fredericton, Canada ; Rev. Canon Mather, M.A., Bristol ; Rev. H. T. Simpson, M.A., Cheltenham ; Mrs. A. Christian, Southport.

HONORARY LOCAL SECRETARY :—W. R. Cooper, Esq., 7, Trinity-terrace, Ventnor.

Also the presentation of the following Works for the Library :—

- | | |
|---|-------------------------------------|
| “Transactions of the Royal Society.” Part 185. | <i>From the Society.</i> |
| “Warwickshire Field Club Transactions, 1877.” | <i>From the Club.</i> |
| “Animal Construction and Adaptation.” | <i>From C. Brooke, Esq., F.R.S.</i> |
| “Chalmers’ Astonomical Discourses.” | <i>Ditto.</i> |
| “Popery in alliance with Heathenism.” By J. Ponder. | <i>Ditto.</i> |
| “Dr. Stroud on the Death of Christ.” | <i>Ditto.</i> |

The following Paper was then read by the Author :—

MODERN GEOGONIES EXAMINED IN THEIR BEARINGS ON THE ANTIQUITY OF MAN. By the Rev. Professor BIRKS, M.A.

I.—INTRODUCTION.

THE charge of error, freely brought in these days against the statements of the Bible concerning Creation and the Origin of Man, has been based on alleged scientific proofs of the high antiquity of the human race. When full allowance has been made for the various readings of the Hebrew and the Septuagint, it is perfectly clear that the Bible date for Adam's creation cannot be placed further back than seven or eight thousand years ago. These are no separable accidents, but main and integral parts of the grand message, that Adam was the first father of all men, that in him all die, through a common fall from innocence and uprightness, and that all are brought within the range of one great redemption, wrought by Jesus Christ, the Second Adam, the Lord from heaven.

Clergymen, as well as laymen, are now found who set aside these statements, as if they were only superstitious errors, which growing light and knowledge have disproved. A special sanction and currency has lately been given to this view, which many Christians must regard as a blow aimed directly, however unwittingly, against the historical foundation of the whole message to sinful man in the Word of God. The importance of the question thus raised is extreme. I propose in this paper to carry further the course of thought in two former papers read before this Society, and to analyze the data upon which some have reared a conjectural pre-Adamite human history of two hundred thousand years.

2. The modern doctrine of Man's high Antiquity rests mainly on two premises, though these are supplemented by other

presumptions of a secondary kind. First, certain flints from Brixham Cave, the valley of the Somme, and caverns in Belgium, are affirmed to have been plainly fashioned into tools, spears, or hatchets, by the hands of savage men. And next, the beds of gravel or stalagmite, where they were found, are said to have been deposited many myriads of years ago. Human deposits are thought to occur in quaternary strata or drift, directly after the close of a great ice period. This period, again, has three different estimates of its remoteness by different geological speculators. One of them assigns two glacial periods to the dates 13,000 and 44,000 years before Christ. Another offers the dates 210,000 and 850,000 years B.C. for a Post-Pliocene and a Miocene glacial period, while others have suggested a date still more remote for man's first appearance on the earth.

3. Mr. Whitley, in two able papers read before this Society, denies even the first premise. The so-called flint implements were formed, he thinks, by the natural change of flint nodules broken under strong pressure. He offers many reasons—from their position, their great number, their relation to the neighbouring beds, and the effects of artificial fracture, to support this view. Mr. Pattison agrees with Mr. Whitley as to a large proportion of the alleged implements, but admits that some are apparently of human origin. He maintains, however, on a full review of all the features both of Brixham Cave and the valley of the Somme, that six or seven thousand years are time enough to account for all the later changes. Mr. Callard, in his short and able essay on the Geological Evidences of Man's Antiquity, argues forcibly for the same view. Whether or not Mr. Whitley is right in his denial of an artificial origin to each and all the so-called implements of the Drift, I think that Mr. Pattison and Mr. Callard are fully justified in their dissent from the other main premise of the theory. It may be shown that there is no scientific proof of these immense ages since the close of a real or imaginary glacial epoch, but only a series of mere conjectures, based on wholly inadequate data; and a more probable theory than any of those hitherto offered would reduce the distance of man's first appearance within a limit in complete harmony with the Scripture statement. Man has, doubtless, been contemporary with many animals now extinct; but this can never prove his entrance on our planet to have been 200,000 or even 20,000 years ago.

The theories I shall examine in succession are these:—First, Sir C. Lyell's doctrine of uniformity; secondly, the thermodynamic theory of Sir W. Thomson; thirdly, the excentric-pre-

cession theory of Lieut.-Col. Drayson, who refers it to a great increase in the obliquity; and, fourthly, the view advocated with great labour and ability by Mr. Croll, in his work "Climate and Time." He there employs more than 500 pages in attempting to prove that a series of glacial periods have been due to successive maxima of excentricity of the earth's orbit during a space of three millions of past years.

II.—THE DOCTRINE OF UNIFORMITY.

4. The title of Sir C. Lyell's work is "Principles of Geology; or an Attempt to Explain the Former Changes of the Earth's Surface by Reference to Causes now in Operation." And he recommends an "earnest and patient endeavour to reconcile the former indications of change with these existing causes." And in Mr. Page's Advanced Text-book we are told, "When such hypotheses as nebular condensation, igneous fluidity, change of axis, secular contraction of the earth's mass, highly carbonated atmosphere, passage of the system through colder and warmer regions of space, are advanced to account for geological phenomena, the student must receive them as mere hypotheses, not as the true and sufficient causes of inductive philosophy. The legitimate progress of science lies over a pathway of observation, fact, and deduction, and is little aided by conjecture, however plausible. Let us strive first to exhaust the range of normal causation in existing nature, and even then continue to work and watch, rather than fall back on the idle and unphilosophical resort of abnormal conditions in primeval nature." And, again, p. 374, "There are two great schools of geology, the one ascribing every result to the ordinary operations of nature, combined with the element of unlimited time; the other, appealing to agents that operated during the earlier epochs of the world with greater intensity, and over wider areas. The former belief is certainly more in accordance with the spirit of right philosophy, though it must be confessed that many problems in geology seem to find their solution only through the admission of the latter hypothesis." And Sir C. Lyell, in his "Treatise on the Antiquity of Man," though his statements are indefinite, says, that the historical period seems "quite insignificant in duration, when compared with the antiquity of the human race" (p. 289), "and that natural barriers would ensure the isolation, for tens of thousands of centuries, of tribes in a primitive state of barbarism" (p. 386). This implies a con-

viction of man's past existence on earth for several millions of years.

5. Here, in the fundamental maxim assumed, there is a serious ambiguity. What is meant by "causes now in operation"? Does it mean simply the central forces, the attractions and repulsions, varying by certain laws of distance, of all the bodies or their component atoms that now exist? If so, the doctrine becomes only a sort of truism. The sudden bursting of a reservoir, the explosion of a magazine, the firing of a broadside, or a volcanic eruption, are as much from causes now in operation, as the quiet state, with no sudden or sensible change, which may have gone before, and lasted months or years. But if we mean by causes now in operation, all acting forces, with merely the same conditions as now exist, which vary with every hour, day, and year of their own action, the maxim is unphilosophical and untrue. We should explain the changes of the earth by causes acting under the conditions of the time when they occurred, and not under new conditions which may have come into being, through the action of those very causes, after many thousands or myriads of years.

6. Averages give a fair approximation, or are wholly fallacious, according to the nature of the facts to which they are applied. They are safe, chiefly when they are taken between two observed limits, since a small part of any curve does not vary widely from the line which joins its extreme points. In many cases the error may not be great for parts which lie beyond this limit, on one side at least. But let a chord of a hyperbola, near the vertex, be prolonged towards the vertex a hundred times beyond its own length, the distance from the answering point of the curve will be very great, and the two will be tending in wholly opposite directions.

Now most of the cases to which the law of averages has been applied by uniformitarian geologists are of this very kind. Each step of past change tends to lessen the motive power on which the future changes depend. Thus every river transports a certain amount of soil in suspension from the high ground near its sources or from the bed through which it travels to the sea. But every year the high ground is wasted, the mouth is silted up, and the soil probably hardens and becomes less easy to remove. The quantity annually carried down will thus diminish for three different reasons. It will also come to be spread over a wider area. Hence the present depth of the annual deposit is no proper test by which to give the average for many thousand years.

7. Let us take one case often referred to,—the Delta of the

Mississippi. Sir C. Lyell, from the present amount of solid matter conveyed by it, and the area and depth of the accumulation near its mouth, inferred that 67,000 years would be needed for the Delta proper, and 33,000 more for the plain above to be transported to its present site. Hence he speaks of the whole period as "perhaps far exceeding 100,000 years." But in 1869 he says that "the data had considerably altered since first he wrote. Recent calculations had doubled the volume of water flowing into the sea, and thus the same effect might be produced in half the time previously calculated." Thus 50,000 years were struck off by the first correction.

But now let us assume, instead of a fixed annual amount of detritus, that there has been a steady decrease of only one four hundredth part of the present quantity. The 50,000 years would then reduce themselves to 5,937, which would bring the commencement of the process within the limits of the known or biblical age of mankind.

8. Again, Mr. Croll makes a calculation, that the same river at its present rate would carry down the whole area drained by it to the sea-level in $4\frac{1}{2}$ million years. But, adopting a similar law, or supposing the decrease each year to be only one part in a thousand of the present amount, how long would have been needed to waste away a double quantity of land or rock to its present amount? Rather less than 94,000 years.

The same principle applies to the mud of the Nile, and a vast number of cases of a similar kind. The doctrine of averages, when so applied, rests on a mere assumption, not only unproved, but highly improbable, and almost certainly untrue. In a single year of high flood a river may transport an amount and kind of material, which could not have been removed by a hundred years in which no flooding has occurred.

9. The case is the same as to upheaval and volcanic eruptions. It is plain that whenever the crust is broken through, and a stream of lava, before pent in, comes from below, the motive force must tend to exhaust itself by the effort. The heat, generated by internal pressure, will partly escape through the opening, while the pressure also is lessened by the rupture of the crust. The approach must be constantly towards a limit, when the upward and expansive force has spent itself, and though the renewal may have gone on through long ages, the first intensity or amount of action can never return. The process of condensation, with the generation of internal heat, and its conflict with the cooling ocean at the surface, or the intense cold of the interstellar

spaces, has a natural limit, beyond which it cannot go, and to which it must approach more and more slowly as the change proceeds.

III.—THE THERMO-DYNAMIC THEORY.

10. The doctrine of uniformity, in its extreme form, as held by Sir C. Lyell and many others, has found of late some strong opponents among our foremost analysts. Sir W. Thomson and Professor Tait would replace it by what may be called a Thermo-dynamic theory. They maintain that the solar energy is in process of constant dissipation, and that hypotheses assuming an average constancy of sun and storms for a million years "cannot possibly be true." It is quite certain, Sir William thinks, that the solar system cannot have gone on as at present for a few million years, without the irrevocable loss, by dissipation, of a very considerable portion of the entire initial energy. He calculates, from Fourier's theory of the rate of conduction, and the specific heat of rocks at Edinburgh and Greenock, that the consolidation of the earth's crust cannot have taken place less than 20 nor more than 400 millions of years ago; also that the general climate cannot have been sensibly affected by conducted heat from the centre, except within the first 10,000 years after the solidification, and that in 96 millions of years the thickness of the crust, through which a given amount of cooling would be experienced, would have increased fivefold. He admits that a wholly different view is maintainable, that internal heat is due to chemical combination, going on slowly everywhere at great unknown depths, and creeping onward gradually as the chemical affinities of each layer are saturated. But he thinks also that "the less hypothetical view, that the earth is merely a warm, chemically inert body, cooling, is clearly to be preferred in the present state of science."

11. The objection may be urged, that the earth cannot well be supposed ever to have been a solid, uniformly heated, and 7,000° warmer than the present heat of the surface, which is the hypothesis assumed. But Sir William replies that the solution may be easily modified, to meet the case of a liquid gradually becoming solid, *at least when three fresh data have been supplied*. And he argues further that the earth, "although once all melted, did in all probability become a solid at its melting temperature all through, or all through the outer layer which had been melted; and that not until it was thus completely solidified, or nearly so, did the crust begin to cool."

12. It is clear, from this very statement, how much remains merely hypothetical in this solution, on which the calculation of the age of the earth's crust is to depend. Professor Tait has since replaced the estimate of the limits of 20 and 400 millions of years by a suggested period of 10 millions only. In the statement quoted it is owned that three further data must be supplied, before the solution can be altered so as to suit the real conditions. The view, which Sir William rejects as more hypothetical, that the heat is generated by chemical change, seems to me less hypothetical and more natural than his own; and needs only to be carried a step further and applied to the formation of the chemical elements themselves, by pressure, to supply a far more complete solution of the great problem.

The rejection of uniformity of action through many millions of years is justified, I conceive, on many grounds. But instead of grounding it on the certain steady decrease of solar heat by exhaustion and dissipation, I think it may be based more reasonably on the opposite ground of its increase. For if the present amount has ensued after solar condensation, and the sun was once a diffused mass of low temperature, variation by increase for long ages must be one constituent element of the theory; but a reversal of the process, and a greater loss than gain of heat for many millions of years must be wholly improbable in the absence of any direct experimental evidence.

13. Those theorems of Fourier, on which the reckoning is based, all rest on the hypothesis that the heat transferred from a hot to a cool body is strictly as the difference of their temperatures, and that the temperature is the quotient of the amount of heat in any body, divided by the mass. This implies the hypothesis that heat is a specific fluid. For it reasons as if the total heat of the system, between the parts of which conduction takes place, were a fixed quantity, not capable of increase or diminution, by forces generating motion, or motion being extinguished by expansion. But the opposite view, the doctrine of Bacon and Rumford, that heat is simply atomic motion, is now fully established, and Sir William is one of those who have had no mean share in its confirmation. Hence the conditions of the problem of conduction, for long periods, must be wholly altered. There is no longer a fixed amount of heat, of which a small part is transferred by a definite law from a hot to a cooler body. It may be generated in the one by condensation, and conversely by expansion be destroyed in the other to an unknown extent. Potential may be turned into kinetic energy on one side, and on the other kinetic into

potential. There may thus be both an indefinite demand, and an equally unlimited supply. The real problem will depend mainly on these two elements, which are entirely absent in the solution Sir William has proposed. The calculation is really a partial survival from that fluid-caloric theory which is now universally abandoned.

14. The doctrine of uniformity, as held by Sir C. Lyell, rests on a confusion of two things wholly distinct,—the constancy of natural laws, such as gravitation and cohesive affinity, and the sameness of the conditions under which they operate at widely separated periods of time. But these conditions are changing hourly through the action of the laws themselves, and the difference in the course of ages becomes so great as wholly to falsify any conclusions which are based on the assumption of their near approach to identity. I fully agree, then, with Sir W. Thomson, in his protest against that theory; but I cannot accept, as reasonable or true, the special ground on which he bases his opposition. Mr. Croll sets the two doctrines in contrast in the following passage, which shows the immense scale of time adopted by uniformitarian theorists.

“It was the modern doctrine that the great changes undergone by the earth’s crust were produced not by convulsions of nature, but by the slow and almost imperceptible action of sun, rivers, snow, frost, ice, which impressed so strongly on the minds of geologists the vast duration of geological periods. When it was considered that the rocky face of our globe had been carved into hill and dale, and worn down to the sea-level by these apparently trifling agents, not once or twice but many times, in past ages, it was not surprising that the views entertained by geologists on the immense antiquity of our globe should not have harmonized with the deductions of physical science. It had been shown by Sir W. Thomson and others, from physical considerations of the sun’s heat and the secular cooling of our globe, that the history of the earth’s crust must be limited to a period of something like a hundred millions of years. But these speculations had little weight when pitted against the stern and undeniable fact of subaërial denudation. How were the two to be reconciled? Was it the physicist who had under-estimated geological time, or the geologist who had over-estimated it? Few familiar with modern physics, who have given attention to the subject, would admit that the sun could have been dissipating his heat at the present enormous rate for a period much beyond a hundred millions of years.”

15. In this conflict of the two theories, I believe that there

is an almost equal error on each side. Each theory is based on data wholly insufficient to establish its truth. The doctrine of uniformity, I believe, is untrue for many reasons, but not for the reason which Mr. Croll, following Sir W. Thomson, has assigned. There is no proof that the sun was much hotter a hundred or fifty millions of years ago than at present. If there be a difference, which is probable, I think it much more likely that it would be of an opposite kind, and that its heat has increased by condensation, more than it has lost by dissipation. In the "Theory of Helmholtz," which Sir William has latterly espoused, having abandoned Meyer's meteoric hypothesis, the heat of the sun is now thought to be supplied by condensation, which replaces the ceaseless waste from dissipation or radiation into space. Now if the sun has reached its present high state of heat and light from an earlier stage, when it was neither hot nor luminous, what proof can there be that the process has been reversed for the last million of years, and the waste exceeded the supply for so long? But this very idea, that all the heat radiated into space is dissipated and lost, is an assumption without solid reason. If it arose at first from a transformation of potential into kinetic energy, or attractive force into motion, by the condensation of the solar mass, it can only cease or be lost by a reconversion of this kinetic energy into potential energy of another kind; namely, the condensation of repulsive ether. Thus the energy which flows out from the sun as sensible heat and light, in the sector of space bordering on the sun's equator, will return to it invisibly and insensibly, in the neighbourhood of the poles, and the sun would thus be an immense magnet by virtue of its revolution.

16. The general climate of the earth, Sir W. Thomson further remarks, "cannot have been sensibly affected by conducted heat, at any time more than ten thousand years after the solidification of the surface." This may be true, if we take the phrase "conducted heat" in a rigorous sense, and exclude all liquefaction, convection, regelation, or fresh generation of heat by condensation from pressure or chemical change. But these omitted or excluded elements are those of chief importance in the actual problem. A solution which omits them may be true as an abstract dynamical theorem, but can have little bearing on the actual course of geological change.

17. The first volume of Sir W. Thomson's and Professor Tait's comprehensive "Treatise on Natural Philosophy" closes with these remarks on the once current hypothesis of the earth's fluidity below a thin superficial crust.

“These conclusions, drawn from a consideration of the necessary order of cooling and consolidation, according to Bischoff’s results on the relative specific gravity of solid and melted rocks, are in perfect accordance with §§ 832—849, on the present condition of the earth’s interior; that it is not, as commonly supposed, all liquid within a solid crust from thirty to one hundred miles thick, but is, on the whole, more rigid than a solid globe of glass of the same diameter, and probably than one of steel.”

The investigation here alluded to seems to me decisive against the doctrine of the earth’s central fluidity, and carries to a further point the conclusion of Mr. Hopkins, thirty years ago, from the phenomena of nutation and precession. It accords with my own inference from an hypothesis wholly distinct. But while I think that Sir William has disproved the notion of the central fluidity of the earth, and justly rejects the notion of geological uniformity for many hundred millions of years, I wholly dispute the soundness of his doctrine, that the date of the formation of the crust can be defined by “Fourier’s Theorems” on conducted heat, or that the waste of solar heat is in constant excess over the fresh supply. In fact, the doctrine of uniformity would be equally untrue, whether the light and heat of the sun have increased or diminished sensibly in the course of a million years.

IV.—THE TRANSLATION THEORY.

18. Another view has been suggested by Poisson, to account for past changes in the earth’s climate, and warm and glacial periods,—the earth’s translation through hotter and colder regions of space. This does not need to detain us long, as there seem to be very simple and decisive reasons against it. Mr. Croll has thus given them briefly and clearly in a few words.

“This is not a very satisfactory hypothesis. . . . Space is not a substance which can possibly be either hot or cold. If we adopt this hypothesis, we must assume that the earth, during hot periods, was in the vicinity of some other great source of heat and light beside the sun. But the proximity of a mass of such magnitude as would be able to affect to any great extent the earth’s climate, would, by its gravity, seriously disarrange the mechanism of the solar system. If it had ever, in a former period, come into the vicinity of such a mass, the orbits of the planets ought to afford evidence of it. But again, to account for a cold period, like the glacial epochs, we must assume the earth to have come near a cold body. And recent discoveries with regard to interglacial periods are wholly irreconcilable with this theory.”

19. But while this translation theory of Poisson is both vague and inadequate, and wanting in direct evidence, the fact of the movement of our system in space is a strong reason against the uniformity assumed by many geologists to have lasted through many millions of years. The rate of the sun's motion in space is held to be 150 millions of miles a year. This would carry it as far as α Centauri, the nearest star whose parallax is determined, in 140,000 years. The direction prolonged backward has its apex only 25° from Sirius, the brightest of all the stars, and of which the light has been reckoned to be 60 times greater than that of the sun. Its parallax is $\frac{2.3}{100}$ of a second. It has been lately inferred from the spectroscope that we are receding from Sirius at the rate of 25 miles a second, or 800 millions in a year, so as to traverse the whole distance in 100,000 years. And since we cannot tell whether the earlier motion may not have varied so far in its direction, we can have no assurance that all the elements of our system may not have been altered by the proximity of Sirius only one hundred thousand years ago. All estimates of solar force and the earth's inclination and eccentricity which go back beyond this limit must remain highly uncertain on this ground alone, and are beyond the range of assured and certain science.

20. Two other theories may be also dismissed in few words. First, that of an altered axis of rotation, so that the north and south poles of the diurnal rotation were at places considerably remote from those which they now occupy. But this is rendered all but impossible by the spheroidal shape of the earth. At any time, after the crust had once hardened and taken a spheroidal form, revolution on any axis, not adjacent to the present one, must have been mechanically impossible. Any secondary change of surface by the uprising of a mountain-chain might produce an increased nutation and a kind of waddling motion around the true axis, but it could not alter the place of that axis, or produce any sensible effect on the climate of any main parts of the surface.

21. Another theory of the same kind is Sir C. Lyell's transposition theory. He supposes that the mean temperature would be raised if the land were mainly in the torrid zone, and be lowered if it were grouped around the poles. Mr. Croll argues that the effect would be diametrically opposite, and that the contour of the surface most favourable to the warmth of the earth is when the water is in all the middle part, and the land only at the poles. Now it is difficult to reason out all the consequences as to the mean temperature of the whole surface. The mere fact that two such opposite

views have been held suggests a doubt whether either can rest on sure scientific grounds. The one thing which seems clear and certain is, that a structure like that of our globe with two main oceans extending almost unbroken from the south to the north pole, over three-fourths of the whole surface, is the arrangement most favourable to a mitigation of fierce extremes, and to fit our world for human habitation. At the same time, since the glacial epoch belongs to a stage of geology when the outlines of land and water were nearly the same as now, it is perfectly clear that no difference in their relative arrangement can serve to account for a much lower or a much warmer temperature than has obtained in the known historical period of the world.

V.—VARIED INCLINATION THEORY.

22. Another theory of a more definite kind is advocated by Lieut.-Colonel Drayson, in his work entitled "The Cause, Date and Duration of the Last Glacial Epoch of Geology." He places the period of maximum glaciation 13,700 years before Christ, or 15,500 years ago. Such a view, if it were established, would plainly be much more reconcilable with the Bible chronology for the date of man's appearance on the earth than the opinions just examined. But I believe that it rests on a fundamental mistake which it is not difficult to place in a clear light. Mr. Croll remarks on it as follows:—

"The theory is beset by a twofold objection. First, it can be shown from celestial mechanics that the variations in the obliquity must always have been so small that they could not affect the climatic condition of the globe. Secondly, even admitting that the obliquity could change to an indefinite extent, it can be shown that no increase or decrease, however great, could possibly account for the glacial epoch, or a warm temperate condition in the polar regions."

23. This second objection, whether true or false, seems to me diametrically opposed to the reasoning of Mr. Croll in favour of his own hypothesis, when he would account for a glacial season by an increased excentricity, concurring with a northern winter solstice in aphelion. With regard to the total heat there is this slight difference, that a change of inclination leaves it quite unaltered, but an increased excentricity causes a small increase. So far the second is less suited than the first to account for a glacial period. But with regard to total winter temperature, the operation of the two causes is precisely of the same kind, and the relative effect in the ratio

of twice the excentricity to the sine of the inclination. Hence an increase of the inclination from $23^{\circ} 28'$ to $35^{\circ} 56'$ with the present excentricity would cause the same degree of inequality as an increase of the excentricity to $\cdot 0747$, its supposed amount 850,000 years ago. If glaciation would result, as Mr. Croll contends, from the latter combination, it must have done so from the other, and for the same reason. On the other hand, if a hotter summer undoes and reverses the effect of a colder winter with an increased obliquity, it must equally do so with an increased excentricity.

24. The real error of Lieut.-Col. Drayson's theory is its contradiction to the laws of physical astronomy. The pole of the equator, by precession, is receding $50''$ in longitude annually at a right angle to the pole of the ecliptic. But the obliquity is also slowly lessening, and the poles are coming nearer together. Lieut.-Col. Drayson finds that the two phenonema will be reconciled, and the observations of precession and polar distance satisfied from Tycho down to the present day, if we assume the pole of the equator to revolve round a point at 6° distance from the pole of the ecliptic. In this case, the nearest approach would be about five centuries hence, the period of revolution 31,840 years, and B.C. 13,600 the obliquity would have its maximum value, or $35^{\circ} 26'$. The excentricity, by Mr. Croll's table, would then be $\cdot 01875$, and the effect to produce inequality of heat at midwinter and midsummer, the same as with the present obliquity and an excentricity of $\cdot 1095$, or half as great again as the maximum in Mr. Croll's table.

25. But the mistake is here. The precession or backward motion of the pole of the equator, and the diminished obliquity or the motion of the pole of the ecliptic nearer to that of the equator depend on two wholly distinct causes. One is due to the action of the sun on the equatorial protuberance, and must be at right angles to the line which joins the two poles at the moment and in no other direction. The other is due to the disturbing action of the other planets on the earth's annual orbit. It does not make the pole of the equator move with reference to that of the ecliptic, but the reverse, that is, the pole of the ecliptic approaches to or recedes from that of the equator. Thus the earth's pole does not revolve round a fixed centre 6° away from the pole of the ecliptic, but round a pole itself moving in a small self-returning curve of definite limits. It moves in fact in a sort of cycloid of a rather complex kind, and not in a circle. No doubt a circle may be found, as Lieut.-Col. Drayson has proved, to satisfy the observations, which range over only four centuries. But this is a striking example of the danger of trusting to a purely

empirical law beyond the limits of the observations from which it is deduced, even when it is much more scientific than a bare average. Lieut.-Col. Drayson's circle is an approximation of the second order, and will satisfy the observations of four centuries much better than a simple average, which is of the first order only. But it will wholly mislead when carried beyond those limits; for the true curve of the earth's pole projected on the celestial sphere is not an excentric circle, but a kind of cycloid, or a circle of which the centre is ever moving, though within narrow limits. The pole of the equator does not move towards that of the ecliptic, but at right angles to the joining line, while the latter does approach to and recede from the pole of the equator. If the hypothesis were true, there is no reasonable doubt that it would involve the consequence of fierce extremes of summer heat and winter cold, over a large part of each hemisphere of the earth.

VI.—THE THEORY OF INCREASED EXCENTRICITY.

26. The most popular theory, at present, which offers a kind of geological chronology, is that of Mr. Croll, in his work entitled, "Climate and Time in their Geological Relations." It has been adopted by Mr. Geikie in his "Great Ice Age," by Sir C. Lyell, and apparently by many others, and has been developed, in a volume of five hundred pages, with great labour, research, and ingenuity. It professes to account for a recurrence of extremely cold or glacial periods by the coincidence of two astronomical elements,—an increased excentricity of the earth's orbit at certain past dates, and the position of the northern winter solstice near the aphelion. It is held, further, that when the southern winter solstice was in the aphelion, there would be a similar period of glaciation of the southern hemisphere. Mr. Croll has calculated the excentricity, by Leverrier's formulæ, at intervals of 50,000 years, for three millions of years of past, and one million of future time, and every 10,000 years for the last million only. He discovers two maxima, 850 and 210 thousand years ago, and identifies them with a Miocene and a Post-Pliocene Ice Period, assumed to be proved by modern geology. The first signs of man's presence on the earth are usually held to be either soon after, or else just before, the Boulder Drift, the second of these periods. The effect, then, of Mr. Croll's theory would be to place the entrance of man on our planet above two hundred thousand years ago. During this vast interval, thirty times greater

than all the known period of human history, aboriginal men, who possessed no arts, and left no monuments, and lived in the dark with no message of light from heaven, must have continued to wander, homeless and hopeless, in deserts and mountains, and in dens and caves of the earth.

The moral and religious difficulties of such a creed are plainly immense. I wish now to examine it simply on the side of physical science. Mr. Croll's theory is certainly elaborated with great pains and care, and includes a wide collection of materials, and a large amount of patient thought and ingenuity. It has received the highest praise from a writer in the *Quarterly Review*, as beautiful, simple, and complete. I need, therefore, to offer strong reasons for my own conviction, expressed before in the Annual Address, that it is based on a complete fallacy, and is wholly wanting in solidity and truth.

27. A first objection, made by Professor C. Martens, and more recently by Mr. Callard, is of a very simple and striking kind. The planet Mars is forty millions of miles further from the sun than our earth. Its excentricity is $\cdot 0933$ instead of $\cdot 01678$, or $5\frac{1}{2}$ times greater, and its absolute amount 26 millions of miles, or nine times greater than the present excentricity of the earth; three times greater than that at Mr. Croll's second, and twice as great as at his first, supposed glacial period. Yet the snows of this planet, while they increase in winter, and decrease in summer, are never seen to extend more than six or seven degrees from either pole. The spectroscope and telescope conspire to prove that Mars is not now suffering under an ice age. How, then, could the increase of the earth's excentricity from 3 to $10\frac{1}{2}$ millions of miles produce the glaciation of more than half the hemisphere, when one of 26 millions has no such effect in a planet half as far again from the sun?

Mr. Croll observes that little is known of the climatic condition of Mars, and that its atmosphere may perhaps be wholly different from our own, and that other physical conditions, besides greater excentricity, may be needed to secure a glacial epoch. This may doubtless be true; but since we have only to guess at such causes of difference, the negative evidence, though not decisive, is strongly adverse to the notion that glaciation, in the case of our earth, is due mainly to a greater excentricity than now exists. For in Mars the aphelion distance is about 148 millions, while in Mr. Croll's ice era, our own would be 97 millions, and still the imaginary result from increased excentricity does not seem to follow.

28. A second objection has some weight. The total heat received by the earth in a year from the sun is inversely as

the minor axis, when the periodic time and the major axis are constant and do not change. This was stated by Sir J. Herschel in a paper read to the Geological Society in 1830. It admits of easy demonstration, and Mr. Croll quotes the paper in his Appendix, and admits the scientific truth. He thinks, however, the difference is so slight that it may be safely neglected, and treated as of no account. But this is not so plain. It would be very strange, if a period in which the earth receives the most heat from the sun were that in which, on the whole, it suffers the most from extreme cold. With an excentricity of $\cdot 0575$, or $10\frac{1}{2}$ millions excess of aphelion over perihelion distance, the excess above the present would be three-twentieths per cent., or $1\frac{1}{2}$ part in a thousand. Let us take 5,000 years on each side of Mr. Croll's date, or the interval from 205 to 215 thousand years ago. If a northern winter aphelion lay midway between, this would include half one whole circuit, in which the aphelion lies within the northern winter season. The excess of heat received from the sun in those 10,000 years above its mean amount will be, in Mr. Croll's mode of reckoning, about 27 billions of billions of foot pounds. This agrees ill with the hypothesis that the period is one marked by extreme and excessive cold.

29. A third and more decisive objection follows. The season which the theory singles out to account for extreme glaciation, is that in which the northern hemisphere receives the greatest excess of solar heat above the mean value.

The proof is simple. The total heat received by the earth from the sun in its annual orbit is equal for equal angles. The swiftness and the nearness, the remoteness and the length of time, compensate each other, varying by the same law of the inverse square of the distance. But this is not true for the separate hemispheres. If the orbit were circular, each would receive more in the summer, and less in the winter half of the year. But from the excentricity, when the perihelion and aphelion are at the two solstices, the summer heat is increased and the winter heat diminished, or conversely, in the same ratio. But since the summer heat is greater than that of the winter, the total for the hemisphere whose summer is in the perihelion must exceed the other.

30. To make this plainer, let us take approximate values. Let the earth's distance from the sun be 90 millions, the excentricity, as in the supposed glacial epoch, one-ninth, or the greatest and least distances, 95 and 85 millions. The quantity of heat at perihelion and aphelion will vary in a duplicate ratio; or if 9 be taken for the mean quantity, 8 and 10. The ratios at midsummer and midwinter are as $1 + \sin. \iota$ to $1 - \sin. \iota$, nearly

as 7 to 3, and for the whole half-year as 5 to 3. There is an excess or defect of about one-fourth of the mean value. Hence $\frac{5}{4}$ of 10 + $\frac{3}{4}$ of 8 = 18·5, will be the total heat for the northern, and $\frac{3}{4}$ of 10 + $\frac{5}{4}$ of 8 = 17·5, for the southern hemisphere, when the northern summer solstice is in the perihelion, and the northern winter solstice in the aphelion. Thus the northern half of our globe will receive from the sun one thirty-sixth, or nearly 3 per cent. of heat in excess of the mean value. Thus the period selected as the Ice Age is one in which the northern hemisphere receives from the sun an amount of heat exceeding by almost 3 per cent. its mean value, and greater than at any other period in the long course of 700,000 years.

31. Thus the result cannot depend on a lessened total amount of solar heat incident on the earth at the eras in question, for the total is increased. Sir J. Herschel, Arago, and other leading men of science, have failed to see that increase of excentricity within the actual limits could produce an ice age in either hemisphere. Mr. Croll admits that it could not, directly, be the cause of such a change; but he argues that, indirectly, it may be the cause, by bringing other causes into operation.

His reasoning is as follows. From the values of the excentricity at past periods he deduces the ratio of the direct solar heat at midwinter to its present amount. One column of his table gives the excentricity, from Leverrier's formulæ, at intervals of 50,000 years for three millions of years backwards, and one forward, and of 10,000 years for one million backward. Another column gives the ratio of the midwinter solar heat at each period to what it is now. The temperature of space is assumed to be -239° F. The excess above this limit is assumed to depend on the midwinter solar radiation, and to be strictly proportional to it. The midwinter heat of our country is taken at 39° F., or the excess as 278° . The ratios for the two selected eras, 850,000 and 210,000 years ago, are ·837 and ·864; hence the deficit at the two eras would be $45^{\circ}\cdot3$, and $37^{\circ}\cdot7$, and the results $-6^{\circ}\cdot3$ and $+1^{\circ}\cdot3$ F. for the midwinter heat of our country at those two eras. With such a degree of cold, ice and snow would rapidly form. The heat of the summer, Mr. Croll argues, would be unable to melt the winter ice, and it would go on accumulating through many successive years, till the orbit and aphelion place were changed, and the main condition was thus reversed, after 10,000 years.

Here Mr. Croll reverses his argument against Poisson's theory, that space is not a body, and can have no temperature,

No. 18, 1. 9. A temperature of space about two hundred and forty degrees below the zero of Fahrenheit is the basis of all his calculations.

In these calculations there are several serious defects, which disprove the conclusion, and require us to look further for an adequate explanation of the general prevalence of cold in the northern hemisphere during the Drift or Glacial period. The amount of the excentricity, the law of radiation, the proper point of the orbit for estimating the balance of solar heat, and loss by radiation, the law of midsummer heat, and the effect of aërial and oceanic currents, are all of them elements which seem to me to have been incorrectly assumed or left out of view. The combined result of the corrections thus required will be practically to set aside the whole theory.

32. First, the excentricity is calculated by M. Leverrier's formulæ. It might seem beforehand very doubtful whether these can be relied on for a date three millions of years ago, or even for 850,000, or 210,000 years. But there is here a special reason for distrust. The present excentricity is $\cdot 0167836$ (Hersch. Ast.), and those at the two eras in debate, $\cdot 0747$ and $\cdot 0575$. Now the maximum for the earth, according to Lagrange, is $\cdot 07641$, and according to Leverrier $\cdot 077747$, and the value at 850,000 years ago is thus very near the limit. But these calculations were made before the discovery of Neptune. Fresh calculations have been made by Mr. Stockwell, since that discovery, and the corrected maxima for the planets from Venus to Saturn are all diminished. Those of Leverrier are M. $\cdot 225646$, V. $\cdot 086716$, E. $\cdot 077747$, M. $\cdot 142243$, J. $\cdot 061548$, S. $\cdot 084919$, U. $\cdot 064666$. But the later values are M. $\cdot 2317185$, V. $\cdot 0706329$, E. $\cdot 0693888$, M. $\cdot 139655$, J. $\cdot 0608274$, S. $\cdot 0843289$, U. $\cdot 0779652$, N. $\cdot 0145066$. Thus the value accepted by Mr. Croll for his earlier date is one which exceeds the corrected maximum by $\cdot 0053$, or nearly a million miles. If Mr. Stockwell's calculation is correct, it is an impossible value.

An exact correction would, of course, involve a prodigious amount of fresh labour; but a reasonable approach to it may be gained by diminishing the excess over the present excentricity in the ratio of the excesses of the two maxima. These are $\cdot 0609634$ and $\cdot 0526052$. The values $\cdot 0747$ and $\cdot 0575$ will thus become $\cdot 06676$ and $\cdot 05192$, or about nine-tenths of those on which the actual calculation has been based. This first correction will lessen the decrease of mid-winter temperature three or four degrees.

33. But the method of deducing the midwinter heat from

the ratio of the heat received from the sun at the winter solstice is also defective. The excess of that winter temperature over the temperature of space is held to be strictly proportional to the amount of solstitial heat received. But this combines a mere hypothesis with a defective law of dispersion or loss by radiation. A simpler rule may be deduced, in a less hypothetical way, from the experiments of MM. Dulong and Petit. According to these, when heat radiates from a hotter to a cooler body, and the difference of their temperatures is constant, the radiation increases or diminishes in the ratio of 1.165 to 1 for a rise or fall of 20° C. or 36° F. in their two temperatures. Of course, if the lower body has a fixed temperature, and the hotter alone varies, the ratio should be slightly greater. To establish an equilibrium between the heat received from the sun and that radiated into space, the midwinter heat must thus be lowered till the radiation is lessened in the same proportion as the solar heat received.

Adopting this rule, and retaining Mr. Croll's values for the excentricity .0747 and .0575, and the answering ratios of midwinter heat, the lowering of temperature will not be 45°·3 and 37°·7 F., but 41°·94 and 34°·34 only, a difference of more than three degrees. But with the corrected values .06676 and .05192 they will be 38°·45 and 31°·84 only; or the winter heat at the later period, Mr. Croll's proper ice age, will be 7°·2 F. instead of 1°·3, a difference of six degrees.

34. But a further correction is plainly required. The equilibrium between the heat received and lost is clearly not at the solstice itself. The greatest heat in summer and cold in winter is well known to be about a month later, that is, at a distance of about 30° from the solstice. Thus the distances, on which the solar heat, when the solstice is in the perihelion or aphelion, depends, will not be $1 - e$ and $1 + e$, but $1 - \frac{1}{2}e\sqrt{3}$ and $1 + \frac{1}{2}e\sqrt{3}$.

Introducing this correction, the lowering of the heat with the two uncorrected values of the excentricity will be 35°·45 and 29°·81, but with the corrected or reduced values .06676 and .05192, it will be 33°·18 and 28°·73; so that, instead of -6°·3 and +1°·3 F. for the extreme or midwinter temperatures, the corrected values would be +5°·8 and +10°·3, or in the earlier period twelve, and in the later period nine degrees higher, than the value Mr. Croll has given.

35. The summer heat, in Mr. Croll's theory, is supposed to depend on wholly different principles from the winter cold. He speaks of it as follows.

“ There is no relation, at the periods in question, between the intensity of the sun's heat and the temperature of the summer. One is apt to suppose, without due consideration, that the summers ought then to be as much warmer than at present as the winters are colder. Sir C. Lyell in his ‘Principles’ has given a column of summer temperature calculated from my table on this principle. Astronomically this is correct, but physically, as shown in ch. iv., it is wholly erroneous, and would convey a wrong impression on the whole subject of geological climate. The summers of that period, instead of being much warmer than at present, would in reality be much colder, notwithstanding the great increase in the sun's heat from her diminished distance.”

36. I think there is not the least solid ground for the contrast here affirmed, and that the want of due consideration is on the other side.

First, let us inquire what will be the summer temperature, if the principle in the previous calculations of midwinter heat is maintained. The contrast will then be between the present heat, when the sun is near the aphelion, and the perihelion heat with the increased excentricity. Adopting the three corrections already introduced, first, of the value of the excentricity, secondly, of the law of radiation, and thirdly, of the maximum heat or cold a month after the solstice, the increase of summer heat would be $34^{\circ}\cdot88$ and $28^{\circ}\cdot5$ at the two eras proposed. Thus, instead of 39° and 64° , the present midwinter and midsummer heat in our island, the temperatures would be, by the corrected rule, $5^{\circ}\cdot8$ and $98^{\circ}\cdot88$ for the earlier, and $10^{\circ}\cdot3$ and $92^{\circ}\cdot5$ for the later date.

37. The reasons assigned, why glaciation should have resulted indirectly from the increased excentricity about 200,000 years ago are these: First, the midwinter temperature would be lowered to an enormous extent. I have just shown that this is not correct. The decrease would be only $28^{\circ}\cdot7$ instead of $37^{\circ}\cdot7$, and the resulting temperature $10^{\circ}\cdot3$. This is nearly the same as that of Canada, near Quebec, while the summer temperature, by the previous estimate, would be almost 30° higher. This is wholly different from the conditions of a glacial period.

The winters, it is said, would be longer as well as colder. Instead of being 8 days shorter than the summer, as now, the excess would be 36 days. But for the period mainly in question the difference is 26 days, or 13 days is the excess of the winter over half a year. The mean rainfall of our island is 32 inches. Without some unproved change in the physical conditions, the rainfall of the winter months would be less than 20 inches, or if snow be reckoned six times lighter than water, this would amount to a depth of 10 feet only. But the latent cold of ice is 140° , and water has four or five times the specific heat of

most solids. The formation of ice is thus a most powerful means of arresting a decline of temperature, as evaporation is the great natural remedy for excessive heat. The heat required to melt 20 inches depth of frozen water over the whole surface of any portion of land is equal to that of 37 hours of vertical sunshine, if we adopt the datum of Sir J. Herschel, that vertical solar heat on a square foot in one second would raise one pound about one-ninth of a degree. The total summer heat, reckoned roughly, would be equal to 1,300 hours of vertical heat at the equator, or lat. 54° , and 900 hours at the pole: hence, if the whole winter rainfall were deposited in snow or ice, the heat needed to melt the whole would be that of four days only nearest to the summer solstice, or one-thirtieth of the whole summer heat in our latitude.

38. The reasoning in "Climate and Time," pp. 58, 59, seems to assume that ice and snow are the cause and not the effect of a cold climate, and tend to aggravate not to mitigate its severity. But the exact opposite is true. As ocean currents tend to equalize the temperature of different parts of the earth, so the formation and melting or evaporation of ice and snow are the chief natural means of lessening the difference of sensible heat in different seasons of the year. When the radiation is in excess of the supply of solar heat, the freezing of water sets free 140° of heat to repair the loss; and when the summer returns, all the ice and snow must be melted before the temperature can have a sensible rise above the freezing-point. A pound of water, with a sensible difference of 180° only from its frozen state to its evaporation at the boiling-point requires $1,320^{\circ}$ of heat, and this will be equivalent to $5,280^{\circ}$ or $6,600^{\circ}$ degrees for a pound of rock or of earth, the specific heat being one-fourth or one-fifth of that of water. Or, taking the interval from zero to 70° , a pound of water, in virtue of the process of freezing and its great specific heat, serves to reduce the sensible change of temperature from twelve to fifteen times.

39. There are three ways in which snow and ice are said to lower the summer temperatures. First by direct radiation. Whatever the heat of the sun, the snow and ice can never rise above 32° , and their radiation lowers all surrounding bodies to that level. Next, the rays which fall on them are to a great extent reflected into space, and those which are not reflected, but absorbed, disappear in the mechanical work of melting the ice. Thirdly, they chill the air, and condense the moisture into fogs, and these prevent the sun's rays from reaching the earth; thus the snow, in these aphelion winters, would remain unmelted the whole summer.

Now of these causes the first and third exclude each other. If fogs hinder the sun's rays from reaching the earth, they must also prevent the ice and snow from radiating heat away into empty space. The dull, cloudy surface above must receive and absorb all the heat of the summer sun, and can allow little heat to radiate into space, except at night; even then much less than under a clear sky. Of course, till the ice and snow are all nearly melted, they effectually hinder a sensible rise of heat above 32° ; but this is only the converse of their previous effect, in their formation, to hinder a lowering of the temperature till the whole has been frozen. All the heat of the sun which falls on the earth must produce its full effect, either in raising the ice, snow, and the ground itself, up to the freezing-point, or in melting them, and turning them into water or aqueous vapour. The same amount of cold which would depress a stratum of chalk ten feet deep to the zero of Fahrenheit would spend itself in turning $7\frac{1}{2}$ inches of rainfall into ice and snow. Thus the presence of moisture, whether in the air or the soil, or lakes and rivers, is the most effectual hinderance to excessive lowering of the winter temperatures, so long as the total annual heat received from the sun is not diminished. But in the imagined glacial epoch, this total amount is increased $\frac{3}{20}$ per cent. for the whole globe, and 3 per cent. for the northern hemisphere.

40. Even with the corrections before named, the calculation cannot lead to a precise result, but shows at the most a limit towards which the temperature would tend, if the solar heat and radiation into space maintained the given proportions for an indefinite period of time. If the rule were sound, some very unnatural conclusions would follow. Each pole, during its winter of half a year, when it receives no heat at all from the sun, would sink to the temperature of space, or -239° F. Again the heat which the pole receives from the sun at midsummer, exceeds that received by an equal surface at the equator in the ratio of $\pi \cdot \sin. \iota$ to $\cos. \iota$, or 1.3638 to 1. But since the summer heat of the equator is 79° , or 318° above that of space, the midsummer heat of the pole, by Mr. Croll's mode of reckoning, should be 115° higher, or 194° , little short of the heat of boiling water. Each conclusion is plainly very wide of the truth.

41. Again, Mr. Croll insists forcibly on the vast amount of heat transferred northward by the Gulf Stream. He reckons it equal to one-fourth part of the whole amount received from the sun by the Atlantic area or basin, from 25° N. up to the Arctic Circle. The consequent increase of the mean temperature of Great Britain is not less, he thinks, than 30° ; but in

estimating the temperature for his glacial epoch this element is omitted altogether. It is plain, however, that it must then have been not much less than it is now. The contour of land and sea was nearly the same as at present in the Boulder Drift period, and the Atlantic basin had nearly its actual outline, and reached as far to the north. The strength of the current must depend on the contrast between the heat of the southern summer and the cold of the northern winter, so far as these were directly dependent on the sun. This would be only 8 per cent. less than it is now. On the other hand the current would be greater in the summer half of the year, and serve more fully to blot out the traces of the cold of the previous winter. The general result would be an increase of summer heat and winter cold, each about 28° at the most, but probably much diminished by the equalizing effects of aerial and ocean currents.

42. Another element has still to be considered. In Mr. Croll's Table, p. 320, vol. iii., the longitude of the perihelion at the date B.C. 210,000 is stated to be $144^{\circ} 55'$. From the last entries it seems plain that this amount has reference to a fixed and not a movable solstice or equinox, and is the change resulting from the progression of the apsides alone. The change from precession for this same period, at the present rate, would be eight complete circuits and $46^{\circ} 56'$. Hence the true longitude of the perihelion, on this view, would be $144^{\circ} 55' - 46^{\circ} 56'$, or just 98° . Thus the northern summer solstice, as it is now, would be nearly in aphelion. This is precisely the opposite condition to that which forms the basis of Mr. Croll's theory. We need to go backward or forward 10,000 years, to have the winter solstice in aphelion, when the excentricity is $\cdot 0497$ or $\cdot 0569$. In the former case the midwinter increase of cold would be only five-sixths of Mr. Croll's estimate, when his other data are retained, or the decrease, which has been reduced from $37^{\circ} \cdot 7$ to $28^{\circ} \cdot 7$, would be further reduced to $23^{\circ} \cdot 9$, or the midwinter temperature by the rule be $15^{\circ} \cdot 1$, which is higher than the temperature of Canada.

43. The main principle involved in Mr. Croll's theory is that the cold or hot state of each hemisphere is determined chiefly by its midwinter temperature, and this in turn by the simple ratio of the direct solar heat then received, the excess over the mean temperature of space, or -239° F., being determined by a simple rule-of-three calculation. And since the winter northern solstice is now very near the perihelion, the present excess above the average value, when combined with the deficit at other periods, results in a very considerable disproportion. The ratio, according to Mr. Croll, 850,000

years ago, is about five-sixths; and hence, one-sixth of 278° , or 45° , will be the aggravation at that date of the winter cold. But if this mode of reckoning were sound, it ought to apply to the northern and southern hemispheres with the present excentricity. In this case the southern winter should be colder than the northern in the amount answering to the ratio $\cdot 93507$, or 18° F. But in fact there is no such inequality, and it would almost appear that the climate, in answering latitudes, is slightly warmer than in the northern hemisphere, except in the immediate neighbourhood of the pole.

44. The following extract from Mr. Croll's table gives his conclusions with regard to his two proposed glacial periods, and the midwinter temperature of Great Britain at the answering periods:—

Date.	Excentricity.	Perihelion.	Excess of Winter, In days.	Sun's Heat.	Depression.	G. B. mid-winter.
880,000	$\cdot 0456$	$152^{\circ} 33'$	21.2	$\cdot 884$	$32^{\circ} 2$	$6^{\circ} 8$
870,000	$\cdot 0607$	$180^{\circ} 23'$	28.2	$\cdot 859$	$39^{\circ} 0$	$0^{\circ} 0$
860,000	$\cdot 0708$	$209^{\circ} 41'$	32.9	$\cdot 843$	$43^{\circ} 6$	$-4^{\circ} 6$
850,000	$\cdot 0747$	$239^{\circ} 28'$	34.7	$\cdot 837$	$45^{\circ} 3$	$-6^{\circ} 3$
840,000	$\cdot 0698$	$269^{\circ} 14'$	32.4	$\cdot 845$	$43^{\circ} 2$	$-4^{\circ} 2$
830,000	$\cdot 0623$	$298^{\circ} 28'$	29.0	$\cdot 857$	$40^{\circ} 0$	$-1^{\circ} 0$
820,000	$\cdot 0476$	$326^{\circ} 4'$	22.1	$\cdot 881$	$33^{\circ} 1$	$5^{\circ} 9$
240,000	$\cdot 0374$	$74^{\circ} 58'$	17.4	$\cdot 898$	$28^{\circ} 3$	$10^{\circ} 7$
230,000	$\cdot 0477$	$102^{\circ} 49'$	22.2	$\cdot 885$	$33^{\circ} 2$	$5^{\circ} 8$
220,000	$\cdot 0497$	$124^{\circ} 33'$	23.2	$\cdot 877$	$34^{\circ} 1$	$4^{\circ} 9$
210,000	$\cdot 0575$	$144^{\circ} 55'$	26.7	$\cdot 864$	$37^{\circ} 7$	$1^{\circ} 3$
200,000	$\cdot 0569$	$168^{\circ} 18'$	26.5	$\cdot 865$	$37^{\circ} 4$	$1^{\circ} 6$
190,000	$\cdot 0539$	$190^{\circ} 4'$	24.7	$\cdot 871$	$35^{\circ} 7$	$3^{\circ} 3$
180,000	$\cdot 0476$	$209^{\circ} 22'$	22.1	$\cdot 881$	$33^{\circ} 1$	$5^{\circ} 9$
170,000	$\cdot 0437$	$228^{\circ} 7'$	20.3	$\cdot 887$	$31^{\circ} 3$	$7^{\circ} 7$
160,000	$\cdot 0364$	$236^{\circ} 38'$	16.9	$\cdot 900$	$27^{\circ} 8$	$11^{\circ} 2$

45. In the following table, the excentricity is reduced by the formula $e' = \frac{e}{2} + \cdot 024$ to correspond with Mr. Stockwell's corrected maximum, $\cdot 0693888$, instead of Leverrier's $\cdot 077747$. The equilibrium of solar heat and radiation is assumed to be 30° after the winter solstice, and the law of radiation is taken from Dulong and Petit's experiments. The ratio $1 \cdot 165 \log. = \cdot 0663259$ answers to a change of 36° F., or a change of solar distance to that amount to 72° . Hence $\log. \text{radius vector} + \frac{1}{11} - \frac{1}{200}$ will give the answering change in degrees. The precession at the rate of $50'' \cdot 3405$ a year, or $139^{\circ} 50'$ for 10,000 years, is combined with the perihelion places of Mr. Croll's table, to give the anomalies at 30° after the solstice. The columns are the date (in 10,000's of years B.C.), excentricities, anomalies,

logarithms of radius vector, change of midwinter heat compared with a mean distance, and results for Great Britain.

88	·0415	302° 47'	·01564	16°·18	48°·41
87	·0544	135° 7'	-·01572	-17°·07	15°·16
86	·0631	326° 0'	·01679	18°·23	50°·46
85	·0664	156° 22'	-·00980	-10°·64	21°·59
84	·0622	346° 46'	·00782	8°·49	40°·72
83	·0558	177° 42'	-·00039	-0°·42	31°·81
82	·0432	10° 16'	-·01058	-11°·49	20°·74
24	·0345	71° 2'	-·01393	-15°·12	17°·11
23	·0433	264° 21'	·01914	20°·78	53°·01
22	·0450	101° 47'	-·01868	-20°·28	11°·95
21	·0517	301° 35'	·01988	21°·58	53°·81
20	·0512	138°·22'	-·01389	-15°·08	17°·15
19	·0480	336°·46'	·00815	8°·85	41°·08
18	·0432	177°·38'	+·00004	°·04	32°·27
17	·0399	19° ·3'	-·00499	-5°·42	26°·81
16	·0366				

In A.D. 1800 the excentricity is ·01678, the anomaly 98°, log. of radius vector in midwinter ·00623, the increase +6°·77 and 39°-6°·77=32°·23 is the midwinter heat of Great Britain, in a circular orbit, to be added to the degrees in col. 5, to obtain the midwinter heat on Mr. Croll's hypothesis, after due corrections.

46. Thus it appears, when the principle of Mr. Croll's calculation is admitted, and necessary corrections are introduced, the midwinter depression, or increase of cold in Great Britain, at his earlier date, B.C. 850,000, would not be 45°·3, but only 10°·6; and that in B.C. 210,000 there would not be a decline of 37°·7, but a rise of 21°·6. At B.C. 220,000 there would be a decline of 20°·3; and this is fourteen degrees less than the amount in his theory. And when we observe, further, that the same principle would involve the consequence, that southern winters should now be 13° colder than at the same latitudes in the northern hemisphere, while there is actually only a very slight difference, the disproof of the hypothesis seems tolerably complete.

47. The way to restore some semblance of truth to the theory is to apply it, not to the periods in round numbers in the table, but to intermediate dates, when the solstice was really in the aphelion. This is nearly fulfilled for the date B.C. 220,000, but neither for B.C. 850,000 nor B.C. 210,000. Indeed at the latter date the winter solstice is almost exactly in the perihelion, and by the hypothesis the midwinter heat would be 21° higher than now, instead of 38° lower. In the other case the solstice has the anomaly 126°·22', by the approximate reckoning. The rate of change is 139°·50 + 29°·47=

169°·37 for 10,000 years. To bring it to 60°, which is nearly the position of maximum effect, would require an interval of 3,900 years, or a date from A.D. 1800 backward, of 846,100 years. The corrected exentricity would then be about ·06476, instead of ·0664 or ·0747. The depression, by the corrected rule, at this the most favourable moment, since the logarithm of the radius vector at the aphelion would be ·02725, will represent a diminished heat, compared with a circular orbit, of 29°·58, or 2°·7 F., and this will be counteracted by a summer heat, exceeding the present by 24°·8 F., or an average of 89°.

48. The other periods most favourable to the effect of depressing the northern winters will be, reckoning backward from A.D. 1800 as before.

823,000	diminution from present winter heat	28°·4	result	10·6
217,400	”	”	”	10·7
195,100	”	”	”	9·4

Now, when we remember that the approach to the maximum would last only one or two thousand years; that the summer, in each case, would be hotter than at present by all the contrast between the present aphelion and the past perihelion distance; that the heat annually received by the northern hemisphere at these periods is 3 or 4 per cent. above the mean amount; and that the actual difference of the northern and southern winters, which by the same scale should be 13°·7, or nearly half the whole amount, is in reality hardly sensible, I think the presumptive evidence is irresistible in favour of the view of Sir J. Herschel, Arago, and others, which Mr. Croll reverses as erroneous; that the differences of exentricity, within their actual limits, will by no means account for the occurrence of glacial periods.

49. There is another hypothesis, wholly distinct from that of Mr. Croll, which seems to me to admit of being confirmed by very strong presumptions. It is that which refers the main stages of geological change to marked eras of chemical transmutation, in the latest stages of terrestrial condensation. But this cannot be unfolded at the close of a paper which has already reached rather an undue length.

I think I have sufficiently shown that the chief definite grounds, of astronomical science, upon which the doctrine of man's extreme antiquity has been assumed to rest, are wholly fallacious and unsound.

The CHAIRMAN (C. Brooke, Esq., M.D., F.R.S.).—I am sure that we all unite in returning our best thanks to Professor Birks for the very able paper which he has read.* It is now open for those present to make observations thereon.

Rev. Prebendary CURREY, D.D.—I feel incompetent to enter upon the details of the arguments which have just been presented to us with reference to the special theories which Professor Birks has discussed; in fact, the accumulation of scientific research and of learning in his paper has been so great as wholly to bewilder me. But what I want to point out is this, that the question before us is “modern cosmogonies examined in their bearing upon the antiquity of man,” and I confess that to me it is very difficult to understand what bearing a great deal of this paper has upon the subject of the antiquity of man. Let us suppose for a moment that all the conclusions which Professor Birks seeks to set up are clearly established, and that all the theories which he attacks are completely overthrown, still, in my opinion, that would not affect the question of the antiquity of man. All that it would do would be to show us that certain theories put forward by particular philosophers are liable to exception, and are, perhaps, unsound; but it would not necessarily follow that other theories may not be quite sound. The destruction of each theory can only affect such others as proceed upon similar lines; and even those only so far as they concern the subject in hand. Professor Birks’s arguments have to do with the antiquity of the earth, rather than with that of man. Now if you can prove that certain strata, containing the remains of man, are not so old as has been represented, you may make it probable that man has not been so old an inhabitant of the earth as some suppose. The paper does not refer to any special antiquity of man,

* Since the meeting Mr. Brooke has sent the following observations, which he intended to have made towards the close of the discussion:—

“I wished to have made a remark, had time permitted, on § 13 of Professor Birks’s paper. I cannot see that, ‘the hypothesis that the heat transferred from a hot to a cool body is strictly as the difference of their temperatures, and that the temperature is the quotient of the heat in any body divided by the mass,’ implies the corpuscular theory of heat. Speaking logically, it must be borne in mind that heat has no *objective* existence; it is a *subjective* impression on the organs of sensation produced by certain molecular wave-motions. If we now suppose two contiguous particles of different bodies to be affected by different amounts of wave-motion, and that the whole motion be then shared between them, it is clear that one must have gained, and the other lost half the difference; which is the same thing as saying that the amount of heat transferred is as the difference of the temperatures of two bodies. It also appears to me equally clear that if a given amount of heat wave-motion, distributed through a given number of particles, be shared with an equal number previously at rest, each particle of the whole will have half the wave-motion that previously affected each of the first-mentioned particles: this amounts to the same thing as saying that the temperature is the quotient of the heat in any body divided by the mass. It therefore appears to me that the matter-theory of heat is *not* involved, as stated by Professor Birks.”

but it considers different theories of great antiquity assigned by philosophers, not to man, but to the surface of the earth and its formation. But, even supposing that to be unsound, and suppose the conclusion is that the earth is not by any means so old as it has been represented to be, and that therefore man, whose remains have been found in it, is not so ancient as has been represented—suppose all that to be established, surely that does not show that there is not still an immense antiquity to fall back upon. Suppose you reduce the past ages of the world's existence from 120,000,000 years to 50,000,000 years, you will still find 50,000,000 years quite enough to deal with. (Laughter.) From the alluvial deposits of the Mississippi the ages assigned by Lyell may have been reduced to not more than 94,000 years; but though Lyell's first calculation may not be maintained, still a period of 94,000 years would carry the antiquity of man back to a time far more remote than any one has as yet asserted. Suppose, then, that all these statements of the antiquity of the earth are greatly exaggerated and overdrawn, does Professor Birks deny that the Glacial period is removed from the present time by a very large number of years—perhaps hundreds of thousands? It seems to me to have been indubitably established and maintained by every geologist of repute, that the period during which the earth's surface has existed is sufficient for us to trace a number of years immensely greater than those periods which we have been accustomed to consider as belonging to the duration of man; and, if that be so, I do not see that we gain anything except a reduction from 250,000,000 to 50,000,000 years; and even though the strata in which the remains of man are found may have their age reduced to tens or hundreds of thousands of years, instead of to millions, still that gives us an antiquity far beyond anything we have been accustomed to assign to the existence of man upon the earth. Therefore I do not see that this very elaborate, scientific, and learned paper helps us much with regard to the antiquity of man in relation to the date here assigned to it. We must remember that the paper sets out by determining very absolutely the number of years to which we must limit the existence of man, which we are not permitted to set down at more than 7,000 or 8,000 years. That is laid down as an absolute proposition; and, more than that, we are told that if we should assume or arrive at a conclusion which places it 10,000 years back, we are not only scientifically wrong, but we have abandoned the very foundation of faith, and we can maintain neither the Bible nor the truths of Christianity. That, I must say, surprised me beyond measure. To be told that if we venture to assume that man has been upon the earth longer than 7,000 or 8,000 years, we are not only wrong, but we contradict the statements of the Bible, and at least implicitly deny the doctrine of the redemption of mankind;—that, I think, is a most dangerous argument. If you lay down certain propositions with regard to facts which are greatly in dispute, or which, at all events, are not generally accepted, and say that any man who differs from you in regard to them is abandoning the doctrines of Christianity, then

I say you are using an argument of the most dangerous character, and one of a kind which I think this, above all other societies, is bound to cry out against, and to disown. The principle of this Society is to reconcile science with Christianity, and to find out, as far as we can, how far the truths of Christianity may be harmonized with the discoveries of modern science; and we find a number of scientific men, including nearly all of the greatest eminence, holding the view that man's age upon the earth is considerably longer than 7,000 years. We must not, even though they may be wrong in their opinions, turn round and tell them that they are infidels, that they are abandoning the principles of Christianity, and that they cannot possibly hold the doctrine of redemption. Our purpose in this Society is, as I have just said, to endeavour to find out how far we can reconcile science and Christianity, and not to place them directly in opposition, as it certainly seems to me that this paper does, from the statements which it makes at its commencement. That is the reason why I cannot help speaking perhaps rather strongly in reference to these propositions. As to the arguments and theories, I am by no means competent to enter upon them, even if I desired to do so; but I do not think they affect the question. But do not let us lay down principles of the kind involved in saying that those who do not agree with you do not hold the doctrines of Christianity. It is the fact that many clergymen do hold views of the kind which Professor Birks condemns, and he seems to condemn them for doing so; but I must say that this is not the manner in which I like to see scientific questions dealt with, holding it out as matter of reproach to any one who dares to hold a contrary opinion. This question of the antiquity of man is an open one, and may be held as an open one by clergymen as well as by other people; and often those clergymen who examine it will find themselves forced to come to conclusions to which Professor Birks is opposed. I am not pretending to discuss this question scientifically, but, like other men, I have read the ordinary works on the subject. Look at this matter historically, look at the monuments to be found in Egypt. Some of those monuments certainly go as far back as the time of Abraham; and you will find that even those old monuments represent the different races of man as existing at present; the negro with all his peculiar characteristics, and various other peoples also. All these variations arising in the few hundred years that elapsed between the date of the Flood and the time of Abraham; is not this a most striking proof that you must carry your date farther back? (A voice: "No," and laughter.) Well, I do not say that my opinion is to be taken dogmatically. I only state it as it presents itself to my own mind. In maintaining my own views I bring forward strong arguments, as they appear to me, for the great antiquity of man; I will not say how great, but certainly much greater than those dates which are said to be deduced from the Bible. We must not forget, however, that the Bible has no chronology, that what we accept as the chronology of the Bible was formed by the ingenious calculations of Archbishop Ussher; and we know that many people, quite independent of the scientific question, hold views of Biblical chronology

which are widely different from those of Ussher. They differ most materially. Hales's system of chronology is certainly not the same as Ussher's. Ussher's was an ingenious calculation, but it is not to be accepted as part of the Bible. We have been so accustomed to see those figures 4004 put opposite to the first chapter of Genesis, in the account of the Creation, that we are considered to be almost abandoning our Bible if we do not accept them. A religious society, in publishing the "Commentary on the Bible," was bold enough to say that the early dates of the Bible did not seem to be sufficiently clearly established to warrant their insertion; and some remonstrances came from earnest men, who said, with alarm, "You are attacking the Bible." This is the way in which a great amount of injury may be done to the cause of truth and of religion. We assume certain interpretations of the Bible with which we have been familiar, and we tell people "if you do not accept these, you cannot accept the doctrines of Redemption." That is a line of argument against which I must emphatically protest. I have referred to the monuments of Egypt as bearing upon the question of dates, and from these I cannot come to any other conclusion than that they afford a much greater antiquity for man's existence than 7,000 years. Then look at language.* Trace it in all its families and their connections as far as you can; and does not the form of those various tongues, with their peculiar characteristics and differences, require a longer time for growth than these few thousand years? To my mind a very much longer time is required. It may be said that we have a dispersion of tongues at the building of the Tower of Babel, but all I can say is, we cannot suppose that in that dispersion of tongues languages were divided out as we now have them, for they all show the marks of gradual progress and gradual formation. If we argue at all, we must argue upon things as we see them; and if we see traces of the progress and improvement of language by gradual stages, we are not to go back and say, all these could have been done miraculously at the building of the Tower of Babel. God does not work with His creatures in that way; He does not invent these things in order to cheat us, and give us historical evidence of what is not historical. Whether we examine the crust of the earth, or the history of language, or the monuments of Egypt, all we can do is to take them on the principle that we are to read their history and their progress in the same manner as we read the history and progress of what is before us. We need not maintain the strict uniformitarian system, that exactly the same rate of deposit was to be laid down every year. A great accumulation of worthless conjecture has been obtained by calculating the geological deposits that we have, and saying they must have taken 200,000 or 250,000 years to produce. All that is extremely vague conjecture, but it does not destroy the main evidence of the great broad facts; and I say look

* These two points are treated on in the *Transactions*, Vol. III. p. 464, *et seq.*

at the great broad facts of the Mississippi again. You say that the Mississippi deposits did not occupy vast numbers of years; but I would ask, where is the theory which will account for these deposits, except by the assumption of a great number of years? I do not say any particular number of hundreds of thousands, but certainly a very large number. Let any one bring forward a counter theory if he can. I do not want to express the least disrespect to Professor Birks. He forms his own conclusions, and everybody knows that he is a great master of mathematics, and a vast accumulator of knowledge, but I would point out the importance, in a society of this kind, of refraining from putting forward such an argument as that no one is to hold a particular view on such a question as the antiquity of man, without being liable to the suspicion of denying the doctrines of redemption, and giving up the possibility of maintaining the truths of Christianity.

Rev. A. G. PEMBERTON.—I have listened with great interest to the reading of this paper, but I have drawn conclusions very opposite to those expressed by Dr. Currey. I thought it most valuable that so great an authority as Professor Birks, with great scientific knowledge, should grapple with these scientific questions. I did not gather from the paper that he contended for the accuracy of Archbishop Ussher's chronology, and I quite agree that we need not defend any such calculations. My Hebrew Bible has no chronological calculations at all. Hales's valuable work is simply a compilation of various systems of chronology. There can be no question that the range of knowledge which is knowable is, as that great intellect Newton pointed out, extremely limited, and man's ignorance is immense when compared with his knowledge. As Jeremy Taylor has said, the most learned pundit would find, if he came to compare his ignorance with his knowledge, that the ignorance immensely outweighed the knowledge. Then we must also remember that geology at present is only in its infancy, and I feel sure that as it grows and increases, our knowledge of the past, we shall find that there is no real antagonism between science and the Bible.* Now so far as natural religion goes, we know that it does not reveal a single syllable about redemption through Christ. The whole of that sublime economy, which is as beautiful as it is sublime, entirely depends on the authenticity, genuineness, and inspiration of the Scriptures. Every man, therefore, who would grapple with the subject fairly, should inquire whether the Bible be an authentic document, whether it be genuine, and whether it be inspired, and if he do this, he will come to the conclusion which the great Grotius, a man as illustrious for the splendour of his genius as for the extent of his attainments, came to, when he wrote his remarkable book *De Veritate*. The acute-minded Le Clerc too, who, from being an unbeliever, became a believer, made objections to the Pentateuch: he was answered, and, being an honest man, he went and studied the subject more deeply, and then wrote a refutation of his own objections; but Voltaire has copied the objections

* See Professor Dawson's remarks, Preface to Vol. XI.—Ed.

without the answers into his *Philosophical Dictionary*. The infidelity which has arisen in the present day is peculiarly injurious to the young, because it assumes what is false,—that there is an antagonism between true science and religion, whereas there is really none. I myself have not the leisure or the opportunity to go deeply into all the questions which are raised by the paper of Professor Birks, but I am glad to find so able an advocate coming forward, with learning, great powers of mind, and accuracy of thought, to go into the depths of the subject, and to show that those men who differ from the Scriptures as to inspiration and as to the doctrines of our redemption through our Lord Jesus Christ, are in the wrong, and ground all their objections upon mere supposition and conjecture, without a line of history or an atom of real proof to support them.

Rev. J. J. COXHEAD.—The existence of an ice age, of which we find many traces, being acknowledged, it appears to me that we are bound to accept Mr. Croll's hypothesis, which seems probable, until a more satisfactory one is substituted for it. (Dissent.) I think that the existence of an ice age and the finding of supposed human implements in the Drift are arguments in favour of the antiquity of man.

A MEMBER.—But the periods of the Ice age and of the Drift have to be ascertained.

Mr. T. K. CALLARD.—Dr. Currey has told us that he could not see what bearing the learned paper we have listened to has upon the question of Man's Antiquity. It might be that Dr. Currey expected more than was proposed by the author. I do not think that Professor Birks supposed that, after reading his paper, we should leave to-night, certain that there did not exist a great antiquity of man, but if he has succeeded in removing one of the strongest arguments that has hitherto been used for assigning to man such great antiquity, I think he has done all that could be expected from him in one evening (Hear, hear), and I think he has very successfully done this. It has been accepted by most of our leading geologists, that man first appeared on the globe some 200,000 or 210,000 years ago. But how was that period arrived at? It was by accepting that as the time of the Glacial epoch; for, as Professor Birks says in his second paragraph, "Human deposits are thought to occur in quaternary strata or drift, directly after the close of a great ice period." If that great ice period, then, was 200,000 years back, and the human deposits occur immediately after its close, you have the case proven that man lived 200,000 years ago. But there is nothing whatever, either in astronomy or geology, to fix that as the date of the Glacial epoch, except the excentricity of the earth's orbit, which was so great at that period. Now, if Professor Birks has made it clear to your minds, in answer to Mr. James Croll's hypothesis, that neither the excentricity of the earth's orbit, nor the changes produced by the precession of the equinoxes, nor the altered obliquity of the ecliptic; that none of these astronomical changes, nor all of them put together, would have produced an ice age; if he has made that clear, we then must give up the

200,000 years as the date of the Ice age, and also as the date of the men who left the "human deposit" referred to in the gravel drift. I think a great step has been taken to-night if Professor Birks has established this one point. I reached the same conclusion as the author of the paper has done, when the hypothesis of Mr. James Croll was first published, and feel honoured by Professor Birks' reference to my pamphlet, and I scarcely need say that the conclusion I then reached has been greatly strengthened by to-night's paper. There may be, as stated by Dr. Currey, other reasons for believing in the great antiquity of man, most of which reasons will be no doubt brought under consideration when Professor McKenny Hughes (Woodwardian Professor of Geology) reads his paper upon the subject; but there are no other reasons that can be produced, except those to which Professor Birks has replied, that will fix 200,000 years as the period of man's introduction to the earth. I would like now to offer a remark or two upon the "human deposits" of the drift; they are described by Professor Birks as flints, which "are affirmed to have been plainly fashioned into tools, spears, or hatchets by the hands of savage men." If the affirmation is correct, the antiquity of the savage men who fashioned them is not proven, unless the age of the drift in which they are found is also proven: but if, on the other hand, there should be reasonable doubt about the human fashioning of these flints into tools, spears, or hatchets, the evidence for man's antiquity will be considerably reduced. I will confine my remarks to the affirmed implements, &c., of the gravel drift; those from Brixham Cave were, in my judgment, satisfactorily disposed of in a paper read by Mr. Whitley before this Institute. But the implements of the gravel drift demand more careful consideration. I have seen that beautiful collection in Blackmore Museum, Salisbury; and some of the still finer specimens in the possession of Mr. John Evans, the President of the Anthropological Society. I have looked at them until I have been hardly able to doubt the human origin claimed for them. But then I have to bear in mind that these are very choice specimens, virtually selected from some thousands of other broken flints that bear more or less resemblance to these chosen ones. I have seen about a thousand together at the residence of the late M. Boucher de Perthes, at Abbeville; they were collected from the implement-bearing gravel in that neighbourhood, but I do not think that there is any one present who would not at once dismiss two-thirds of them as simply flints that had met with accidental fracture, yet all bearing a certain resemblance to the better forms. Here is a very fine specimen of the spearhead type [Mr. Callard produced a specimen, which was handed round the room for inspection]; it was found in the gravel-bed of Moulin Quignon, and no believer in drift implements would question the human fashioning of this specimen. But here is a broken flint which I took out of the same gravel-pit [the specimen was shown] which I do not think that any member of this Institute would claim for a human implement; but when the other side of the flint is presented to you, it exhibits the same *outline* as the accepted spear-

head. I also, from the same gravels, obtained this specimen [another specimen shown], which bears not the faintest resemblance to spear-head, hatchet, or to any other implement, but you will observe that the surface is covered with the minute chipping and flaking, that, had it occurred on the other specimen with a spear-head outline, it would certainly have been received as one of the implements fashioned by the hands of Palæolithic man. I will now show you a flint which I obtained in the neighbourhood of Marlborough Downs [specimen exhibited]; it has not yet been out of its matrix, therefore could not have received its form from the hand of man; it is incased in silicious sandstone, and it has so happened that the blow given to the stone by the mason has split the flint longitudinally, which affords a good opportunity of examining its natural form, and if you compare it with the accepted implement from the gravel-bed of Moulin Quignon, you will observe that both in size and shape they are identical; in addition to which, the exposed part of the flint is covered with facets. As there is no *collateral* evidence whatever to support the claim of these chipped flints being the work of man, the evidence of their being such resting exclusively upon their form and chipping, and seeing that nature does produce similar forms, which by natural causes can get similarly chipped, I think we may be justified in some hesitation in accepting these flints, however remarkable they may appear, as the workmanship of Palæolithic man. To say the least, they appear too doubtful to be made the basis to support the theory of man's great antiquity.*

* The greater or lesser antiquity of the *earth* in no respect affects the question of the antiquity of *man*. No scientific man has thought of placing man farther back than the Miocene period, and but few would claim for man a greater antiquity than that of the Gravel Drift. The reasons which would lead to claiming a great antiquity for the former are totally different to those that are adduced for the antiquity of the latter.—(T. K. C.)

With respect to certain well-known theories requiring vast epochs for geological changes. In a work just published, *Recent Researches in Physical Science*, Professor P. G. Tait says that the Uniformitarian theories of geologists are "totally inconsistent with modern physical knowledge as to the dissipation of energy"; he then speaks of "the Law of the Dissipation of Energy, discovered by Sir W. Thomson," and remarks, "It enables us distinctly to say, that the present order of things has not been evolved through infinite past time by the agency of laws now at work, but must have had a distinct beginning—a state beyond which we are totally unable to penetrate, a state which must have been produced by other than the now (visibly) acting causes." And, arguing from our present knowledge of radiation, against the claims of "Lyell and others, especially of Darwin, who tell us that even for a comparatively brief portion of recent geological history three hundred millions of years will not suffice," Professor Tait quotes Sir W. Thomson's three lines of argument, and urges, "Ten million years is the utmost we can give to geologists for their speculations as to the history even of the lowest orders of fossils" and "for all the changes that have taken place on the earth's surface since vegetable life of the lowest known form was capable of existing there." Of course, it remains to be seen how far future researches may induce others to modify the above statements (vol. x. p. ii.).—Ed.

Rev. T. M. GORMAN.—I must dissent from one portion of Professor Birks' statements, for in the text of the earlier chapters of *Genesis* I cannot discover sufficient data for an exact chronology; but we may be sure that the true chronology would harmonize with the *facts* of science.

Captain F. PETRIE (Hon. Sec.).—Without offering any opinion upon the special question raised in the paper, I venture to refer to two remarks made by Dr. Currey: the first is that in which he alluded to Sir C. Lyell's calculation as to the antiquity of man in the Mississippi valley. Sir C. Lyell, in the fourth edition of his *Antiquity of Man* (1873), refers to only two instances of fossil human remains having been found in the Mississippi valley; the first being that of the skeleton of a Red Indian, the cranium in good preservation, found 16 feet below the surface when excavating for some gas-works: Dr. Dowler considered it to be 57,600 years old. Sir C. Lyell cites his opinion with apparent approval (p. 46), and gives his reasons, founded upon a calculation as to the rate of deposit of the mud; but Messrs. Humphreys and Abbot, quoted by Sir C. Lyell in the later edition of his work as reliable authorities, have calculated that the whole ground on which New Orleans stands, down to a depth of 40 feet, has been deposited in forty-four centuries. In regard to the second instance of fossil human remains, Sir C. Lyell says, "It is necessary to suspend our judgment as to the high antiquity of the fossil" (p. 239). To show the rapid rate of deposit in the valley, M. Fontaine mentions that near Tamaulipas Street, New Orleans, the whole area to the depth of over 100 feet has been deposited within the last sixty years; and that since the construction of the gas-works, some deep excavations at Port Jackson, at a considerable distance from the river, and at a depth of from 15 to 20 feet below the surface, a piece of wood shaped by human art had been found, which on examination proved to be a portion of a modern boat. In a work entitled *The Recent Origin of Man* it is mentioned (p. 472) that the body of a man, which had been buried between two stumps of trees, had been covered by the deposit of the river to a much greater extent in four years than even 16 feet. With respect to the discovery of fossil human remains, many have been found, in regard to every one of which some controversy has taken place: a skeleton in the British Museum is a curious example; it is that of an Indian, killed in battle only two centuries ago; it is embedded in solid rock, and came from the North-west coast of Guadeloupe, where "the rock is a limestone, harder than statuary marble, and is forming daily: it contains minute fragments of shells and coral, encrusted with a calcareous cement resembling travertine, by which the particles are bound together: the skeleton still contains some of its animal matter and all the phosphate of lime." (*Recent Origin of Man*, p. 78.) The foregoing remarks may show some of the difficulties with which we have to cope in our search for geological facts which will throw light upon "the antiquity of man." At the recent conference, held on May 22, 1877, the President, Mr. John Evans, F.R.S., "pointed

out the extreme caution which was necessary in dealing with the subject, as it lay within the domain of the archæologist, the anthropologist, and the geologist; neither of whom was sufficient, alone by himself, to offer a very strong opinion on the subject. Great care was also necessary with regard to the facts of the discoveries themselves, as the objects discovered were liable to get mixed with other objects below them; and this was important in the case of cave-deposits, in which there might be interments of a later date than the human skeletons deposited in the caves. The question was now very much within the province of the geologist, whose business it was to determine the antiquity of the deposits in which the discoveries may have been made. After alluding to several recent discoveries in France, Spain, and Switzerland, the President remarked that each successive discovery, or presumed discovery, must be received in a cautious but candid spirit; and, looking to the many sources of doubt and error which attached to isolated discoveries, their watchword must for the present be "caution, caution, caution." With regard to the physiognomy of the negro, as delineated upon ancient monuments being the same as that existing in the present day, a well-known fact should not be forgotten, namely, that a special type will develop rapidly, and then remain to all appearance permanent; the writings and investigations of Dawson, Parker, and others have shown this.* Finally, I do not think we can, in any of our scientific investigations in regard to these subjects, have a better watchword than Mr. Evans's, the more we investigate and the more we know, the more will this appear; and I hope our faith is not held so lightly as for us to allow its safety to be compromised by the lights and shadows which may fall upon it during our labours.

Professor BIRKS.—I think it should hardly have been expected that I could, in one paper, treat the whole of the large question which my subject involves. I have only dealt with one specific point on which the theory now in vogue, for insisting on the high antiquity of man, mainly rests as a definite result of science. I should be sorry to have it supposed that I say that any one who does not accept my view of the antiquity of man is an infidel. I only say that so far as that point is concerned he departs from the Bible testimony. I do not mean to say that any one who does not believe in the one point of the 7,000 or 8,000 years does not believe in 19-20ths of the Bible absolutely and in the New Testament, but he seems to me to have surrendered one integral part of the whole message, and in so doing he impairs his faith in the rest. I do not deny an ice age, but I have a view of my own which is quite consistent with the narrative of the Bible.†

The meeting was then adjourned.

* Vol. X. p. 384.

† Professor Andrews and other Americans have argued that the Ice age ended scarce 8,000 years ago; Sir C. Lyell and Mr. Geikie admit that the Glacial period in Scotland may be brought down to the "Polished Stone age," or 6,000 years ago. (*Recent Origin of Man.*)

CONCLUSION OF PROFESSOR BIRKS' REPLY (COMMUNICATED).

My second paper, like my first; in which I have sought to repel the charge that the Bible is inaccurate, and opposed to the certain and proved conclusions of science, has brought upon me a strong censure from Dr. Currey. He thinks my defence mischievous and unsound, though he does not profess to understand it as a scientific argument. He thinks it lost labour to show that five or six different theories, upon which the dogma of man's high antiquity has been based, are erroneous, and exclude each other, unless I can prove the same, in this one paper, of every possible hypothesis or presumption of the same kind. I am astonished at such a test of valid argument in defence of the thorough truth of the Bible being laid down by any one. I must strive to clear away the mist which would make my labour almost fruitless unless it be removed. The basis of my argument is that the Bible does not merely contain the "Word of God" somewhere within it, but is itself "God's word written," or a series of messages which the Holy Spirit spake by the prophets; that it is truth, "the true sayings of God," and not an imperfect mixture, in unknown proportions, of God's truth with numerous errors; that hence it is not lawful for any Christian "so to expound one part of Scripture as to be repugnant to another": this could only be true if it contains no real self-contradiction. If the Scripture, then, is God's word, and all self-consistent, it cannot contradict genuine science. Two kinds of contradiction are possible, and very frequent. False constructions of Scripture may be opposed to true and sound conclusions of science; and false conjectures, hypotheses, and inferences of students of science may contradict alike the real truths of science and unambiguous statements of the word of God. Wherever there is a seeming collision, the duty of every honest Christian is to inquire, first, what is its real source,—a false interpretation of the Bible, or of the works of God, and the facts of science. Now, I cannot defend the Bible from infidel assaults under these two unfair conditions—unlimited scientific credulity, and an unlimited license of non-natural interpretation of the Bible, so as to impute to it the almost entire absence of any definite meaning. In the present paper I am said to have charged all with being infidels who do not accept "Ussher's" chronology, and to have made this one essential part of Christian orthodoxy. I am astonished at the charge, when I have done the exact reverse. I named a limit for the Bible date of man's entrance on the earth, which includes the highest estimates of those who do not altogether discard the Scriptural testimony concerning it. There may be Christians who, in deference to the inferences or guesses of modern geologists, can accept some such paraphrase as this of the earliest link in St. Luke's genealogy of Christ. Having climbed some four or five thousand years to Seth in seventy ascents, then, in order to complete a hundred thousand years, they must proceed: Who was the son of Adam;

who was the son in a thousandth descent, of some pre-Adamite man, who was the son, in the ten thousandth generation, of some ape, chimpanzee, or gorilla, which was the son, or creature at least, of God. But those, if such there be, who can stretch the words of God so far, to make them fit the supposed exigencies of modern thought, will never persuade infidels that they are honest in this process of accommodation. The author of *Supernatural Religion* speaks with contempt of "the profoundly illogical zeal of distinguished men within the Church," who endeavour "to arrest for a moment the pursuing wolves of doubt and unbelief by throwing to them scrap by scrap every element which does not quite accord with current opinion." The nature of my own argument is clear as the day. If distinct and repeated statements of the Bible, linked with the very foundations of the faith, are to be rejected, something more than a "perhaps" or "peradventure," or loose notions about what we think was the probable lapse of time from Adam to the first negro, can alone warrant their rejection. Now the one definite argument I find amidst a sea of conjectures and loose guesswork is this, that traces of man's presence are first found soon after what is called the Glacial age or Boulder Drift period. Next, Mr. Croll, in an elaborate and ingenious theory, very widely accepted, ascribes this to a definite astronomical cause, and places it just about 200,000 years ago. I have shown, on the grounds of pure science, that this theory, however great the labour and skill bestowed upon it, is radically defective, and that at the period in question the more correct and scientific conclusion is, that the winter in Great Britain would be just as cold as the winter in Canada, but the summer heat 30 deg. higher than the summer of Canada or our own. To complete the defence of the Bible from its assailants under this head, it would be needful to propose a different explanation of the facts, in harmony with the statements of Scripture. This I think that I see clearly, and I shall hope to unfold it at some future time.

REMARKS BY C. R. BREE, M.D., F.Z.S.

Human remains have not been found in any well-marked geological stratum. Certain implements, said to have been of human manufacture, have been found in caves, gravel, and kitchen-middens of doubtful age, though evidently much older than the time allotted to man's existence on earth. But, as Dr. Currey remarks, we have no definite human chronology mentioned in Scripture; so there is no contradiction. There can be no doubt but that man lived on the earth much before 7,000 years ago, but we have no proof in the records of geology that his life began in any well-known geological epoch. The real fact of value is that no remains of man or his antecedent, "the hairy cocked-eared wild man" of Darwin, have hitherto been found in any geological stratum. The paper certainly does not deserve the charge brought against it in Dr. Currey's concluding remarks.

ANNUAL GENERAL MEETING,
HELD AT THE HOUSE OF THE SOCIETY OF ARTS,
FRIDAY, MAY 31, 1878.

The HONORARY SECRETARY, Capt. F. PETRIE, read the following report :—

*TWELFTH ANNUAL REPORT of the Council of the
VICTORIA INSTITUTE, OR PHILOSOPHICAL SOCIETY OF
GREAT BRITAIN (7, Adelphi Terrace, London, W.C.).*

Progress of the Institute.

1. In presenting the TWELFTH ANNUAL REPORT, the Council desire to state that during the past year, both at home and abroad, there has been manifested an increasing interest in the Society: they look upon its condition as satisfactory, considering the unsettled condition of European affairs, the effect of which has been almost universally felt. Still, however, the continued steady support of each Member and Associate is now no less indispensable for the Society's well-being than before.

2. With the object of furthering the Society's progress abroad, communications have this year been addressed to those leading Englishmen and Americans throughout the world who were considered most likely to take advantage of the Institute in the countries in which they reside. The correspondence has been somewhat large, but the first results of this step have been very encouraging. Further communications are now being made to ensure increased publicity for the objects of the Institute in the Colonies, especially those that have expressed the desirableness of so doing.

The extension of the operations of the Society in America

and the Colonies is of no little moment, for nowhere are its operations more needed; the state of thought in new countries has a great tendency to a shallow scepticism; it is marked by a great mental activity, and little deep thought; a wide knowledge of the practical applications of science, and little time for real philosophical study; and it is just in such soils that modern scientific scepticism takes root most freely.

3. The increase in the number of American Members is remarkably gratifying, and leads the Council to hope that the work of the Institute will be carried out in the United States with characteristic energy.

4. The election of the Vice-Presidents and Council has been carried out as usual. The following have been elected:—

President.—The Right Hon. the EARL OF SHAFESBURY, K.G.

Vice-Presidents.

The Right Hon. the EARL OF HARROWBY, K.G.

C. BROOKE, Esq., M.A., F.R.S. P. H. GOSSE, Esq., F.R.S.

Rev. ROBINSON THORNTON, D.D. C. B. RADCLIFFE, Esq., M.D., &c.

W. FORSYTH, Esq., Q.C., LL.D., M.P. Rev. Principal T. P. BOULTBEE, LL.D.

Hon. Tr.—W. N. WEST, Esq.

Hon. Sec. and Editor.—Capt. F. W. H. PETRIE, F.R.S.L., &c.

Council.

ROBERT BAXTER, Esq. (*Trustee*).

V.-Adm. E. G. FISHBOURNE, R.N., C.B.

R. N. FOWLER, Esq., M.A. (*Trustee*).

W. H. INCE, Esq., F.L.S., F.R.M.S.

A. MCARTHUR, Esq., M.P.

E. J. MORSHEAD, Esq., H.M.C. (*F.C.*)

ALFRED V. NEWTON, Esq.

WILLIAM M. ORD, Esq., M.D.

WILLIAM VANNER, Esq., F.R.M.S.

S. D. WADDY, Esq., Q.C., M.P.

A. J. WOODHOUSE, Esq., M.R.I., F.R.M.S.

Rev. Principal J. H. RIGG, D.D.

Rev. Prebendary C. A. ROW, M.A.

Right Rev. BISHOP OF RANGOON, D.D.

J. A. FRASER, Esq., M.D., I.G.H.

H. CADMAN JONES, Esq., M.A.

Rev. W. ARTHUR, D.D.

C. R. BREE, Esq., M.D., F.Z.S.

J. E. HOWARD, Esq., F.R.S., F.L.S.

Rev. G. W. WELDON, M.A., M.B.

Rev. Principal J. ANGUS, M.A., D.D.

J. BATEMAN, Esq., F.R.S., F.L.S.

The Master of the Charterhouse.

Rev. Professor H. WACE, M.A.

D. HOWARD, Esq., F.C.S.

5. The Council regrets to announce the decease of the following valued supporters of the Institute:—

Rev. W. H. Bathurst, M.A. (Foundation Member); Rev. A. Duff, D.D. (Member); J. Fairfax, Esq. (Foundation Member); Rev. G. Howard (Associate); Rev. R. Main, M.A., F.R.S., V.P., R.A.S. (Cor. Member); Rev. Canon Mozley, D.D. (Member); R. Mullings, Esq. (Member); Rev. E. Thrupp (Associate); Right Rev. Bishop Trower, D.D. (Member); R. Trotter, Esq. (Member); T. V. Wollaston, Esq. (Foundation Member).

6. The following is a statement of the changes which have occurred during the past twelve months :—

	Life		Annual	
	Members.	Associates.	Members.	Associates.
Numbers on 1st June, 1877...	32	18	322	320
Deduct deaths			8	2
			<u>314</u>	<u>318</u>
Withdrawn (many temporarily)*			15	32
			<u>299</u>	<u>286</u>
Changes	1	1	-4	2
			<u>295</u>	<u>288</u>
Joined between June 1st, 1877, and May 20th, 1878	3	2	27	53
	<u>36</u>	<u>21</u>	<u>322</u>	<u>341</u>
	57		663	
Total				720
Hon. Foreign Correspondents and Local Secretaries, 27.				

Finance.

7. The Audited Balance Sheet of the Treasurer for the year ending 31st December, 1877, is appended, showing a balance in hand of £1. 8s. 6d. The amount now invested in the New Three per Cent. Annuities is £787. 8s. 1d.

8. The arrears of subscription are now as follows :—

	1872.	1874.	1875.	1876.	1877.
Members	1	2	1	9	7
Associates.....	0	0	2	2	15
	<u>1</u>	<u>2</u>	<u>3</u>	<u>11</u>	<u>22</u>

9. The estimated ordinary assets of the Institute for the current year, exclusive of arrears and of new subscribers, are as follows :—

Annual Subscribers.	£.	s.
322 Members, at £2. 2s.....	676	4
341 Associates, at £1. 1s.	358	1
Vice-Patrons, Life Members, and Life Associates.		
Dividend on £787. 8s. 1d. (Three per Cent. Stock)	23	2
Total.....	£1,057	7

* Those influences which this and last year greatly affected all Societies have been somewhat felt by this Institute.

Meetings.

- "Creation and Providence." By J. E. HOWARD, Esq., F.R.S. December 3, 1877.
- "Nature's Limits; an Argument for Theism." By S. R. PATTISON, Esq., F.G.S. January 7, 1878.
- "Mr. Matthew Arnold and Modern Culture." By Professor LIAS, St. David's College, Lampeter. January 21.
- "On the Relation of Scientific Thought to Religion." By the Right Reverend the LORD BISHOP OF EDINBURGH, D.D. February 4.
- "Assyrian Monuments." By W. S'CHAD BOSCAWEN, Esq. February 18. (Intermediate.)
- "Monotheism." By the Rev. Dr. RULE (Author of "Oriental Records") March 4.
- "Was the name Jehovah known to all Shemitic Nations?" By Professor SWAINSON, D.D. (Cambridge University). March 18. (Intermediate.)
- "Modern Geogenies exemplified in their bearing on the Antiquity of Man." By Professor BIRKS (Cambridge). April 1.
- "On the Formation of Valleys." By G. RACE, Esq. April 15. (Intermediate.)
- "Physical Geography of the East." By Professor J. L. PORTER, D.D. May 6.
- "Physical Geography." By J. THORNHILL HARRISON, Esq., M. Inst., C.E., F.G.S. May 20. (Intermediate.)
- ANNIVERSARY. Annual Address by Rev. Principal J. H. RIGG, D.D. (*at the House of the Society of Arts*). May 31.

10. The meetings during this session have been numerously attended.

*Publications.**

11. The Eleventh Volume of the *Journal of Transactions* has been issued.

* The *Transactions* now extend to eleven volumes, containing the papers and discussions thought worthy of publication. Some are purely scientific, such as, *e.g.*, the paper on the Isomorphism of Crystalline Bodies, and some take up those questions of Science or Philosophy which bear upon the truths revealed in Scripture,—these latter are taken up on account of the assaults made in the name of Science or Philosophy upon Revelation, and with a view to elucidating the Truth, and getting rid of such philosophic or scientific theories as prove baseless. Theological questions, being naturally outside the Institute's objects, are left for other Societies and ministers of religion.

12. The Journal contains Papers read at the Meetings, and the Discussions thereon. Before they are published in the Journal, the Papers themselves, and the Discussions, are revised and corrected by their Authors, and MS. comments and supplementary remarks are added, which have been sent in by those Home and Foreign Members to whom, as being specially qualified to pronounce an opinion on the respective subjects, proof copies of the Papers have been submitted for consideration. These arrangements, which cannot but add to the value of the Journal, are carried out with a view to the advantage of all, especially Country and Foreign Members, WHO THUS FIND IN THE JOURNAL MUCH VALUABLE MATTER, IN ADDITION TO THAT WHICH HAS COME BEFORE THOSE ACTUALLY PRESENT AT THE MEETINGS.

13. Many Members at home and abroad continue to use the Journal as the basis of lectures in their neighbourhoods.

14. It is very desirable that the translation of the more popular Papers into foreign languages should be extended.

15. The Institute exchanges Transactions with many leading home and foreign Scientific Societies.

16. Finally, it is most important that the VICTORIA INSTITUTE should not only be maintained in a state of thorough efficiency by its present supporters, but that it should be enabled to go forward rapidly in carrying out its work. The President and Council, being anxious that the extent and value of that work should be increased, ask the co-operation of all Members and Associates; all can aid in raising the numerical strength

THE PEOPLE'S EDITION.—With a view to further opposing that scepticism of the day which takes its rise from erroneous views as to the results of scientific discovery, or from the rash adoption of such pseudo-Philosophical or quasi-Scientific theories as tend to undermine the public belief in revealed religion, the Council decided in 1874 to commence the issue, in a cheap form, of single copies of some of the Papers in the *Journal of Transactions*; seven Papers are now so published. The Institute has now many bookseller-agents in various large towns of the United Kingdom for the sale of this Edition, and it has been much sought after, for circulation amongst friends and distribution amongst the intelligent working classes in manufacturing, mining, and other districts. It may be mentioned that many have reported that they find them of much use as works of reference, especially in districts where lecturers or literature advocating philosophical or scientific theories tending to scepticism are common.

of the Institute by introducing new Members, and by making its objects known in their respective neighbourhoods.

In conclusion, the Council cannot but express its thankfulness for the success which continues to attend the Society's exertions. The time when it was only known as a Society working in the United Kingdom has passed by, and it can now count its supporters in many a country throughout the world. The existence of such support greatly adds to the efficiency with which its objects are carried out, and should induce all to assist in extending its influence whilst opportunity offers.

Signed on behalf of the Council,

SHAFTESBURY.

DONATIONS IN 1877.

		£.	s.	d.
LIBRARY FUND.....	F. B. Hawkins, Esq., M.D.,			
	F.R.S.	5	0	0
	John Walter Lea, Esq. ...	2	0	0
		7	0	0
PEOPLE'S EDITION FUND.	J. E. Howard, Esq., F.R.S.	10	0	0
	S. Morley, Esq., M.P.	10	0	0
	F. W. P. Long, Esq., Dun-			
	ston, Norwich	5	0	0
	Professor E. H. Plumptre,			
D.D.	2	2	0	
		£27	2	0

The following balance-sheet was then read:—

TWELFTH ANNUAL BALANCE-SHEET, from 1st January to 31st December, 1877.

RECEIPTS.				EXPENDITURE.			
	£.	s.	d.		£.	s.	d.
Balance in hand				Printing	436	0	7
Subscriptions:—			0 3 5	Lithography and Photography	5	16	8
1 Life Member	21	0	0	Binding	6	7	0
1 Member 1873	2	2	0	Reporting	32	11	0
1 „ 1874	2	2	0	Stationery	24	5	9
1 „ 1875	2	2	0	Postage	95	10	9
9 „ 1876	18	18	0	Advertising	42	10	8
274 „ 1877	575	8	0	Expenses of Meetings	24	18	6
3 „ 1878	6	6	0	Rent to Christmas, 1876	160	0	0
27 Entrance-fees	28	7	0	Salaries for Year, Clerk	52	0	0
4 Life Associates	42	0	0	„ Extra Clerks	5	16	4
11 Associates, 1876	11	11	0	Housekeeper	19	10	0
287 „ 1877	301	7	0	Travelling Expenses	13	7	7
10 „ 1878	10	10	0	Coals	2	10	0
			1,021 13 0	Gas and Oil	3	7	5
One Year's Dividend on £699. 8s. 7d.				Insurance	0	12	0
New 3 per Cent. Annuities			20 14 4	Sundry Office Expenses	10	9	10
Donations to Library Fund			7 0 0	Hon. Secretary's Expenses	105	0	0
„ People's Edition Fund			27 2 0	Bankers' Charges	0	11	10
Sale of Journals, &c.			75 0 2	*Investments £87. 19s. 6d. New 3 per Cent. Annuities	84	2	6
			£1,151 12 11	Library, Books, Repairs, and Removing	24	16	0
				Balance in hand at Bank	1	8	6
					£1,151	12	11

We have examined the Balance Sheet with the Books and Vouchers, and find a Balance in hand of £1. 8s. 6d.

G. CRAWFURD HARRISON, }
 JOHN ALLEN, } *Auditors.*

W. N. WEST, *Treasurer.*

* Invested in December, 1877, making now £787. 8s. 1d. (see Report, § 7.)

The Right Hon. the EARL NELSON ; had much pleasure in moving, "That the Report of the Council now read be received and adopted, and circulated amongst the members and associates." In doing so, he wished to express his gratification at the progress which the Institute had made. It was, he said, one of the glories of the Church of England that she had so nobly come forward, not to check Science, as some Churches had done, but to sanctify it. He condemned the crude deductions of men of science, which were put forward as irrefragable proofs of the absurdity of Revealed Religion. One of the essential works of this Institute was to sanctify Science, and to show that Revelation was in no way antagonistic to modern scientific discovery. He strongly counselled unity among all Christian bodies, for unity was essentially needed to meet the speculations and dogmatism of infidel writers.

Rear-Admiral J. SELWYN, R.N.—I regret to say that although one of the original foundation members, yet I have not been able to be present at any of the previous meetings, having been very much engaged in foreign countries for many years past. I have made myself acquainted with the nature of the report, which is now offered for your approval. While in many other institutions known to me there is a lamentably long list of defaulters, when the arrears of subscriptions come to be read, often amounting to 25 or 30 per cent., I am happy to draw your attention to the fact, that in this Institute the number of those who have not paid their subscriptions for 1877 is only about $3\frac{1}{2}$ per cent. of the total number of annual contributors. I think this result is largely due to the exertions of the officers of the Institute, but it is also a most gratifying feature of the Annual Report, as showing the real interest taken in the work of the Society. No test of this feeling is more certain than that of the regularity with which such payments are made, and no result can be more advantageous to the Society in which it occurs. The work which has elicited so solid a commendation has been, during the past year, of a character even more likely to interest large numbers of thoughtful men of all nations than ever before; since the papers read, and the discussions that have taken place on them, have not only ably confuted much false reasoning on all-important subjects, but have materially added to the true basis of reasoning, by bringing forward new facts and new explanations of old records. Among the latter I would especially point to the paper on the "Horus Myth," by Mr. Cooper, most interesting as evidence of the primeval feeling among mankind as to the inevitable necessity to the human race of a Redeemer, however grossly portrayed. The refutation of errors advocated by Mr. Darwin and Professor Tyndal and their followers, ably conducted as it has been, can never possess the abiding interest which attaches to new facts, such as become the best weapons of future controversy. Theories and their authors often perish together, but new facts in each generation make up the true sum of science. To these facts, travellers by sea and land can largely contribute, and I cannot but think, if a wider field of observation were more closely studied, we should advance faster, and along safer tracks than by

generalizing on insufficient premises. As one of these travellers, I hope some day, by the permission of the Council, to contribute something towards the elucidation of the probable causes of the Noachian Deluge. A new fact which I have seen illustrated at another Institution this very day—the microphone—gives to the world the power of microscopic hearing, as it has long had that of microscopic seeing, and if the latter power has led philosophers into some errors of theory, it may be that this new power will correct their views, and bring them more nearly into accordance with truth. Meanwhile, we can scarcely be surprised if there are some in all ages—more and more, it is to be remarked, a minority—who misuse the increments of knowledge, as they are vouchsafed from the Divine Giver of all human science. Approving, then, as I do most heartily, the financial state of the VICTORIA INSTITUTE, and the manner in which the noble work on which it is engaged is conducted I have the greatest pleasure in seconding the resolution.

The resolution was carried unanimously.

Rev. Principal BOULTBEE, LL.D.—I beg to move “That the thanks of the members and associates be presented to the Council, Honorary Officers, and Auditors, for their efficient conduct of the business of the Victoria Institute during the past year.” If the length of a speech were any measure of one’s sense of the importance of a subject, my speech ought to be a very long one. The success of the Institute has been beyond any expectation that might fairly have been raised. This has been due to the wisdom and industry of the managers, amongst whom the honorary secretary deserves conspicuous mention. They have had many delicate and difficult matters to deal with, and their discretion and good judgment have safely carried the Institute through its earlier struggles to its present position of power and usefulness. But experience tells me that a lengthy speech is out of place and out of taste at these annual meetings, as tending to keep us from the leading object of our assemblage, the delivery of the Address from the eminent person appointed to speak. I would therefore only observe that the existence and success of the Institute testify to two facts :—First, our conviction that true science can never be discordant with revelation rightly interpreted—God’s voice in nature and in His word must be in harmony ; secondly, that a certain section of men of science are unfairly using supposed scientific discoveries as weapons against Revelation. Instead of the simple endeavour to discover and establish the truth of scientific knowledge, there is a manifest tendency to use imperfectly discovered or doubtful and speculative matters as stones to be thrown at Revelation. To meet and expose this unfairness—to examine and adjust the real bearing to Revelation of that which is known and established—to sift the speculative from the ascertained, is under these circumstances a duty of the gravest nature ; and this work has been faithfully and efficiently done by this Institute (cheers).

M. H. HABERSHON, Esq.—I have great pleasure in seconding the resolution so ably moved by Dr. Boulton. The progress of the Institute in times which have tried every Society, more or less, is a sufficient evidence both of

the careful manner in which the executive have managed the affairs of the Institute and of the need of our existence (cheers).

The resolution was carried *nem. con.*

REV. ROBINSON THORNTON, D.D.—I rise to express the thanks of the Council for the vote of confidence, for such I presume it may be called, which has been so kindly proposed, seconded, and affirmed. It cannot be denied that the duties of the Council are important, and, as has been said, involve many difficult matters requiring discretion and judgment, and it is not unwelcome to be told that we have acquitted ourselves to your satisfaction in performing those duties. Starting with the grand principle that between Scripture rightly interpreted and scientific conclusions rightly drawn from ascertained facts there can be no opposition whatever, the Institute endeavours to meet the attacks upon Revelation, made in the name of science or philosophy, by investigating the scientific or philosophical grounds upon which those attacks are made, with the view of eliminating such theories and hypotheses as prove baseless. In this work we are careful to keep within our lines as a scientific Society, and neither to trench on theological questions, nor to waste the time of the Institute in airing new hypotheses, however ingenious. We leave theology and speculation to others, and content ourselves with our own definite work; and are glad to find that you see reason to continue that kind confidence which you have hitherto reposed in us as your Council. For the vote of thanks, and the terms in which it has been expressed, I beg to return, in the name of the Council, sincere thanks.

THE ANNUAL ADDRESS.

THE PRESENT POSITION OF CHRISTIANITY AND
THE CHRISTIAN FAITH IN THIS COUNTRY.

MY LORD SHAFTESBURY, LADIES, AND GENTLEMEN,—

My task to-night must be a humble one. I have at all times too little leisure, and I have too little learning, even if I had the general ability, to be able to provide for this annual meeting any such a discourse on the present condition or position of science in relation to philosophy or theology as we have been favoured with in several former years. I have, therefore, shrunk very much from undertaking so responsible a task as that which, notwithstanding, has been forced upon me. Nevertheless, other men—men who could have brought valuable contributions to the literature of the Institute, and whose names would have conferred distinction upon our annual meeting—having proved unable to accomplish what had been expected from them, and there being no one else, as it appeared, to whom the Council could at the present moment resort—no one at least who had not already delivered the Annual Address,—I was obliged to leave myself—under protest, I am bound to say—in the hands of the Council; and, at their risk, hardly with my own proper consent, I shall to-night say what I may best be able in regard to the present position of Christianity and the Christian faith in this country.

There is one thing, I venture to affirm, which can hardly be disputed; viz., that such an association as the *Victoria Institute* was very greatly needed at the time when it was founded, that its course has been one of marked usefulness and of undeniable success, and that at this moment the relations of Christian faith to philosophy and science are better settled, and at the same time more satisfactory, than for some years past. Ten years ago infidelity was more confident in its tone, notwithstanding all that has since been published in the way of sceptical argument or speculation, than it is to-day. Ten years ago it was not suspected by many how much support Christianity could claim from philosophy, or how powerfully the defenders of Christianity would be able to maintain their contention against the usurpations

and dogmatism of science. The *Victoria Institute* having, in the name of philosophy and science no less than of Christianity, uplifted the banner of Christian faith, a puissant host of adherents, counting not a few names of undeniable eminence in every department of cultivated thought, have gathered to that banner, and have manned the defences of our faith and swelled the garrison of the Institute.

It appears to me that there was ten years ago, and that there is still to some extent, a danger of allowing exaggerated fears to prevail in regard to the hold which Christianity, in its essential faith and in its spiritual power, maintains upon our country and upon the rising thought and energy of the nation. Not only is there no need for alarm, there is, I cannot but hope, no need for discouragement; although, on the other hand, false security would be a fatal mistake, and there is need undoubtedly for vigilance and energy,—such vigilance and energy as the *Victoria Institute* was created for the sake of enlisting, of organizing, of setting in array.

The position of Christianity in a country is not to be estimated according to the negative gauge of the absence of professed unbelief, but by the positive gauge of the amount of fruitful Christian energy and life among the people, by the amount of living faith as tested by Christian fruits, of faith and life actually found growing and flourishing in the nation. The opposition now, as from the beginning, is between “that which is of the Father” and “that which is of the world,” to use St. John’s language; between “the mind of the Spirit” and “the mind of the flesh” (the *carnal mind*), to use St. Paul’s language. “That which is of the world” the “lust of the flesh, the lust of the eye, the pride of life,” comprehending in this last the pride and self-sufficiency of the natural understanding—may, at the present time, include much more of professed and active unbelief than in many former ages; but it does not, therefore, follow that the fortunes and hopes of Christianity are lower now than in the ages when professed orthodoxy was too often associated with all that is evil in the world’s appetites and passions. “The mind of the flesh”—the “carnal mind”—may not now, as in some former periods, find it necessary, or at least convenient, to disguise its “enmity” against the spiritual “law of God” and the nature-humbling faith of Christ; but it would surely be a mistake therefore to infer that the faith of Christ and “the law of the spirit of life in Christ Jesus” have less power now than in those former periods: it is an old maxim that an open foe is less dangerous than a hypocritical professed friend.

Sixty or seventy years ago there was little public profession of unbelief,—indeed, the state of the law made such public profession hazardous; but society was honeycombed, nevertheless, with an infidelity not the less deadly because it was contemptuously cold, an infidelity which was to all faith or religious earnestness as a malaria, which seldom showed any respect for morals—often, on the contrary, making a boast of immorality—and which habitually employed language, whatever might be the occasion, of the grossest irreverence and profanity. Can it for a moment be supposed that there was more Christian faith in proportion, that there was really less unbelief, in this country then than now? Let the Parliament of this land during the first twenty years of the present century, with the advantage, if it were indeed an advantage, of its being as yet unreformed, be compared with the Parliament of the last twenty years, and then let it be judged whether the power of Christianity is less to-day, or its prospects less hopeful, than sixty years ago.

Sixty years ago more anti-Christian energy in proportion among the educated classes went into vice and fashionable frivolity than now; to-day our social anti-Christ develops more energy in the direction of critical infidelity; of intellectual rebellion against the “truth as it is in Jesus.” The advance of Christianity during the last two generations is marked—may be said to be registered—by the moral superiority of the avowed unbelief of to-day to the covert infidelity of the early years of this century. Scepticism and agnosticism can of themselves as little inspire morality, can as little teach nobleness or holy love, can as little sustain beneficence and self-sacrifice, whether in right and authority as a principle, or in force and fervour as a passion, as the tide-washed sands of the seashore could bring forth the growths and fruits and flowering beauty of Eden. It is a marvellous evidence of the power and authority of Christianity, of the victory which it has wrung from its foes in the realm of morals, of its indisputable ascendancy over whatever is highest and best in human nature, that anti-Christianity to-day so far does homage to the Christian faith as to assume its ethical code and to imitate its morality. The power, the inspiration, the example of Christianity have thus availed so far as almost to “create a soul under the ribs of death.”

Or, to go back still half a century farther, can any one imagine that there was more in proportion of Christian faith or of Christian life in this country in the last century than there is now? We have only to refer to Bishop Berkeley’s “Minute Philosopher,” to look again at Bishop Butler’s great

work, to consider the gist and purpose of Paley's writings, in order to dissipate any such idea. It is scarcely possible to conceive of an age more heartless, less Christian, more abjectly materialized, than the eighteenth century in England. Infidelity was then vastly stronger in proportion, more fashionable, more arrogant, in what were regarded as cultivated circles, than agnosticism is to-day among educated Englishmen. It may be instructive and encouraging to mark the agencies which Providence has employed during the last century to raise up the power of true religion in this country. The successive waves of spiritual force will serve, in some general way, to register the interval between the Christianity of to-day and that of a hundred years ago. I can, of course, but indicate these agencies and their operation very briefly.

The first I name was the power of right reason applied to Divine things. The fashionable infidelity of England was reduced to absurdity by the fine philosophic irony of the accomplished Berkeley; the grave doubts on moral subjects of sincere questioners, of honest and earnest seekers after truth, were worthily dealt with by the profound intellect, equally candid and humble, of Butler; the metaphysical scepticism of Hume, prototype of the sceptical idealism—shall I call it, or nihilism?—of Mill, was ably refuted by Dr. George Campbell in Scotland, and in England by the luminous common-sense of Paley. Thus infidel intellect was foiled at its own weapons, and Christianity remained mistress of the field of argument.

This was a great and needful success, without which the position of Christianity, at least among educated men, must have been left very insecure. But yet the labours of these masters of argument only gave Christianity a negative triumph. Speculative argument may subdue the aggressive foe, may keep him back, may beat him down; but for Christianity to gain positive triumphs other weapons are needed, not the armour and arms of intellectual defence, but of spiritual onset—the *sword of the Spirit*, the *Word of God*, and, as the only protection against “fiery darts” of doubt and unbelief which no chain-mail of logic however complete and cunningly wrought can always avail to “quench,” the *shield of a living faith*. These other weapons were provided in connection with successive movements of spiritual revival which arose during the century following the rise of Methodism.

These movements may all have been traceable, more or less remotely, to the same fontal influences, but the waves broke successively in different directions. The earliest Methodism—

that of the Wesleys, of Whitefield, and of "the Countess"*—found its field chiefly among miners, ironworkers, handloom weavers, upland agriculturists, and northern dalesmen; among certain circles of "high life," in fashionable watering-places, and in some of the larger towns, especially in the west of England; it made scarcely any impression on the southern and eastern counties, and, except for the eccentric Mr. Berridge's work in Bedfordshire, took but a feeble hold of the midlands south of the Trent. But at length, in its Low Church Calvinistic form, Methodism gained a footing in Cambridge about fifty years after it had emerged from Oxford in its High-Church and Arminian form, to receive its true baptism of faith and power from Moravian Germany. Cambridge was the real source of the Low Church Evangelical movement. Whitefield and "the Countess"—for want of a University school of the prophets—diffused their influence, especially in the later periods of their work, rather beyond than within the pale of the Church of England; but Charles Simeon, entering into the field at Cambridge which his erratic predecessor, Rowland Hill, had helped to prepare, gave form and direction to the Evangelical Low Church movement. In this he was greatly aided by the authority and influence of Dr. Milner, Dean of Carlisle, and Master of Queen's College, Cambridge. Anthony Milner's Church History—he was the brother of the Dean—Scott's Commentary, and even the Olney Hymns, had furnished a necessary apparatus and basis for the work of leavening the Church of England with Evangelical ideas and life which Simeon organized. Earlier still, indeed, the preaching of Romaine in London and Venn in Yorkshire had also helped to prepare the way for an Evangelical revival in the Church; but of the Evangelical movement in its permanent organization Simeon's preaching at Cambridge and his personal intercourse with the undergraduates maintained the central energy and impulse, whilst his unbounded liberality in the use of his private fortune for the planting throughout the country of Evangelical clergymen, and the foundation of well-guarded trusts in the interests of Evangelical orthodoxy, especially in the most influential town centres and the most frequented places of fashionable resort, enabled him to lay wide and firm the basis of Low Church Evangelical revival and extension. He died little more than forty years ago, just, indeed, as the earlier preludings of the High Church revival were beginning to produce a sensible effect, not only in Oxford, but through a widening circle. During

* So Lady Huntingdon was familiarly called throughout all "Methodist" circles in her own day.

fifty years preceding he had been doing his work at Cambridge. John Wesley, for six years before his own death, had known him, and had hailed him as an earnest fellow-labourer. His labours thus occupied the interval between John Wesley and the rise of the Oxford High Church party. The movement, of which he was the leading organizer, must be reckoned as the second wave of religious influence which, during the past hundred years, has spread widely through the land.

The third great wave of Christian influence, mingling with and reinforcing the second, was that with which the name of Wilberforce is identified. Though this movement was closely connected with the Evangelical Church of England movement of which I have just spoken, it was not altogether limited or defined by it. A well-known religious book by an eminent Nonconformist divine—Dr. Doddridge's "Rise and Progress of Religion"—the companionship of Isaac Milner on two continental tours, and, finally and above all, the study of the Greek Testament, were the visible links in the chain of causes by which William Wilberforce was brought to spiritual faith and true conversion. His conversion was no corollary of a movement, can be no boast of a section or of a school,—it was of God; and his personality and personal influence were not capable of being limited to any particular school,—nor indeed to any one Church or denomination. Wilberforce was a Catholic Evangelical, and found his friends and allies among all those "who loved the Lord Jesus Christ in sincerity." He was, in many respects, the forerunner of Lord Shaftesbury. He was father of the modern lay Church of England, founder of the great English lay brotherhood of Christian philanthropy and home mission work. He was himself a preacher of no ordinary power. Of his "Practical View" fifty editions were sold within fifty years after its publication. He carried his Christian influence straight and full into Parliament, and there confessed Christ as a legislator. Thus was another wave of vast scope and mighty influence, another wave of Christian life and love, launched on its career of blessing. The work of which Wilberforce was during his lifetime the soul and centre has been carried forward since his death by a host of noble men and devoted women—the most distinguished of all these ministers of mercy in the influence he has been enabled to exercise having been, as I have already intimated, the honoured nobleman who now presides over this Institute, and who looks back over forty years of philanthropic and Christian enterprise.

The last movement of life in English Christianity which

in this slight sketch I have to notice is that which began in Oxford rather more than forty years ago. Cambridge had been the nurse, at least, if not the parent—had for nearly half a century been the acknowledged centre—of the Low Church Evangelical revival in the Church of England. Oxford was to be the parent of revived Anglican High Church zeal and devotion. It cannot, indeed, I suppose, be doubted that in a sense the Oxford revival was the result, humanly speaking, of the Evangelical movement during the half-century preceding. It was not merely in great part a reaction from that movement, it was in part a direct fruit of it; at least in this sense, that some of the leading souls in the Oxford movement were first quickened into spiritual life under Evangelical doctrines and in Evangelical homes. Dr. Newman, in his "Apologia," has told us the facts as to himself, and he has never disowned or spoken slightingly of his "conversion" whilst still under what are currently described as Evangelical influences. Similarly, we learn from Canon Liddon's sketch of the life of the late Bishop of Salisbury, Dr. Hamilton, that his conversion took place whilst he was under Evangelical Low Church influences. These instances occur to my memory as I am writing. It is likely that if I were to search I should find others of the same kind; but these two are enough to cite for my purpose. Dr. Newman was in its earlier stage the arch-leader of the High Church revival. Bishop Hamilton was, to the end of his life, one of its brightest and most reverend names. How the movement has advanced during the last forty years I have neither need nor wish to describe in this sketch.

But I wish to point out how these various movements or agencies of which I have been speaking have combined, in a very remarkable manner, to cover the whole ground of English society, and to bring Christianity to bear upon every field, every province, every class. The Methodism of Wesley took hold of colliers, miners, ironworkers, handloom weavers (both in the west and north), upland farmers, northern dalesmen, and some of the larger towns in England, especially where there were manufactures, or an independent shop-keeping middle class. Whitefield's labours stirred up a considerable number of Dissenting congregations, and in conjunction with the "Countess" he gained for his Evangelical doctrines a good lodgment in the leading watering-places of England. Alike at Bath, at the Hotwells at Tunbridge Wells, and at Spafields, Whitefield and her ladyship—one or both—left influential congregations behind them. The Low Church Evangelical movement in the Church of England developed

largely in the same direction in which the Countess had broken ground; its strongholds were found chiefly in fashionable places of resort and in considerable towns, its adherents belonged chiefly to the middle class, especially the upper middle class. The numerous and powerful circle of which Wilberforce was the centre was of the same class. His most generous and influential supporters were found among the highest ranks of commercial life. Thus it resulted, that notwithstanding all that had been done by Methodism in its various forms, by the Low Church Evangelical movement, by the philanthropic efforts of which Wilberforce and "the Clapham sect" were the centre, there were left wide spaces and important sections of England and English society almost untouched by the new life which had flamed so far and so wide through the land. Leaving out of account the west and south-west of England, there was little sign of earnest religious life in any purely agricultural region south-west of the Trent; there was quite as little in the eastern counties; nor was there any more sign of fervency or life in those districts of country north of the Trent where the politico-ecclesiastical alliance of the Church and the hereditary landed interest was strictly maintained. In short, in the England of which Oxford may be said to have been pre-eminently the representative—alike in general culture and in political and ecclesiastical tendencies—there was no movement of religious revival and aggression, whatever amount there may have been of steadfast orthodoxy or of religious reverence.

Now it is precisely these regions of England and the corresponding sections of English life which have at length been reached by means of the Oxford High Church movement. I am far from meaning to intimate that within these limits only that movement has been confined; I know that it is far otherwise. Nevertheless the High Church revival was applied first of all to some of the rural parishes, and took hold first of some of the sections of society which I have attempted to describe, and it took hold of them with authority and directness. While elsewhere it encountered organized opposition, here, for the most part, it obtained entrance with comparative ease, and in these spheres of influence the High Church revival has made a powerful impression, whereas the other forms of religious life and organization had, for the most part, failed to strike any root of power.

But High Church zeal has besides applied itself to the reclaiming and converting of the lowest classes of our large towns with great earnestness, and not without success. It works more by specific missions, by brotherhoods and sister-

hoods, than the Evangelical section of the Church ; it makes less of doctrine and much more of ritual ; it is great in services and in public demonstrations ; it cultivates attractive music, and makes the Church the theatre of much symbolism and much decoration ; its donations are most generous and its charities profuse.

Thus equipped the Anglican High Church has entered into the fellowship of revivals, and has completed the circle for England of religious awakening. The whole land is now full of religious movement—every county, every town, of whatever class, every section of society. Church and Dissent, High Church and Low Church, vie with each other in revival services and in homely mission work. In all this revived energy and activity there are not wanting features which even Christians, each from his own point of view, cannot but regard with doubt and even fear ; but surely also there is much on all sides in which Christians of a catholic spirit cannot but rejoice. For myself, I would say with St. Paul, “ By all means Christ is preached, and therein I do rejoice, yea, and will rejoice.” To many Christians—as to myself—the characteristic tenets of High Church Anglicanism seem to savour of serious and even dangerous error, while extreme Ritualism is regarded by such Christians with a feeling not only of dislike, but of alarm. Yet surely no Evangelical Protestant of a catholic spirit, however strong in his Protestant and Evangelical convictions, can fail to recognize much good in a party which numbers among its leading men such preachers as Canon Liddon, and such working clergy as the newly-appointed Bishop of Lichfield. There is large common ground between such men and earnest Evangelicals. Whatever their High Anglicanism may mean, whatever it may imply from which an Evangelical Low Churchman or a Nonconformist is bound strongly to dissent, it is certain that Evangelical doctrine forms the main staple in the ordinary public ministrations of such High Churchmen as I have named. Therefore, even those who utterly dread all hierarchical claims, especially as touching confession, penance, and the sacraments, may, notwithstanding, thank God for such men, and for such revival work as that with which they are identified. So, on the other hand, I would fain hope that all large-hearted and truly cultivated High Churchmen cannot but rejoice in the labours and influence of such men as Dr. Vaughan and Dean Howson, however they may differ from them as to points of great importance. Nor would I allow myself to doubt that, although to many Churchmen Dissent as such may be an offence,—Nonconformity, even in the mildest form of Metho-

dism, a grievous delinquency,—and the doctrine preached in some at least of the pulpits of Baptists, or Congregationalists, or Methodists, especially by the least instructed and refined among the preachers of these sects, may appear as perilous an extreme as the most highly developed and emblazoned ritualism appears to be to an old-fashioned Protestant Dissenter, yet, on the whole, earnest and thoughtful Churchmen cannot but thank God for the Christian work done by such men as Thomas Binney in the last generation, as Dr. Stoughton through a life still happily continued among us, as the powerful preacher of the Surrey Tabernacle, strong Dissenter though he may be, during the last five-and-twenty years. In our controversy with infidelity the Christian union of forces, virtually represented by our *Victoria Institute*, for ours is an omni-denominational, or else an undenominational, union, cannot afford to ignore our common Christian basis of faith, or the common Christian life which ramifies through all our various organizations and developments, and which leavens with Christian conviction and feeling the different classes of our English population.

In the presence of the common foe of us all—the terrible blight of agnostic unbelief which has withered so much fair promise in our Universities, which has so strongly infected our civil service all over the world, which makes so considerable a figure in our social circles, which seeks to inspire all our periodical literature, and has deeply tainted not a little of it—it seems as if there were just now a special need for cultivating in all Christian circles, and among all professors of faith in Christ, a liberal and loving spirit; for seeking, apart from mere forms, to realize “the unity of the Spirit in the bond of peace and in righteousness of life.”

My object, however, in this address is not, even incidentally, to read a homily on Christian charity, however brief, and however noble may be the theme, but to attempt a sketch of the progress which Christianity has made in this country since the time of George II. and his favourite minister Walpole; to note, as I said awhile ago, the agencies which Providence has employed during the last century to raise up the power of Christian faith and religion in the country; to mark the successive waves of force and influence which have carried Christian energy and life into all parts of the land and into all sections of society, and which serve, in a general way, to indicate, to register, the interval between the Christianity of to-day and that of the first half of the eighteenth century. It is for this reason that I have referred specifically to different sections of the Church of England in their several

influences and operations, and to the work respectively of the national Church, as such, and of the various great Dissenting bodies. All these may be said, with insignificant exceptions, to agree as Christians on the common basis of the Apostles' Creed; all recognize as their common foe that infidelity which it is one of the special objects of this Institute to resist and refute; in their combined operations they represent the total Christianity of our land as organized for aggression against sin and evil, and for defence of the Divine revelation of truth and life in Christ Jesus.

And what a marvellous contrast does the Christianity of England as thus regarded present to the condition of this country at the period to which I have referred! What the moral and religious state of England was in the early part of the last century may be learnt from Mr. Leckie's "History of the Eighteenth Century" better even than from the reports of the Society for the Reformation of Manners, as published during the very period. We complain to-day of the wicked rudeness of our street boys in certain parts of London, insulting passengers, and especially women, as they move to and fro. But what are the worst excesses of our street scum to-day compared to the daring and customary outrages of the fashionable Mohocks of London, in the most frequented west-end thoroughfares, during the first third of the last century? To have put down with a strong hand those gentlemen Mohocks was counted one of the high merits of England's greatest Minister of that age. Those were days in which famous highwaymen were favourites in fashionable society, kept their lodgings publicly in St. James'-street and Jermyn-street, were privileged to fight duels with military officers, and openly played bowls on the best-frequented greens and in the company of the most highly titled of the nobility. Intemperance—the intemperance of the masses of the people—is often spoken of as one of the special curses and disgraces of our time; and curse indeed it is, beyond power of words to describe its shame and its horrors. Gin-drinking, in particular, is the peculiar disgrace and ruin of London and of our larger cities. Nevertheless, the gin-drinking of to-day is positively inconsiderable in proportion when compared with the gin-drinking of 1750. Even our lowest classes accordingly, the classes which we sometimes think have defied so obstinately and so hopelessly the ameliorating influences of our Christianity during the present century, have notwithstanding shared, more or less, in the general improvement. It cannot be doubted that the language, the morals, the manners to-day of the Seven Dials or Ratcliff-highway are

very far less lewd, less coarse, less violent and offensive, than the language, the morals, the manners which prevailed in the days of Swift and Bolingbroke among the profligate classes of fashionable life in St. James'-street and Mayfair. And as to all sections of reputable society to-day—the better artisans, the middle classes, the higher ranks—who can doubt the immeasurable advance and improvement which has taken place?

Nor would the contrast of to-day with former times be greatly less striking if the comparison were taken with the early years of the present century instead of the first half of the last century, with the age of Fox and of the famous Westminster elections, the period preceding the wider development of the Evangelical movement in the Church of England and the matured influence of Wilberforce and his fellows. Infidelity, vice, and intemperance were at that time fearfully prevalent in English society.

We seem, indeed, to be living comparatively in a new world. Let us think of the world surrounding Walpole; let us think of Jack Wilkes and his times; or, again, of the moral and social aspects of the Regency and of the ten years preceding; and then consider the progress of the last fifty years, and the Christian tone and aspect of the present age. There are many drawbacks now—there is much inconsistency, there is flagrant immorality, there is not a little daring unbelief; but yet, as a whole, how immeasurably superior is the present time! I have referred already to the contrast between the Parliament of to-day and the Parliament of those former periods. Now, among our foremost statesmen, on either side of either House, how many are there of the highest Christian character, men of Christian profession, Christian zeal and activity, Christian life and spirit. Let us only think of the three men who in succession have held the great seal of the kingdom. Three successive Lord Chancellors have been earnest, devout, and active Christians; two of them having been engaged for more than one generation in such works of lowly and practical Christian service as, in the case of men of such position and accomplishments, best represent the example of Him, who, in stooping down to wash His disciples' feet, left to His followers the injunction that they should do to others as He had done to them.

Perhaps there is no fruit of the complex civilization of our age which so fully, so faithfully, with such delicate accuracy of representation, reflects the character of the age, as our leading journalism. Judged by this test, as there is no country in the world which, measured by a Christian standard, can compare with our own, so there has never been an age to

compare with the present. Our leading daily and weekly journals, our most influential monthly and quarterly vehicles of opinion and discussion, are distinguished by a standard of moral principle, by a sense of moral responsibility, by a generosity in the construction of conduct, by a tenderness in dealing with motives, by a reverence of tone in regard to religious subjects, which can only be properly described as Christian, and the beauty of which can only be appreciated by reverting to the journalism of former generations, or by reference to that of other countries even at the present time. In these results we see the Christian progress, the Christian culture and influence of England compendiously represented. There are, of course, journals more or less disreputable; but then they are disreputable, they have comparatively little influence, they in no way lead the country. In a sense, therefore, they may be referred to as exceptions which prove the point on which I am insisting. There may also in one or two journals of considerable pretensions, and of influence among an important though limited class, be a strong taint of unbelief; but as yet this is mostly disguised, and the journals are not very widely read.

Some, indeed, there probably are who, passing over more than two centuries at a bound, would take us back to the earlier part of the Carolan age, whilst others would take us to the Commonwealth, for a time when Christianity, as they believe, held a far superior position in this country to that which it holds to-day. Doubtless, there may at first appear to be some plausibility in such a view, but it certainly will not bear investigation. If a high form of Christianity had really taken a strong hold of England as a whole in the first half of the seventeenth century, England could never have become what we know it to have been for thirty years before the close of that century. Doubtless, there were great divines, and noble Christians, heroic men and heroic women, brave, pure, and gentle, both among Anglicans and Puritans, among Cavaliers and Commonwealthmen. The names of Jeremy Taylor and John Howe, of Bishop Hall and Richard Baxter, of Lucy Hutchinson and Mrs. Evelyn, of Eliot and Fairfax and Falkland, are sufficient to bring this truth home to our recollection and appreciation. But what of the ordinary parish priest, the ordinary squire, the ordinary farmer or yeoman, the ordinary peasant of those times? It is certain and most evident that the elaborate sermons which remain to us from that age, ponderous with abstruse theology and lavishly brocaded with learned allusions and Greek and Latin quotations, could never have been prepared with the thought

of yeoman, or farmer, or peasant, or even country squire, before the mind of the preacher. They were the works of the learned few for the learned few—for men of scholarship and parts and high position, in an age when the novelty and the comparative rarity of learning made almost all learned men to be more or less pedantic. The average country parson had but a slight tincture of such learning—often, indeed, as extant records show, had none at all. He was mainly such a parish priest as had been the ordinary type in King Henry's reign, save that the forms and offices which he used had been changed. And as for squire, or yeoman, or farmer, or peasant, there is no reason to suppose that their manners or morals had greatly altered since the days of Chaucer, whose *Canterbury Tales* so vividly reflect to us both the manners and the morals of his age. The shires and parishes of England in the days of Charles the First showed a form and a degree of Christian culture, such as it was, immeasurably inferior to what is now to be found in church and chapel and meeting-house, in Sunday-school and day-school, under the instructions and influence of tens of thousands of ministers of all denominations and hundreds of thousands of devoted men and women, fellow-helpers of the clergy, throughout all the towns and villages of England.

Such, then, is the result of Christian progress in this country. Christianity has leavened the whole life of the nation; it has given a high tone to society, to the press, to Parliament; it has filled the country with life. In one form or other it has entered every parish and regulates every public organization. It has moulded our institutions; it has inspired and organized our philanthropy—an all-embracing philanthropy; it makes its voice heard in every detail of local government as well as in every great passage of public life; it has raised England to an unparalleled eminence among the nations. Its most rapid strides of progress have been made during the past fifty years; its most energetic efforts, among all sects and classes, have been put forth during the generation now drawing towards a close; it was never so universally active, so zealous, so thoroughly organized as at present; never did it carry its energies and its efforts so boldly and so successfully into the most neglected quarters as now.

Why, then, if all this be true, or if anything like it be true, should we hear every now and then words of despondency, should we be able yet oftener to detect tones of misgiving, in what some Christian men have to say, in what they venture to forecast, about the future of our religion and

our faith? Let us review what appear to be the causes of these words of despondency, these tones of misgiving, and endeavour to judge how much there may be of reason for the doubts and fears of these Christian men.

I pass over with a bare mention one source of despondency and misgiving, which, however, is very real and affects a considerable number of Christian people—I mean a certain pessimism of tendency or of theory. Some good people always look on the dark and dismal side. They do so in business and in their family affairs. Naturally, therefore, they look on the dark side and are full of despondency as to the affairs of the Christian Church and the future of Christianity. No other aspect would attract them; no other expectation would be congenial. Others there are who hold a pessimist theory as to the future of Christianity. Their exegesis of Scripture, their interpretation of the prophecies, are settled according to this theory. A “sanguine despondency” is their habitual temper, gives animation to their life and inspiration to their eloquence. The influence of these classes of Christians is by no means small, and has helped more than a little to diffuse a tone of gloom over certain circles of earnest Christian people in their anticipations of the future.

Passing, however, over such influences as these, it will probably be agreed that the causes most likely, and likely with the most reason, to awaken foreboding as to the future of Christianity in this country are connected with the condition of our Universities, of our literary circles, of our schools of philosophy and science. It is believed by many, and not without some apparent ground, that the outlook for the future in the directions I have already indicated is really alarming. I wish to adduce some considerations which, I hope, may avail to mitigate, if not to remove, that alarm.

I must, however, first make an admission. I admit, then, that in the independent intellectual activity of the country there mingle powerful tendencies towards unbelief, tendencies which incline men to assume an attitude of antagonism to Christianity. I have already in the opening paragraphs of this address intimated some of the reasons for this tendency. Anti-Christian feelings, alienation of mind from the Christian revelation, which in former times would have taken other forms of opposition, are now free to take the form of professed unbelief.

Infidelity is no longer regarded by the law and society as a form of sedition. Persecution, secret or open, legal or social, is at an end. Criticism, moreover, and intellectual questioning, in all departments, are the passion of the age.

Under these circumstances Christianity, which touches every department of thought and lays its blessing or its ban on every act and circumstance of life, could least of all expect to be exempt from the keen scrutiny of awakened, daring, self-willed intellect. And the schools of intellect, the workshops of inquiry, I mean our Universities, themselves emancipated from all tests and from all restraints, could not but be chief centres of such questioning as I have described.

What is still more to be noted is that the very prevalence of the Christian life could not but lead to the spread of critical and unfriendly questioning as to the claims of Christianity, and to the development of an infidel propagandism. There could not be such intense action without corresponding reaction; such peremptory and all-invading claims without rebellion of spirit being stirred up in the "carnal mind"; such missionary aggression and propagandism as that of Christianity among all classes during the last half-century without provoking infidel aggression and propagandism in return. When Christianity was torpid, and only known by its creeds and forms, infidelity was a latent foe. The intense life of Christianity has stirred and quickened its enemies into activity. The signs, therefore, which some construe as ominous of future danger and reverse to the Christian Church are themselves, in great part, only the consequences and evidences of the triumph of active Christianity in this modern age of stir and life. Like the wash and the wake which the swift steamer leaves behind her as she rushes through the sea, and which seem to be sweeping backwards as if in resistance to the grand vessel's advance, these signs of antagonism serve, in effect, to measure and to mark the line and rate of progress to which they are opposed. Like the backwater or counter-tide on some portions of our southern coast, they are themselves the result of the great and true tide-sweep to which the law and set of their own movement seems to be opposed.

These considerations, however, would not avail to quiet our apprehensions for the future if there were reason to fear that the school of critical or philosophic or scientific thought in our Universities and elsewhere would be permanently alienated from Christianity and the Christian faith. I cannot admit such a fear. I think there are clear reasons why we must come to a contrary conclusion. *Philosophy*, in certain schools, and at certain times, has seemed again and again to revolt from the Christian alliance, but it has always come back again. The recent revival and spread of a masquerading materialistic scepticism in this country was due to special causes, and is already beginning manifestly to decline. The

noblest sons of *science*, again, as has been shown in former Annual Addresses before this Institute, have almost always, perhaps always, been men of reverent faith. They are so to this day. *Criticism*, also, has now and again seemed to threaten precious portions of our Christian inheritance of Holy Scripture; but up to the present time it has really done us little but good. It has been far more our friend than our foe. It has furnished marvellous historical confirmation to the Scriptures, both of the Old and New Testaments. It may possibly hereafter remove some difficulties from our faith, but it will never impair its integrity, nor the integrity of the record of God's revelations to man. The Acts, the Fourth Gospel, as well as the great Epistles of St. Paul, will come forth, are coming forth, from the crucible of criticism brighter than ever; they stand immovably firm, the impregnable pillars of our historical faith in Christ. The Gospel by St. Luke stands unassailable by the side of the vindicated Acts. The other Gospels are abundantly safe when St. John and St. Luke are safe. The Old Testament is better established by far as historically true and authentic, taking it in all its length and breadth, than it was fifty years ago, when modern criticism had only just begun its course. Let us, as believers in divine revelation, be content to wait in steadfast, patient faith. Let us not be cramped by *à priori* notions. We do not understand the meaning of all the sacred words which have been handed down to us. "He that believeth shall not make haste" and shall "not be confounded." Let us precipitate no controversies, above all no controversies with science. When texts seem to contradict each other, we are content to leave the apparent contradiction unsolved, and yet we retain our faith. Christianity does not depend for its evidence on particular texts, nor on the interpretation of any special passage or paragraph; its evidence lies in grand historical lines of argument, and in broad illustrations of fact and truth. By these its principal books and its main outlines of fact and doctrine are conclusively established, and the faith which may have needed first to learn to stand on these, and which has thus been enabled to embrace the spiritual truths which they establish, is thereby afterwards strengthened and enlarged spiritually to appreciate and to receive with a sympathetic and growing assurance other points of divine truth, the harmony and beauty of which shine forth more and more to the believing soul. But when dealing with unbelievers, as one of our own number, Prebendary Row, has so ably shown in his "Bampton Lectures," it is with the citadel we have to do. If we hold that, we, in effect, hold all; that commands all the rest, both *enceinte* and *precinct*; while

it is, in itself, uncommanded and unassailable from every point. The historical evidence of Christ's life, death, and resurrection is the citadel of our fortress.

It is remarkable, after all, how little, notwithstanding all our modern controversies, the ground of the evidential argument, the basis of our Christian defence, has been shifted. Essentially in his "Bampton Lectures" Mr. Row stands on the selfsame ground as Paley in his "Evidences of Christianity." Both defenders disencumber themselves of whatever is non-essential, of whatever to the eye of mere intellect is incapable of evidential proof, and then address themselves to their argument; and both argue on virtually the same principles. So also Paley's argument from design, instead of being torn up, as we were told it was to be, and cast away as worthless, has been effectually rehabilitated. Having been modified in accordance with the language of modern thought—by such writers, for example, as the Rev. Brownlow Maitland, in his excellent manual entitled "Theism or Agnosticism," and by the Rev. Eustace R. Conder in his Congregational Lectures entitled, "The Basis of Faith"—that grand common-sense argument holds good its ground, unanswerable as before. And as respects science and philosophy—to recur now to these points for a few moments—there is, I venture to believe, no reason for panic, no reason for despondency.

How far it is from being true that the highest teachers of science have given, or do give, any countenance to the Agnostic unbelief of to-day, you have, as I have already intimated, heard before, on occasions similar to the present, from men eminently competent to speak on the subject. I may, however, be forgiven for referring again for a moment to a point so important. We all know that among the list of devout believers in these modern times have been included such men as Faraday, Sir John Herschel, Professor Phillips, Professor Sedgwick; we know to-day that such men as Professor Stokes, Professor Pritchard, Professor Clerk-Maxwell are among the number. But I wish to ask your attention to the judgment and testimony of the well-known Professor Tait, of Edinburgh. This distinguished man adopts and makes his own a passage from the *Church of England Quarterly Review*, in which, after referring to that branch of science of which Professor Huxley and Professor Tyndall are such distinguished professors, the branch as the writers call it, of scientific phenomenology, as "a most valuable but lower department of" natural science, the reviewer thus proceeds:—

"But the inferior and auxiliary science has of late assumed

a position to which it is by no means entitled. It gives itself airs, as if it were the mistress instead of the handmaid, and often conceals its own incapacity and want of scientific purity by high-sounding phrases as to the mysteries of nature. It may even complain of true science, the knowledge of causes, as merely mechanical. It will endue matter with mysterious qualities and occult powers, and imagines that it discerns in the physical atom the promise and the potency of all terrestrial life."

Professor Tait, in the same work, declares that "science enables us distinctly to say that the present order of things has *not* been evolved through infinite time past by the agency of laws now at work, but must have had a distinctive beginning, a state beyond which we are totally unable to penetrate; a state, in fact, which must have been produced by other than the now [visibly] acting causes." He speaks furthermore of "the *absolute necessity* of an intervention of creative power to form or to destroy one atom even of dead matter," whilst he declares that "it is simply preposterous to suppose that we shall ever be able to understand scientifically the source of consciousness and volition, not to speak of higher things." ("Some Recent Advances in Physical Science," pp. 349, and 22-24.)

Christians need not, therefore, be disturbed by such unphilosophic assumptions and audacities, such unscientific charlatanry as that of Professor Tyndall in some of his popular addresses. Rashness and recklessness such as his, with whatever gifts of exposition and of address they may be accompanied, merely go to show the defect of thorough training and education in the brilliant Irishman, who, having learnt so much while acting as assistant to the great Faraday, unfortunately never learnt from the example of that profound and sagacious master of experimental philosophy that the "fear of the Lord is the beginning of wisdom," and that a childlike faith in God and Christ is compatible with the character of the greatest of philosophers.

Nor, if the fear be laid aside of any lasting danger to Christianity arising from "the opposition of science falsely so called," is there any more reason why Christian believers should stand in fear of a lasting feud between Christian faith and the accepted philosophy of the schools. It is true that during the last five-and-twenty years the nihilistic idealism—or nihilistic materialism, for either description would be equally appropriate—of Mr. Mill has infected very largely and deeply the thinking of Oxford and the higher English culture generally. But one chief reason of this was that Oxford, that

England, had no philosophy of its own, and no philosophic culture. There were neither principles of philosophy nor a philosophic discipline and training in our English Universities, whereby a student might be enabled to appreciate, to criticise, or to resist the assumptions and insinuations by means of which Mill undermined all positive faith in any principles either of philosophy or morals. Mill's sceptical phenomenology, his denial of all realism, and all intuitions, moral or intellectual, was not directly taught; not built up into a system, in which form its vast gaps and multiple contradictoriness must presently have become visible to all real thinkers, but was implicated by means of the covert postulates on which was founded the whole fabric of his work on Inductive Logic. It was thus conveyed into the system of his readers' opinions, and into the habits of their critical thought, so that its principles were continually suggested as if they had been axioms. Thus a nihilistic scepticism, in which all principles of religious faith, of morality, or indeed of belief in anything whatever as necessarily true or right, were resolved into mere fallacies, or at best utilitarian conventions, was diffused as a subtle poison into the life-blood of a whole generation of young Englishmen. Mill's Logic, before they were aware, turned many of these men into sceptics of Hume's school. After this they were prepared easily to accept George Henry Lewes—who, indeed, is a very able and, from his own point of view, a very honest historian and critic—as their historian of philosophy, and, under his hands, to become admirers of Comte and professors of the Positivist system of negations. Herbert Spencer, again, seemed to those who had sat under Mill, to be a teacher of a higher order, though fundamentally of the same school. If he could not give them a substantial faith, he at least recognized the utterances of their consciousness and the struggles of their nature after a ground of reality. In some sort, indeed, his seemed to be a philosophy of realism, though of a very nebulous description; and if he did not lead them back to God, he brought them within a dim and distant inkling of the inscrutable mystery of the unknown and unknowable reality, in which subject and object darkly and eternally blend. They accordingly passed with some sense of gain from the school of Mill to the oracle of Herbert Spencer. He became their prophet.

But such a philosophy as that of Mill, such a realism as that of Herbert Spencer, could not, endure for long. If our Universities had possessed living schools of philosophy, and a living succession of philosophers, such teachers could

never have gained such a hold on the English mind as they have gained. Already it is evident that their day is past. It was a subtle inoculation by which Mill infused his principles into the English mind. But now the retribution has come. The fallacies of Mill's Logic, the false assumptions which underlie its skilful exposition, had been more or less exposed by various writers, including Whewell and M'Cosh. But now the University of London, his own University, holds them up to view. Professor Jevons, long himself a disciple of Mill, has come to see how the nihilistic assumptions of which I have spoken, how the ignoring, or how the explaining away of all except phenomena, of all realities, of all intuitions, mental or moral, have vitiated the entire fabric of his speculations, and made large sections of his work a congeries of inconsistencies and incoherences.*

And as to Herbert Spencer, his teaching is being sifted by various writers and after a decisive manner. Professor Green, of Oxford, examines him in the *Contemporary Review*. Mr. Conder and Mr. Brownlow Maitland, to whom I have already referred, have admirably refuted his Agnosticism as related to our Christian Theism.

In short, on all sides round, the forces of Christian orthodoxy appear to be rallying and turning the enemy to the gate. As a hundred years ago, so now, unbelief will be, is being, defeated in argument. The victories of Butler and Paley and Berkeley are being repeated. There is a tone of confidence in the Christian camp such as there was not ten years ago. Our champions have gone out—our unknown Davids—and have met, and, meeting, have overthrown the giants of the Philistines. Ten years ago we hardly knew the intellectual strength of the orthodox side. We are beginning to understand it now, and yet only beginning; in ten years more I doubt not our ranks of defence and, let me add, of aggression will be better filled, better disciplined, and more full of confidence than now.

Nor can I doubt, as I intimated at the opening of this address, that the *Victoria Institute* has done something towards bringing about this result. It has presented a rallying-point, a centre of union, not only for Christian thinkers in these kingdoms, but also from America, on which continent

* I am not sure that I always agree with Professor Jevons' own positions; at all events the last paragraph in his last paper on Mill, contained in the *Contemporary* for April, seems to me to be an inadequate statement; but his exposure of the inconsistencies and contradictions of Mill would seem to be complete and crushing.

more than one of our ablest contributors have their home. Let me be allowed here to mention in particular Principal Dawson, of Montreal, and Professor Morris, of Michigan University—very able men both in different lines. Here, in this Institute, some of the ablest defenders of the Christian faith have trained themselves for their work. Two recent Bampton Lecturers are among our leading members. Both Dr. Irons and Prebendary Row have contributed a series of most valuable papers to the Transactions of the Institute. It is just possible even that Mr. Row might not have been Bampton Lecturer but for the *Victoria Institute*. Certain it is that his papers read before this Institute have served as a valuable *propædeusis* for certain sections of his volume of lectures. The Institute which has been enriched by papers from such Christian students of philosophy and science as the gentlemen I have named; as our founder and first honorary secretary, Mr. Reddie, so suddenly removed from us; as that able man of science and exemplary Christian, the late Rev. Walter Mitchell, one of our original vice-presidents; as Professor Kirk, of Glasgow; as the late Professor Main, the *Radcliffe Observer*; as Dr. Thornton; as Professor Birks; as our truly learned and very acute colleague, Mr. J. E. Howard, one of the earliest members of the Institute, and one of the ablest opponents of evolutionary atheism in whatever form, is an association which has not been created in vain. The number of its members has vastly increased during the last five years, and now presents a brilliant and impressive array of names, including not a few of the most distinguished in this and other countries. I venture to anticipate for the Institute still growing success, and that it will proceed from conquering to conquer.

Whilst I was in the midst of writing this address an article appeared in the *Saturday Review* so apposite in its line of thought and in its conclusions to the plan and outline which I had laid out for myself, and had begun to fill up, that I may perhaps be excused for quoting from it some sentences. If I had not already half written this paper before I fell in with the article, it might naturally been thought that I had borrowed from it my main line of thought and some of my illustrations. But in fact the coincidence is a case of independent agreement. The article (April 13) is entitled "Morality and Religious Belief," and the sentences I have selected for quotation are as follows:—

"As to the alleged indications of an approaching collapse of dogmatic belief," says the writer, "it should be remembered that appearances of this kind may very easily be taken

for a great deal more than they are worth. That scepticism, both in its negative and positive forms, is more outspoken than formerly makes it a more noticeable and impressive phenomenon, but does not therefore prove that it is really more widespread or influential than it was, *e.g.*, in the eighteenth century. The open avowal of sceptical views is partly a recoil from the more earnest and explicit avowal of religious convictions, and partly a consequence of it. The plain-spoken frankness or fierceness of sceptical literature testifies among other things to the acknowledged vitality of the religion which it assails. Men do not care to waste their sturdiest blows on a prostrate foe. Those who think religion is really losing its hold on the world might fairly be asked to account for the prominent place occupied by religious considerations in all the great wars and social revolutions of the present century, not excepting the critical struggle in the East which is going on before our eyes at the present moment."

English Christianity may even gather reassurance from the case of France. There is vastly more religious faith in France, I venture to think, at this moment than there has been since the terrible revolution. May I not go further, and say that there is more religious faith and feeling now than for a hundred years past? And yet Christianity in France stands at every disadvantage. It is identified in its popular form with superstitions which are not only idolatrous in their aspect, but heathenish in their character. In popular belief it has been identified with all the wrongs and tyrannies which helped so largely to provoke the revolution.

On the other hand, atheistic unbelief has claimed identity in France with all liberty, whether moral or intellectual, or civil and political, and with all enlightened progress. Nor have the claims of religion been recommended, or its position improved, by the tactics of Ultramontanism during the last five-and-twenty years. Nevertheless, in spite of all these disadvantages, the strongest instincts of national self-preservation have gradually linked themselves into a steadfast array and union against atheistic principles and theories. The strength of Ultramontanism, that which has made it so formidable a power, that which has compelled the nation, though it fears and hates it, yet to tolerate and even to a certain extent to indulge it, is that the nation dreads and loathes atheistic politics even more than it fears and hates Ultramontanism. The nation cannot live without some faith, some religion, some ground of conscience, some basis of morals. It craves a religion which shall not be Ultramontane,

or puerile, or superstitious, or, above all, tyrannical; but, if it must elect between unbelief and Ultramontaniam, it will not, at all events, choose atheism for its creed, and atheistic communism for its civil and political basis. Alas! for the country which has before it such a dilemma. Alas! for the country where the strongest champion against the name and spell of Voltaire is a Dupanloup! Still, notwithstanding such disadvantages on the side of faith in its controversy with unbelief, it is a thing to be noted that, while at this moment the municipal Council of Paris remains unhappily true to its principles of democratic and atheistic irreligion, and had resolved to celebrate, with a statue and all public honours, the centenary of Voltaire, as representing the enfranchisement of the human mind from the yoke of priests and priestcraft, the French Republican Government has intervened to prevent any official action of the nature intended on the part of the Parisian Council. The nation at this point is in sympathy with the Government, not with the municipal officials of Paris—the brilliant but unhappy city of the Commune.

The career of the famous—five-and-twenty years ago the epithet might have been infamous—Madame Dudevant, George Sand, is in this connection full of interest and instruction. That daring and very gifted woman waged war for years against all social decencies and all forms of religious belief. In her later years, however, she greatly modified her views, and altogether changed her tone. She endeavoured to come to terms with Christianity; she professed some form of quasi-Christian faith; she even in the end, it is said, became reconciled to the Church, and died within its pale. Her case seems to me to be in a sense typical. She was eminently a representative woman. Woman though she was, she was as justly representative of the genius of France as any man could have been, perhaps, indeed, more so. On the other hand, the case of Comte, grotesque as it is in some of its aspects, and mournful as it is throughout, teaches the same lesson as that of Madame Dudevant. Even France, even the French mind and character, cannot live without a religion, without a worship. The travesty of faith and worship adopted by Comte is a tribute even to Catholicism. He did homage to the faith of his country even by his own ritual of the worship of humanity. Thank God, English Christianity may command a more reasonable allegiance than French Catholicism. The dilemma of France is not our dilemma, and England will not reject the Christianity of England for the sake of French or even English Comtism or Agnosticism. It will accept no religion of humanity which deprives every man living of

humanity's one hope and consolation, and would despoil the human soul of the essential prerogative of humanity, of that moral character and power which constitutes man's proper definition and being.

German Communism, Russian Communism, are just now showing us the nature of the fruit which cannot but grow from the root of Atheistic or Pantheistic unbelief. Such results as we see at this moment cannot be without their effect on the English mind. They will strengthen the national reverence for the religion of God as revealed in Christ Jesus our Lord.

Christianity, therefore, I conclude, is by no means losing its hold of England nor of the world. Less protected by legal defences than formerly, it possesses far more intrinsic strength and energy. It has taken a much larger and stronger hold than at any former period of the great body of the people, including the best-educated classes. It has a life and energy, a zeal and enthusiasm altogether unprecedented. In Parliament it counts far more illustrious and devoted adherents than in any former age. It maintains an array of philanthropic enterprises, it inspires and maintains an amount of practical beneficence such as the world had never seen. All this is done in the face of an active infidel propagandism which is no longer fettered as in former times, but is free to do its worst. Let no one, then, fear for Christianity. Nearly 150 years ago, Butler, in the advertisement to his "Analogy," said: "It is come, I know not how, to be taken for granted by many persons, that Christianity is not so much as a subject of inquiry, but that it is now at length discovered to be fictitious." Accordingly, he goes on to say that those reputed to be "people of discernment," treated it as a subject only fit to provoke "mirth and ridicule." And yet a few years later John Wesley was converted, and Methodism began its race. Butler's faith and Butler's arguments survive, while the "people of discernment," and their supercilious unbelief with them, have passed into oblivion. Writing some years earlier than Butler, the accomplished Berkeley thus describes the infidelity of his day. "Moschon," he says, "hath proved that man and beast are really of the same nature; consequently, a man need only indulge his senses and his appetites to be as happy as a brute. Gorgias hath gone farther, demonstrating man to be a piece of clock-work or a machine; and that thought or reason is the same thing as the impulse of one ball against another. Cimon hath made noble use of these discoveries, proving as clearly as any proposition in mathematics,

that conscience is a whim, and morality a prejudice; and that a man is no more accountable for his actions than a clock is for striking. But the masterpiece and finishing stroke is a learned anecdote of our great Diagoras, containing a demonstration against the being of God. I am assured that it is as clear as daylight, and will do a world of good, at one blow demolishing the whole system of religion." "Our philosophers," it is added, "are the best-bred men of the age, men who know the world, men of pleasure, men of fashion, and fine gentlemen." The fashion of scepticism, indeed, 150 years ago was considered especially attractive and suitable in the case of smart and cultivated young people. "You may now commonly see," remarks one of the speakers in Berkeley's dialogue, "what no former age ever saw, a young lady, or a *petit maître*, nonplus a divine, or an old-fashioned gentleman, who hath read many a Greek or Latin author and spent much time in hard methodical study."

So wrote Berkeley in his "Minute Philosopher." But Christianity survived the fashion of unbelief which that exquisite dialogue so inimitably portrays, and with such serene and beneficent mercilessness reduces to its true colour and character—as a fashion of vanity and arrogance and absurdity, equally empty and demoralizing, as contrary to the reason and well-being of man as to the majesty of God. The *esprits forts* were put to the rout. Christian faith not only rose superior to their impieties, but, what was far more, revived from the lethargy and formalism into which it had sunk. When we look back to the age in which Berkeley and Butler lived, we do not wonder that men should have been tempted to despair of Christianity. But how great and how re-assuring is the contrast now! If even in such an age Christianity asserted its Divine character and claims by the revival which followed, having first refuted and shaken off, even in that dark hour, the attacks of its critics and its foes, how unworthy would it be to doubt for a moment of the vitality, of the advance, of the victory of Christianity in the present age!

C. BROOKE, Esq., F.R.S.—I have much pleasure in moving "That our best thanks be presented to the Rev. Principal Rigg, D.D., for the Annual Address now delivered, and to those who have read papers during the session." I think Dr. Rigg's Address is especially valuable, as showing that the rise of Christianity in our own land has been coeval with the advance of learning; and it fittingly comes after those valuable papers which have been read during the past session (cheers). Most will probably agree with Dr. Rigg,

that, notwithstanding much open and avowed infidelity and atheism, the present time is marked by a much deeper, as well as more divergent tone of religious thought, than the preceding and early part of the present century, the chief feature of which might rather be termed indifferentism. The abundance of personal ministrations in the present day contrasts favourably with its conspicuous absence at the former period. The hunting and sporting parson of that day in scarlet and buckskin would now be an anachronism, and probably would not be tolerated.

D. HOWARD, Esq., F.C.S.—I have much pleasure in seconding this resolution, thanking Dr. Rigg for his most interesting Address. It is well for some of us, who are perhaps too much inclined to take a gloomy view of the sceptical tendencies of Modern Thought, to be reminded of the brighter side of the question, of the triumph and progress of Christian thought and feeling; and it is specially well to be reminded, by the eloquent passage quoted in the paper, that the assumptions of unbelief that we have to meet nowadays are but the old weapons with which Christianity has been attacked for centuries past, and which neither have prevailed nor shall prevail against it (cheers).

The resolution was then unanimously agreed to.

J. THORNHILL HARRISON, Esq., M. Inst. C.E.—I have been requested to move the next resolution, which I feel confident will be affirmed by you with great pleasure:—It is, “That the thanks of the meeting be presented to our President, the Earl of Shaftesbury, for taking the chair upon the present occasion.” I have but recently become a member of the Victoria Institute, for I was only lately aware of its existence. I am delighted to be connected with it, for it is an exceedingly valuable Institute, and I thoroughly approve of its objects. It is most gratifying to have the support of such men as our noble President, who takes so great an interest in these objects.

H. CADMAN JONES, Esq.—The task of seconding this resolution is an easy one, for no words of mine can be wanting to persuade this meeting to express its feelings towards one whom I many years ago heard well described as “a nobleman of God’s own making.” This Society must feel gratified at seeing in the chair one who has done so much to justify aristocratic institutions by using the advantages of his high position to help those whom circumstances made unable to help themselves.

The resolution was then carried with applause.

THE EARL OF SHAFTESBURY, K.G.—My lords, ladies, and gentlemen:—I am sure you will readily believe that I accept with much gratitude the vote you have been pleased to pass. I believe I was present at the very birth of this Society, when an address was delivered by my friend Mr. Walter Mitchell, in a small dark room. I had no conception at that time of the work which the Society would do, and of the position which it would hold, not only at home, but also, as it is now beginning to do, in America and our colonies. I had no expectation whatever of seeing the Society assume such magnificent proportions, and from the bottom of my heart I thank

Almighty God that He has so prospered our efforts (cheers). We are greatly indebted to Dr. Rigg to-night for his interesting Address, written in so masterly and literary a style (loud cheers). The object with which this Society was formed was, not merely to beat down the views of others, not to be antagonistic to the progress of Science, but to do all that we could do for the development of Truth, and, if I may use the phrase, to give Religion "fair play." This Society was not founded to establish either one opinion or another. It was not started for the purpose of setting up the Bible against Science. THE OBJECT OF THE SOCIETY WAS, THAT SCIENCE SHOULD HAVE FAIR PLAY, THAT THE TRUTH SHOULD BE TOLD ON ALL SIDES, and that we might get rid of the despotism of certain scientific men (hear, hear). Because it is perfectly well known that men of science, with all their sublime and mighty notions, are as despotic as the weakest of the human race, and they are exercising their despotic sway to a remarkable extent over a very large number of rising young men, who are either fascinated by what they have read and discovered, or are crushed by the authority of a few great names. It was in order, as I have said, that Science should have fair play that this Institute was established, and the blessing of God has so rested upon it that it has at last taken a hold in public estimation. Before I sit down I want to say that great credit is due to our Honorary Secretary, Captain Petrie, for the patience, affability, zeal, tact, and energy which he has displayed; and from the manner in which he has acquitted himself in regard to the Institute, I doubt not that, should he be called upon to serve his country elsewhere, he will be quite equal to any emergency.

[The Annual Meeting being concluded, the members, associates, and their friends assembled in the Museum, where refreshments were served.]

ORDINARY MEETING, DECEMBER 2, 1878.

H. CADMAN JONES, ESQ., M.A., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

HONORARY CORRESPONDING MEMBER :—Hormuzd Rassam, Esq., Mossul.

LIFE MEMBERS :—J. G. Barclay, Esq., Essex ; R. H. Gunning, Esq., M.D., America.

MEMBERS :—The Right Rev. the Bishop of Madras, D.D., Madras ; the Right Rev. the Bishop of Victoria, D.D., Hong Kong ; Rev. J. Buller, Norwood ; Rev. J. Crampton, A.M., Ireland ; Canon J. F. McCormick, Geashill, Ireland ; Rev. G. F. Maclear, D.D., King's College, London ; Rev. W. T. Moore, M.A., Southport ; Rev. D. Nickerson, M.A., Cyprus ; Rev. F. Rowland Young, Swindon ; R. Crewdson, Esq., Ambleside ; Captain T. A. Freeman, M.A. (Oxon), 70th Regiment, India.

LIFE ASSOCIATES :—The Hon. J. M. Langston, Resident Minister of the United States, Haiti ; J. E. Mullings, Esq., Cirencester.

ASSOCIATES :—The Right Reverend the Bishop of Auckland, D.D., New Zealand ; the Right Reverend the Bishop of Sodor and Man, D.D., Isle of Man ; Rev. J. Adams, Ireland ; Rev. M. Bradshaw, M.A., Ireland ; Rev. C. Bosanquet, Folkstone ; Rev. G. Curnock, London ; Venerable Archdeacon D. G. Croghan, M.A., South Africa ; Rev. C. F. Deems, D.D., New York ; Rev. G. W. Dalton, D.D., Ireland ; Rev. R. Douglas, M.A., Sheffield ; Rev. T. Flavell, New Zealand ; Venerable Archdeacon H. W. Harper, M.A., Oxon, New Zealand ; Rev. J. Morris, York ; Rev. D. S. McClean, M.A., Southall ; Rev. J. G. Locke, Liverpool ; Rev. D. D. Rutledge, New Zealand ; Rev. J. Saul, D.D., LL.D., Manchester ; Rev. A. T. Wirgman, M.A., South Africa ; J. Marshall, Esq., Leeds ; H. Minchin, Esq., M.B., F.R.C.S.I., Ireland ; Mrs. Gordon, Hampshire.

Also the presentation of the following works for the Library :—

"Proceedings of the Royal Society."	<i>From the Society.</i>
"Proceedings of the Royal Geographical Society."	<i>Ditto.</i>
"Proceedings of the Royal United Service Institution."	<i>Ditto.</i>
"Proceedings of the Royal Colonial Institution."	<i>Ditto.</i>
"Proceedings of the Geological Society."	<i>Ditto.</i>
"Proceedings of the Society of Biblical Archæology."	<i>Ditto.</i>
"Proceedings of the Barrow Natural History Field Club."	<i>Ditto.</i>
"Proceedings of the American Philosophical Society."	<i>Ditto.</i>
"Proceedings of the Canadian Institution.?"	<i>Ditto.</i>
"Proceedings of the Smithsonian Institution."	<i>Ditto.</i>
"Proceedings of the United States Geological and Geographical Survey."	<i>Ditto.</i>
"Proceedings of the Sydney Public Library."	<i>Ditto.</i>

- "Astronomical Observations." J. G. Barclay, Esq. *From the Author.*
 "Bael Fruit." Sir J. Fayer, F.R.S. *Ditto.*
 "Brief." *Messrs. Wyman.*
 "Commentary on Isaiah." Canon Birks *From the Author.*
 "Creation." Rev. A. Stewart, M.D. *Ditto.*
 "Doctrine of a Future Life." W. Alger. *J. S. Crisp, Esq.*
 "Egyptian Belief and Modern Thought." J. Bonwick, Esq. *From the Author.*
 "Future Life;" Papers by Eminent American Divines. *„ Editor.*
 "Genesis." Rev. G. V. Garland. *Ditto.*
 "Implements of the Stone Age." Rev. J. P. Thompson, D.D., LL.D. *From the Author.*
 "Is Palæolithic Man a Reality." By N. Whitley, Esq. *Ditto.*
 "Man's Age in the World." Dr. J. C. Southall. *Ditto.*
 "Medical Times for 1878." *A. Fraser, M.D., I.G.H.*
 "Metaphysics." J. Muller. *From the Author.*
 "Modern Pseudo-Philosophy." J. M. Winn, Esq., M.D. *Ditto.*
 "Palæontology. Bibliography of N. American Invertebrata."
 By Professor H. A. Nicholson, M.D. and W. White, Esq.
Professor H. A. Nicholson, M.D.
 "Physiological Metaphysics." By President Porter, D.D., M.D. *From the Author.*
 "Present Rights and Duties of Science." Principal J. W. Dawson, LL.D., F.R.S. *Ditto.*
 "Princetown Review." *Dr. Dawson, F.R.S.*
 "Why am I a Christian?" By W. R. Bradlaugh, Esq. *From the Publisher.*
 Also Pamphlets from J. Coutts, Esq., Rev. R. Douglas, Rev. G. W. Dalton, the Bishop of Haiti, and the Rev. G. Sexton, D.D.

The following paper was then read by the Rev. T. M. Gorman, M.A., the Author being unavoidably absent.

SCIENCE AND MAN: being Critical Remarks upon Prof. Tyndall's Presidential Address, delivered before the Birmingham and Midland Institute. By NOAH PORTER, President of Yale College, United States.

PROFESSOR TYNDALL has the reputation, and deservedly, of being one of the most brilliant expounders of modern physics among living Englishmen. He is clear and condensed, vivacious and eloquent. It were hard to say whether insight or imagination, method or diction, has the most to do with his success. Though his themes are limited, he rarely repeats himself. The order of his thoughts is usually novel, and his illustrations and language are always fresh and varied. For these reasons he is always welcome as a lecturer, and he rarely disappoints his hearers. He shares with Prof. Huxley the honour of having demonstrated, each in his own

way, that a discipline of classical culture, or of early literary studies, is by no means essential to the training of an effective popular speaker or lecturer upon the severest topics of science. We say each in his way, for the excellencies of Prof. Tyndall and Prof. Huxley are unlike—Prof. Tyndall being strong in illustration, ornament, and suggestiveness, while Prof. Huxley excels in directness, simplicity, and force.

The specialty of Prof. Tyndall, as is well known, is that department of physics which includes the kindred agents of light, heat, and electricity. Prof. Huxley is eminently a physiologist—both human and comparative. Neither of the two, however, confines himself to the specialties named, especially in their popular lectures and addresses—both being more than usually fond of following out the suggestions of physics and physiology in respect to the nature of the soul, the progress and destiny of man, and the origin and end of the physical universe. In plain English, both these gentlemen are very fond of teaching the public metaphysics and theology after what they please to call the methods and conclusions of physical science. We do not altogether blame them for this. The desire and effort show a generous recognition of other phenomena than those which are included within their own departments, and the rooted conviction that all truth is one, and therefore it is impossible that any science of nature should conflict with the other forms of scientific truth, or offend any rational conviction. Prof. Tyndall has appropriated to himself a somewhat wider field of discussion than Prof. Huxley, having discussed very frequently the method of scientific inquiry with a sagacious appreciation of the problem, and with commendable, if not always consistent, sagacity in solving it. From the metaphysics of induction, he has very naturally proceeded to discuss the nature and essence of the soul, and has consequently yielded to the further impulse to inquire what science teaches concerning freedom, morality, immortality, prayer, and God. All this has been done under the impulse of an implicit faith in what he calls science. His confidence concerning his mastery of what he calls the known and the analogies which it suggests in respect to the unknown—his predictions of what is the inevitable tendency of modern thinking in respect to every one of the topics named, and the eager haste with which he seeks to place himself among the foremost of its heralds—are contagiously exhilarating even to the looker-on who neither accepts his data nor his inferences. How much more must the lecturer himself enjoy the glowing excitement with which he sweeps along his triumphant course and the responsive enthusiasm of his confiding and admiring

audiences. It is not surprising, as from year to year he grows more confident in his psychological and theological faith, and is more and more aware of the power which he wields, that he should take occasion as often as once a year to announce with befitting eloquence and ardour the advances by which the thoughtful men of the age are fast proceeding towards the mastery of the universe by scientific thought after truly scientific methods. On the 1st of October last he gave one of these confessions of his faith before the Birmingham and Midland Institute, of which he is President. It was characterized by his usual gracefulness in the introduction, and by his never-failing ingenuity in the development, and by more than usually startling frankness in the conclusion. In reading such a discourse we very naturally ask, of what topic does it treat? We confess that this is a question which it is not easy to answer. It might almost seem at first that it treats *de omni scibili et quibusdam aliis*, so wide is the range of subjects which it passes in review. It will be safe to say in the author's own words that he begins by asserting "that it is now generally admitted that the man of to-day is the child and product of incalculable antecedent time. His physical and intellectual textures have been woven for him during his passage through phases of history and forms of existence which lead the mind back to an abyssmal past," and that he concludes with the equally confident assertions: "Thus following the lead of physical science we are brought without solution of continuity into the presence of problems which as usually classified lie entirely outside the domain of physics. To these problems thoughtful and penetrative minds are now applying those methods of research which in physical science have proved their truth by their fruits. There is on all hands a growing repugnance to invoke the supernatural in accounting for the phenomena of human life; and the thoughtful minds, just referred to, finding no trace of any other origin, are driven to seek in the interaction of social forces the genesis and development of man's moral nature. If they succeed in their search—and I think they are sure to succeed—social duty will be raised to a higher level of significance, and the deepening sense of social duty will, it is to be hoped, lessen, if not obliterate, the strife and heart-burnings which now beset and disfigure our social life." The terminus *a quo* is evolution as an admitted fact of the widest conceivable application. The terminus *ad quem* is a rounded scientific theory which excludes all faith in the supernatural and any possible scientific occasion for God; involving as a corollary, the development from society of all the relations and sanctions of moral obligation. This

faith is fitted to elevate practical morality and to deliver social life for ever from its strifes and hatreds. All these positions except one had been asserted or implied in Prof. Tyndall's previous deliverances. The only advanced position which he takes in this discourse is the very familiar dogma of Hobbes, which has been transfigured by Herbert Spencer, that moral distinctions are created or evolved from social relations and are sanctioned by social forces. "But if this is all that is new in this address, why notice it at all? We have had enough of all this at Belfast and on other occasions, and the staple of such reasoning has been so often used that it is becoming somewhat threadbare." But this does not follow. Prof. Tyndall never repeats himself. If his logic is in principle unchanged, the form in which it is presented always varies. Every time he rises to argue on these extra-physical themes, he adduces what he considers new facts, and employs fresh and novel illustrations. He invariably aims to strengthen the most familiar and oftenest used chain of argument by some links freshly forged. Moreover, he is sensitively alive to what the men of these times are thinking of; so sensitively, that he cannot rest content with old arguments, if new ones are required. He is too ingenuous not to confess, or at least not to betray, his sense of the weakness of some of the positions which he had previously taken, and too ingenious not to attempt to strengthen them. The occasional discourses of so sensitive and frank a thinker as he, are also in a sort the outspokening of what is going on in the minds of scores and hundreds of men who want the honesty or the opportunity to speak their minds as freely as he speaks for them. What is more to the purpose, they declare the secret misgivings and the more than half-formed creed of multitudes of younger men who know not how to answer the reasons of an argument from the conclusions of which they shrink. These are the reasons why we think it worth while to subject this eloquent discourse to a careful examination. We shall do this with the same frankness which our excellent friend, the author, always exhibits, and we hope with equal fidelity to the scientific spirit by which he is animated.

We observe before the argument begins, a little skirmishing, the design of which is not at first view very obvious. In speaking of the dependence of the individual upon the forces of the past, Prof. Tyndall says that Boyle regarded the universe as a machine, but Mr. Carlyle prefers to regard it as a tree, and adds: "A machine may be defined as an organism with life and direction outside, a tree may be defined as an organism with life and direction within." This language seems novel. Can a machine be an organism,—and an organism with

life? Surely the common speech of Prof. Tyndall has made him forget his philosophy. It seems a pity that his German studies did not suggest to him the well-worn definition from Kant,—from whom he is somewhat fond of quoting commonplaces—that “an organism is that in which the parts and the whole are respectively means and ends.”* How marvellous that this commonplace and yet fundamental conception of physiology should have been so strangely misconceived, through the apparent haste of Prof. Tyndall to give, as he does, in the next sentence, an atheistic turn to his very inadequate conception of what an organism is. “I close with the conception of Carlyle. The order and energy of the universe I hold to be inherent and not imposed from without—the expression of fixed law and not of arbitrary will.” In this also, he forgets the patent truth that in the judgment of the great majority of scientific thinkers an organism in its very conception implies intelligence without itself. His confusion of mechanical with organic relations is still more apparent, as he traces the growth of scientific theories from vague anticipations into verified discoveries and fixed methods, and concludes with the remark, which is least of all true in respect to the science of organized existence, that “the interdependence of our day has become quantitative—expressible by numbers—leading, it must be added, directly into that inexorable reign of law which so many gentle people regard with dread.”

In one aspect, as we have said, the intent of these preliminary movements is not very obvious, but in another it is clear that they are designed to prepare his hearers for the conclusion to which he directs every position of his subsequent argument—that the universe of matter and spirit, including as he concedes the phenomena of moral conviction and feeling, as also of religious emotion and religious faith, is in every process and manifestation subject to no other than mechanical laws.

Thus far the movements have been preliminary. The author begins the argument proper with a theme very familiar to himself, viz.: the correlation of physical forces. He traces the growth of this theory from the first felicitous conjecture

* “Ein organisches Product der Natur ist das in welchem alles Zweck und wechselseitig auch Mittel ist.” *Kritik der Urtheils-Kraft*, § 66. To understand the complete significance of this phraseology, the reader must bear in mind that Kant denies that a work of art, i.e., a machine of any sort, can properly be said to be organic or organized. In this doctrine most scientists would agree with him.

to the demonstrated conclusion. He illustrates it by the relations of heat to mechanical work and their mutual interchange, in examples with which the readers of his other essays and lectures are entirely familiar. He considers next the analogous interchange of decomposition and combustion in the use of the galvanic battery for chemical results—illustrating by several examples the truth that chemical elements, say hydrogen and oxygen, which are united in combustion at one point in the circuit, are liberated in exact equivalents at the other. Having taken two steps in his argument, he essays a third, and suggests that the same process under similar laws may go on in the body of man. Having demonstrated that heat is interchangeable backwards and forwards with mechanical energy in mathematical equivalents, and that combustion involving heat is in like manner interchangeable with chemical decompositions, he abruptly asks: “Is the animal body then to be classed among machines?” The friction wheel or the galvanic battery only distributes force—transferring it from one point to another, and varying its manifestations to the senses—but never creating it. Does the animal body do anything more? “When I lift a weight, or throw a stone, or climb a mountain, or wrestle with my comrade, am I not conscious of actually creating and expending force?” The ingenuity of thus putting his case is altogether admirable. It is as though he had said: the question whether the body is or is not a machine must be decided by the question whether it is capable of generating muscular or mechanical energy. The man who asserts that it only transfers force must own that it is a machine—the man who denies that it is a machine must hold that it can of itself generate, *i.e.*, originate, muscular force. The tyro in logic would recognize the possible fallacy which may lie in the major premise of Prof. Tyndall’s disjunctive syllogism. Even did he know little about the subject matter, he might at least be wary enough to say: I am not prepared to say that A is either B or C, for it may possibly be either B, C, or C + D. That is, the human body may be something else than either a generator or a transmuter of force—it may perhaps perform other offices than a friction wheel or a galvanic battery. Whether Prof. Tyndall does not himself concede this a little further on, we shall ask in due time. But Prof. Tyndall having shaped his major premise to suit himself, proceeds to discuss the minor premise by asking whether the human body originates, *i.e.*, generates, mechanical force. He answers his own question by an elaborate and varied series of illustrations, all of which are designed to show that mechanical force and heat and chemism (chemical attraction) are related to one another in

the human body precisely as in the use of the friction wheel or the voltaic battery, *i.e.*, that eating and breathing are simply more refined forms of combustion and decomposition with which heat and motion are correlated. "All this points to the conclusion that the force we employ in muscular exertion is the force of burning fuel and not of creative will." "The body, in other words, falls into the category of machines." "The matter of the human body is the same as that of the world without us, and here we find the forces of the body identical with those of inorganic nature. Just as little as the voltaic battery, is the human body a creator of force. It is an apparatus exquisite and effectual beyond all others in transforming and distributing the energy with which it is supplied, but it possesses no creative power." We have no disposition to dispute this. We concede that so far as *the production of muscular power* is concerned and its transmutation into heat, all this may be true. We question very much, indeed, whether the experiments have been conducted with mathematical exactness, or whether the laws have been formulated with scientific precision or, as Tyndall phrases it, whether "the interdependence" between the several factors has "become quantitative—expressible by numbers." But making nothing of this, and conceding that the law of conservation and correlation of muscular force operates as Prof. Tyndall contends, we cannot but inquire whether the human body performs no other offices than these two, *i.e.*, whether all the functions of life are resolvable into digestion, breathing, walking, climbing, and lifting weights? Prof. Tyndall himself, it would seem, more than half suspects that his machine does something more than transmute force by eating and breathing. When he says: "Thus far every action of the organism belongs to the domain either of physics or chemistry," he bethinks himself that the nerves have something to do with the application and direction of force, if not with its generation. These are sensor and motor. But these do not create force—they do not originate energy—they simply *direct* it, "as Mayer says, with *admirable lucidity*, as an engineer by the motion of his finger in opening a valve, or loosening a detent can liberate an amount of mechanical energy almost infinite, compared with its exciting cause, so the nerves acting on the muscles can *unlock* an amount of power out of all proportion to *the work done by the nerves themselves*. The nerves, according to Mayer, pull the trigger, but the gunpowder which they ignite is stored in the muscles. This is the view now universally entertained." We pass over the concession that has inadvertently dropped from the lips of our author, that work of some sort is done by the nerves themselves, which he had not noticed, and

certainly had not shown to be the accumulation or transmission of some occult transformation of heat. We simply observe that according to Tyndall and Mayer and all the scientific world, a special function is accorded to the nerves—over and above any which the correlation of forces can illustrate, under mechanical law in the machine or chemical decomposition in the battery—and this is a function of directing—*i.e.* of liberating and detaining muscular force—which is illustrated by lifting a valve, or pulling a trigger. It were far better illustrated, as it seems to our unsophisticated minds, by the power of a band or gearing to carry motion in a machine, or of wire to transfer potential motion or potential heat in a battery. It is very evident that when Prof. Tyndall began his argument which was to prove that “the body falls under the category of machines,” and that as a machine it generates no force, he does not seem to have thought of any other function as possible except the two, of generating or transforming force. Not seeing that his animal body, his *homme machine*, does through the nerves perform the additional function of directing or transferring force, that is of determining when and where it should act, it is not surprising that he meets this indefinitely conceived demand by the convenient image or picture of a valve, a detent in a machine or a trigger in a musket. He ought to have bethought himself, and corrected the premises of his disjunctive, and instead of asserting, the animal body either creates force or transforms force, he should have said, the human body either creates force or transforms force or also directs force. Then in order to prove that it is a machine, he must prove that it directs force through the nerves, by either mechanical or chemical agency. This last he does not attempt to do. He does indeed assume that nerve substance is wasted by use, and implies that heat is probably evolved in nerve activity, and illustrates this by a rod of antimony rendered sensitive by electrolysis as it carries forward heat and smoke from one end to another. From this he would doubtless leave us to infer that the nerves like the muscles never act, except under the general conditions of correlation. But in all this there is not the slightest attempt to explain by what mechanical process the nerves *direct* or *transfer* motion. He does indeed tell a somewhat long story about experiments which show that the process of movement or affection in the nerves, sensor and motor, to and from the brain, requires an appreciable lapse of time, so that a second must elapse before a whale seventy feet long would feel a wound in his tail, but he is sublimely unconscious of the fact that the new function of shifting motion, by valve, detent, or trigger during this second, makes the machine a little more complicated than he had at

first supposed. But this slight difficulty not having occurred to him, the animal body is accepted as a finished machine, which is now ready for the "kindling of consciousness," which he confidently anticipates may turn out to be a more refined form of heat evolved by mechanical laws. With this impression, he marches boldly up to the new line of inquiry, which relates to the connection between this machine and a highly poetical or idealized force, sometimes called the soul. To say nothing of these little difficulties, which have hindered us from going forward with him at the rapid pace which he has assumed, there are others which compel us still to follow him *haud passibus æquis*. We are not satisfied that he has disposed of sundry other questions which may be asked in respect to the "animal body." Conceding that in breathing and eating and muscular action, this body is a machine or a voltaic battery, and not insisting on the peculiarity of the function by which the nerves transfer or liberate motion, which Prof. Tyndall has scarcely recognized and imperfectly explained, we hold that this body performs other functions, which the doctrine of the conservation of force does not at all account for, and which are not proved to be mechanical by Prof. Tyndall's argument, or the analogies which it suggests. We need only refer to these. This body grows by a peculiar method, through cellular accretion from within, from living food, making thereby new and peculiar tissues in great variety. Many of these tissues become organs which are capable of secreting special fluids or substances, which themselves pass by an orderly succession into the various permanent substances of the body. Each organ secretes that which finally returns to itself, increasing its bulk, following its form, and fitting for its function. These parts grow after a plan, which is general in likeness of form, size, and symmetry, so far as it is common to all living bodies, special so far as it is peculiar to each species, and individual so far as it is fitted to each individual. Not any one of these effects has ever been accounted for by the joint operation of any known mechanical or chemical laws, much less by their sole or separate activity; least of all with the slightest approximation to that mathematical rigour which Prof. Tyndall contends is the indispensable requisite of scientific certainty. All that can be said has been said by Prof. Tyndall, that so far as heat and muscular activity are concerned, there is probable correlation between the two—that in living matter as truly as in inorganic matter, the combinations in growth and the decompositions of waste are chemical in their ingredients and chemical in their relations. This is not surprising—did not the living body consist of materials which obey mechanical and chemical

laws, this body would so far not be material. This is not at all in question, and so far as a correct conception of an animal body is concerned, it is superfluous to argue the point. What is in question is whether this body is capable of no other functions than these, not whether it is a machine or a voltaic battery, but whether it is not something more. The question is not whether so far as it is material it is subject to material laws, but whether it is not also a living body, and what forces, relations, and laws this conception implies.*

What is most surprising is, not that a certain class of scientific men do not see this distinction, but that so many insist in one breath that no scientific theory can be accepted which is incapable of mathematical formulization and experimental verification, and in the next breath adopt a theory of life on a mechanical and chemical basis, the laws of which they do not profess to have formulated in numbers, nor to have tested the alleged facts by experiment. Prof. Tyndall insists that "the interdependence of our day has become quantitative—expressible by numbers"—and that where law cannot be formulated by numbers there is no science. We insist that if under this definition, Psychology, Morals, and Theology are excluded from the domain of science, Physiology should be excluded also, and yet the whole doctrine of development,—with heredity and its variations and integrations, and all the nomenclature by which the soul is demonstrated to be but a higher potency of matter, and personality to be an ideal fiction, and God an entirely superfluous hypothesis—is derived from the very operations of life, scarcely a single one of which if tried by the criterion in question has been scientifically fixed or formulated.†

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But leaving this consideration and conceding for the moment all that Prof. Tyndall violently and unscientifically assumes, viz.: that the animal body is a machine—let us follow him up to the line where its supposed relations to the soul begin. We accept the case suggested by himself: “An aërial wave, the energy of which would not reach a minute fraction of that necessary to raise the thousandth of a grain through the thousandth of an inch, can throw the human frame into a powerful mechanical spasm followed by violent respiration and palpitation.” We give the illustration which he quotes from Lange. ‘A merchant sits quietly in his chair—he reads a letter, it makes him spring to his feet, he calls his carriage, gives orders in haste to all his clerks and servants—rushes on Change, buys, and sells, and signs a few papers, and in a half-hour has saved his fortune from wreck; he comes back, and throwing himself into his chair says, now I can breathe.’ “This complex mass of action, emotional, intellectual, and mechanical, is evoked by the impact upon the retina of the infinitesimal waves of light coming from a few pencil marks on a bit of paper.” “What caused the merchant to spring out of his chair? The contraction of his muscles. What made his muscles contract? An impulse of the nerves which lifted the proper latch and liberated the muscular power. Whence this impulse? From the centre of the nervous system. But how did it originate there? This is the critical question.” It is indeed the critical question. And how does Prof. Tyndall answer it? We should first inquire, how does he ask it? for it is important to notice that as with lawyers so with philosophers it often happens that the way in which they phrase their questions reveals the answers which they expect or desire, and in some sort compel. Prof. Tyndall does not deny that other phenomena come in beside those of the ordinary nervous, digestive, and breathing mechanism. He admits that terror and hope, sensation and calculation, with possible ruin, all succeed one another between the impact on the retina and the lifting the latch which releases the reaction that proceeds from the centre of the nervous system. But he assumes that whatever is the nature

look the fact, that tried by this test, physiology itself, as conceived by the great majority of its devotees, is as little a science as psychology. His own conjectures that the animal body is a machine, are as far from any mathematical formulation as the not dissimilar theory of Descartes. The psychological theories of the school of Herbart are more solidly and consistently mathematical than are the headlong guesses of Prof. Tyndall's physiology. Tried by Tyndall's test, the new chemistry is also in some danger of being pronounced unscientific. See Du Bois Reymond.—*Ueber die Grenzen des Naturerkennens*, pp. 4, 5.

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of these phenomena they are caused by the impact of the undulating light upon the responsive retina, that this imparts another impact to a somewhat causing terror, which in its turn by another stroke or impact is transformed into hope, till at last the latch is lifted and the muscular power is set free. This assumption concerning all these processes resolves them into mechanism and subjects them to the law of necessity. It takes for granted that whatever the soul may be, whether it is a set of friction wheels or a voltaic battery, whether brain or a poetical expression for an ideal x , its phenomena are caused at first by the impact of a material object and follow in succession according to mechanical necessity. The proper attitude to assume is of protest against every such assumption and the language which asserts or implies it. The true and wary philosopher will say just at this point, I do not accept your version of these intervening phenomena, they are in no sense evoked by the object striking upon the man, but they are performed by the man with reference to the object. It is not the letter which strikes its impacts upon the man, but it is the man who reads the letter and thereafter acts in calculation and hope until the latch is lifted and the muscular motion is set free. We know that this view is very strange to Prof. Tyndall's method of philosophizing and is fatal to all his conclusions, but in our view it is true to the facts, and we must protest against this stealthy if it be an unconscious way of disguising the facts by the mode of asking the question, Whence the impulse and how did it originate, that directs or liberates motion in the various methods so vividly described? This is indeed the critical question. It is none other than whether there is any other agent than matter, and whether the agent, be it material or aught besides, acts according to mechanical laws and under mechanical necessity? How does Prof. Tyndall answer this question? He remarks first of all, "The aim and effort of Science is to explain the unknown in terms of the known. Explanation, therefore, is conditioned by knowledge." This truth he proceeds to illustrate by the story of a German peasant, who, when he saw a locomotive for the first time, having never known any other than animal power, after long reflection solemnly said: *Es müssen Pferde darin seyn*: There are horses inside! The story in Prof. Tyndall's opinion illustrates a deep-lying truth. It strikes us that the deep-lying truth which Prof. Tyndall finds in it admits of an application of which he was not fully aware or he would scarcely have introduced the story. Had the peasant known no other locomotive power than that by horses, he had reasoned wisely, provided the peculiarity of the effect was not fitted to awaken

the suspicion that there were more things in heaven and earth than were dreamt of in his philosophy. Otherwise his confident dogmatism should be ascribed to his stolid incapacity or his narrow positiveness. We certainly see no objection if Prof. Tyndall feels none to his recognizing in the peasant the ideal of a true philosopher and placing himself by his side, as one who like him can only interpret the unknown by the known. When Prof. Tyndall insists that all the functions of the animal body can be explained by mechanical or galvanic agency, he seems to us to say, *there are horses inside*. Motion, and heat, and breathing, and eating are the forces which I recognize and believe in, and these are the only forces which I accept. Were the German peasant told of steam and its expansive power, of its capacity of quick generation by heat and of condensation, and were there shown to him the steam boiler and the furnace—he would doubtless say, the force and the laws of which you speak are both to me unknown, and I can only explain the unknown in terms of the known. Similarly when the attention of Prof. Tyndall is directed to the activities of spirit he replies, all these are practically unknown to me, for I believe in nothing except the mechanics of friction or the voltaic battery. That is to say, if we know or could know anything about terror, and hope, and calculation, and resolve, and all the other phenomena that were evoked between the first impact of the light and the reaction on the muscles—we might explain the intervening phenomena, but inasmuch as we cannot, we must assume that they do not exist. They are to Science a set of unknown quantities, which have no claims to be scientifically recognized and can neither explain other phenomena nor be explained themselves. Prof. Tyndall by his subsequent concessions is far less excusable and far less philosophical than his associate philosopher. For Prof. Tyndall is frank enough to say that there are *peculiar* phenomena (he does not say there is a force) such as terror, hope, sensation, calculation, etc., which are associated with or attendant on the molecular motions set up by the waves of light in a previously prepared brain. But he denies that there is any causal connection between them. He rejects the explanation given by Mr. Bain, once partially admitted by himself, that the two are objective and subjective sides of the same phenomenon. He repeats, however, his position that the reason why we cannot unite them in a causal connection, is that while we can form a coherent picture of physical processes, as the stirring of the brain, the thrilling of the nerves (a new idea), the discharging of the muscles (previously the lifting of a latch), we can form no picture of a molecule producing a state of consciousness or

of a state of consciousness acting on a molecule. Physical science offers no justification for either of these connections, the ordinary canons of science fail to extricate us from our difficulties, and therefore we conclude that there can be nothing but *horses inside the locomotive*. Even the facts, as terror, hope, calculation, &c., are almost as difficult to seize as the idea of the soul as their cause. But "if you are content to make your soul a poetic rendering of a phenomenon which refuses the yoke of ordinary mechanical laws, I for one would not object to this exercise of ideality."

The reader will be able by this time to form some idea of what Prof. Tyndall intends, when he says that the phenomena of the soul, the soul itself, the possible action of matter on the soul and of the action of the soul upon matter are facts and phenomena which are scientifically unknown. They are unknown because they cannot be pictured to the mind, *i. e.*, united in a mental picture with one another or with physical facts. If by picturing the soul or the mind is intended that it cannot be pictured as occupying space and as affecting the bodily senses, *i. e.*, cannot be imagined as material substance, this is true; but if it is contended that the mind cannot be pictured as the mind finds itself in its own operations, then it is untrue, and that it is untrue is affirmed by Prof. Tyndall himself every time in this discourse he says I see, or know, or remember, or believe. If he means that he cannot picture the mind as acting, we reply he can picture the acting of the mind as truly as he can picture the acting of the body. If he attempts to picture what he means by force, whether galvanic or mechanical, he will find this as difficult as when he attempts to picture mental force. If he cannot picture mind as acting on matter, or matter acting on mind, no more can he picture matter acting on matter. If he says that he knows nothing about mind, and that therefore psychological existence and psychological action cannot be used to explain any phenomenon because this would be to explain the unknown by that which is more unknown, he refutes himself every time that the word *to know* escapes from his lips. The brilliant essay by Prof. Tyndall himself On the Scientific Uses of the Imagination and the many sagacious and brilliant remarks which he has made from time to time upon the processes and grounds of Induction are themselves decisive evidences that many phenomena in his own mind have been well considered by himself and causally connected. The entire Theory of Modern Science, in which he so much glories, and which in so many respects he so well understands and expounds so skilfully, is an exposition of the operations of an agent within that body, which for the sake of

scientific consistency he calls a machine. If this agent or force within is nothing more than an idealized abstraction, this abstraction discoursed most eloquently from the chair of the Midland Institute. Again: If we know nothing about the knowing process or the knowing agent, then what confidence have we in what it knows of matter? If physical science and its methods are to furnish bounds to what we know and to impose law as to how we are to know it, then we know something about the spiritual activity which we call knowledge and the agent which exercises its functions. To say that the only species of existence which this agent can know is matter and its laws, and that every kind of activity which we can explain must be explained by material relations, or the so-called methods of physical science, is to beg the question to begin with, but in the very terms in which we beg if we assume that that function which we call knowledge has supreme authority and gives law and authority to itself and the science which it creates.

But here Prof. Tyndall takes another step in advance. He graciously concedes to those who desire to do so the liberty to think and speak of the soul as the poetic rendering of peculiar phenomena when abstractly conceived, provided only that they will admit that in all these phenomena it obeys the law of necessity that rules in the world of matter. This, indeed, is the last point which he makes, and upon this he dwells at very great length. He introduces the discussion by saying: "Amid all our speculative uncertainty, there is one practical point as clear as the day—namely, that the brightness and the usefulness of life, as well as its darkness and disaster, depend to a great extent upon our own use of this miraculous organ," *i.e.*, the brain. This means, that whether we are spirit or no it is certain we are brain, and what we are and what we become depends upon the use or abuse of this organ. But does not this imply that we are free,—for if we are not free how can we be responsible? Here "we stand face to face with the final problem; it is this,—Are the brain and the moral and intellectual processes known to be associated with the brain * * * subjected to the laws which we find paramount in physical nature?" To this inquiry he gives the following as his answer, in a rambling series of remarks, which we shall seek to follow and condense as best we may.

First, he observes, that Fichte recoiled from the thought of necessity in a well-known volume which records the struggle between his head and his heart. His recoil was so violent that rather than subject man to nature he made nature subject to man, creating nature out of the free actings of the spirit.

But all men do not share in this recoil of Fichte. Even Bishop Butler teaches that, so far as human conduct is concerned, the theories of free will and necessity bring us to the same practical issue. But even free will cannot imply the production of events without antecedents. Free will must be consistent with reasons. And, on the other hand, the voice of this united assembly would say that I can lift my arm if I wish to do so. The wish then, or, if you please, the man is the decisive element. But what and whence is the wish or the man? At the starting of this question Prof. Tyndall falls back upon the axiomatic affirmation with which he began. "As stated at the beginning of this discourse, my physical and intellectual textures were woven for me, not by me. Processes in the conduct or regulation of which I had no share have made me what I am. Here surely, if anywhere, we are as clay in the hands of the potter." The age finds each man to be the product of all the ages before—it will make of us what the combined forces of all the present can make out of that past added to this present. Robert Owen's doctrine that man is the product of circumstances was correct if you count the past circumstances along with the present. Every court of justice makes allowances for hereditary tendency to insanity. An acute governor of one of the largest prisons in England informed Prof. Tyndall that he should divide all prisoners into three classes—the good, who ought not to have been convicted—the hopeful, who under more favourable training may be moulded to something good—and the hopeless, who might as well be "put compendiously under water," as tortured with punishment of any kind. The observations and testimony of such men with individuals are, however, of little significance compared with Darwin's speculations, which have at last convinced even "the clerical world" that "the progenitors of this assembly," when traced very far into the past, "could not be called human." These changes, to which each generation adds its slender contribution, are owing to what we in our ignorance are obliged to call "accidental variation," and secondly, to a law of "heredity in the passing of which our suffrages were not collected." That the process is one of amelioration is ascribed by Matthew Arnold to "a power not ourselves which works for righteousness," "when with characteristic felicity and precision he lifts the question into the free air of poetry, but not out of the atmosphere of truth." But does not this law of progress under hereditary influences give free sanction to crime by removing all exposure to punishment? Not in the least. Society says frankly to the unfortunate inheritor of irresistible proclivities to evil: We must imprison or hang you that we may give greater energy to

the tendencies against evil, if not in you, at least with other men, even though we accept with Darwin the doctrine of accidental variation as well as of fixing environment. "Practically, then, as Bishop Butler predicted, we act as the world acted when it supposed the evil deeds of its criminals to be the products of free will. We even continue to preach, for the preacher's words of enlightenment and courage and admonition enter into the list of forces employed by nature for man's amelioration," as the speaker himself remembers to have been helped by George Dawson thirty-two years ago, as he exhorted to industry and self-control "when he made himself the mouth-piece of Nature, which secures advance by the encouragement of what is best." Last of all, will not all religious or theological influences be enfeebled by this theory? will not society be given over to demoralization and crime? Not in the least, for even George Holyoake, avowed Atheist as he is, preaches against low views of life, and incites to the higher ends and aims of civilization and character. It is, however, a serious mistake to suppose that theologic belief has been a very potent element in working for man's amelioration. Very many fundamental differences of character "depend upon primary distinctions of character which religion does not remove." Faraday, whom he describes in a passage of elaborate eulogy, added since the address was originally written, though depending upon his Christian and even his Sandemanian tenets for his spiritual life and comfort and peace, was singularly like Charles Darwin, "who neither shared the theologic views nor the religious emotions which formed so dominant a factor in Faraday's life." "Facts rather than dogmas have been the ministers" of the power not ourselves working for righteousness, "hunger and thirst, heat and cold, pleasure and pain, sympathy, shame, pride, love, hate, terror, and awe;" and yet "it cannot be denied that the beliefs of religion, including the dogmas of theology and the freedom of the will, have had some effect in moulding the moral world." "Granted; but I do not think that this goes to the root of the matter. Are you quite sure that these beliefs and dogmas are primary and not derived—that they are not the products instead of being the creators of the moral nature?" In support of this view he refers to Carlyle, and quotes a familiar passage from one of Emerson's poems, both to the effect that religious faiths and rites are the products rather than the creative factors of man's moral nature. He ventures to ask: "Does the song of the herald angels, 'Glory to God in the Highest, and on earth peace, good-will towards men,' express the exaltation and the yearning of a human soul, or does it describe an optical—

acoustical fact—a visible host and an audible song?” “If the former, the exaltation and the yearning are man’s imperishable possession.” “If the latter, the belief in the entire transaction is wrecked by non-fulfilment.”

This finishes the argument, if argument it may be called. The conclusion is summed up as already quoted: Thus, following the lead of physical science, we are brought without solution of continuity into the presence of problems which, as usually classified, lie entirely outside the domain of physics. To these problems thoughtful and penetrative minds are now applying those methods of research which in physical science have proved their truth by their fruit. There is on all hands a growing repugnance to invoke the supernatural in accounting for the phenomena of human life, and the thoughtful minds just referred to, finding no trace of evidence in favour of any other origin, are driven to seek *in the interaction of social forces the genesis and development of man’s moral nature.*” The careful reader will observe in these concluding words the affirmation for the first time in any of Prof. Tyndall’s writings, of the tenet that moral distinctions are the product of social agencies. That he must of necessity hold this opinion was clearly enough to be seen by any one who follows the logic of Atheistic Evolutionism, to which Prof. Tyndall professes that he has been led with so many other thoughtful minds by scientific necessity.

We have endeavoured to trace the successive steps by which Prof. Tyndall declares that he has been led to these conclusions. We have carefully stated his points, that we might candidly judge of the logical coherence and convincing force of the facts and analogies by which, “following the lead of physical science,” he has been brought first to face these problems, and then to solve them in these appalling answers:—Negatively there is no spirit, no freedom, no God, and no immortality, and positively the scientific and practical explanation of the past and the promise of the future lie in a blind force working under the law of progress for man’s amelioration, as the result of whose workings the idea of moral good is in due time developed, in whose name law is administered without justice. Morality as a social product creates religion which rules by relentless force without personal sympathy. As the result of the new solutions of these old problems, according to “those methods of research which in physical science have proved their truth by their fruit,” we are told that “social duty will be raised to a higher level of significance, and the deepening sense of social duty will, it is to be hoped, lessen if not obliterate the strifes and heart-burnings which now beset and disfigure our social life.”

The argument which we have analyzed consists of four divisions. Of these divisions the first recapitulates the history and evidence of the conservation and correlation of force in the domain of physics. In this argument Prof. Tyndall is at home. His statements are clear, his examples are pertinent, and the experiments are manifold. We will admit that the argument is decisive, without interposing a single one of the exceptions which we should reserve, were the case to be tried before another tribunal. The second division is that in which he argues that the animal body is a machine, which is controlled by those forces and only those forces, and obeys those laws and only those laws, which are found in the inorganic sphere. This argument seems to us obviously defective, in that it omits many of the phenomena which are most characteristic of the animal body, and transfers analogies from one physiological function to another, with an intellectual haste and audacity which are utterly foreign to the methods of physical science, or indeed of any science, whether pure or applied. The third division declares that all those phenomena commonly called psychical should be treated by the scientific man as utterly unknown—as incapable themselves of being explained by any other than material forces and laws, and of being stated in any other than figures of poetic ideality. This position he does not argue. He simply begs the conclusion, and not only this, but he dishonours science itself by this very assumption, because he dishonours the agent which is the creator of science, and by its own sovereignty is the lawgiver of science, imposing upon its own work the methods of procedure, and declaring the manifold services, Prof. Tyndall himself being witness, which theory, inquiry, imagination, and experiment have contributed towards its triumphs. Moreover he asserts that the soul though potent and sovereign in these creations, is nothing but an idealized abstraction; although when he forgets his theory, he himself gives fervent and eloquent testimony to the spiritual light and comfort and peace of his great teacher Faraday, and the simple and sturdy honour of "Mr. Charles Darwin, the Abraham of scientific men—a searcher as obedient to the command of truth as was the patriarch to the command of God." The fourth division consists of the rambling and somewhat incoherent argument, which we have endeavoured to condense, upon the higher themes of man's responsibility to himself, his fellow men, and to God. In all this part of the discourse there is not the slightest suggestion of the methods of induction or experiment, such as are pursued in physical science. There is not a single example of those analogies which open to the sagacious interpretations of scientific genius

glimpses of a brilliant speculative theory. The author gathers the scraps of his readings and the shreds of his reflections in literature and theology, and sets them forth with no force except such as startling paradoxes always obtain when they fall from lips as eloquent as those of this attractive speaker. All recognition of the methods of physical science seems to have departed from his memory. The four divisions of the argument are held together by the foregone conclusion of the author that the devotee of science may recognize nothing in the universe but matter and fate and evolution, and requires for the explanation of the existence and history of this universe neither intelligence nor goodness.

In the first of these divisions Prof. Tyndall writes as a *Physicist*. As a Physicist, he never fails to be clear, consistent, and eloquent, even when he is not convincing. In the second, he is a *Physiologist*. Here he is limited in his recognition of vital phenomena, and committed to the foregone conclusion that life can be explained by mechanism. In the third, he is a *Psychologist*. In this rôle, he is a sturdy materialist in his reasonings and a poetical abstractionist in his concessions. In the fourth division he is a *Moralist*, *Metaphysician*, and *Theologian*. As a Moralist he accepts the hard theory of Hobbes as made flexible by Darwin and Spencer. As a Metaphysician he is a fatalistic Evolutionist with a dash of imaginative optimism. As a Theologian he is a sentimental Atheist or an imaginative Agnostic. In each of these several capacities he dexterously shifts from one phase to the other of his sensitive many-sidedness of opinion and phraseology, according to the varying needs and aspects of his argument and his audience.

We have read many things from Prof. Tyndall, with sincere admiration for the sagacity of his insight, the skill of his expositions, and the splendour of his generalizations. We must confess that in the perusal of this address our admiration has passed into wonder and our wonder into astonishment. If this is science, then science has ceased to be scientific. No man has insisted more energetically than Prof. Tyndall upon the necessity of mathematical formulization to fix whatever laws are surmised, and of rigid experiment to test and confirm the most plausible of generalizations. In this address, he seems to us to have forgotten to exemplify the first article of his own philosophic creed and to have wholly failed to apply the tests of experimental verification.

As we have read the occasional addresses of Prof. Tyndall with unabated interest, and noticed that they have usually represented the results of the meditations of his summer

holidays, we have learned to conceive of them as the romantic essays of an imagination surcharged with the ferment of philosophical speculations and kindled to a midsummer excitement by the glow of his inward fervour. We have been more than once reminded of similar utterances of the philosophic Hamlet as he also mused upon Science and Man.—“ I have of late foregone all custom of exercises and it goes so heavily with my disposition, that this goodly frame the earth, seems to me a sterile promontory, this most excellent canopy the air, look you, this brave overhanging firmament, this majestic roof fretted with golden fire, *why it appears no other thing to me, than a foul and pestilent congregation of vapours!* What a piece of work is man! how noble in reason! how exquisite in faculties! in form and moving, how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals! *And yet, to me, what is this quintessence of dust?* ”

In common with many others in this country we have not only admired Prof. Tyndall as a philosopher, but have been delighted with him as a kindly and courteous gentleman, and welcomed him as a friend. The friendly interest which we still retain for him only deepens our regret that he should have been misled so far as to mistake the brilliant analogies of a teeming imagination for the sober verities of scientific truth.

The CHAIRMAN.—I am sure all will unite in returning thanks, both to the author of the paper, and to Mr. Gorman who has so ably rendered it. Any remarks may now be offered.

Rev. Prebendary Row.—I do not propose to discuss this paper at length, but I think I may say that we cannot be too much gratified when men like Professor Tyndall plainly speak out their sentiments. When their arguments are disguised in the metaphysics with which many Germans, and some Englishmen, such as Herbert Spencer, have rendered us familiar, the controversy is raised to a height considerably beyond the level of ordinary minds; but when they are brought down to the clear statements of Professor Tyndall much trouble is saved. If a great man of the last century—I allude to Dr. Johnson—could be present here to-day, there is little doubt but that he would have dealt with Professor Tyndall's theories in a very summary manner. He would have said: “ Sir, you are talking gross nonsense.” In the present case we have the great advantage of having these things clearly placed before us, and we find that the end and object of atheistic, pantheistic, and agnostic philosophy, is to reduce man to a machine mentally, morally, and spiritually. It is of great benefit to have these things thus stated plainly, because there is a certain faculty called common sense against which this philosophy is certain to be hopelessly dashed to pieces. Sir, we

are told that you and I have come here to-night because we cannot help it—that each one of us is simply compelled to do so by an irresistible necessity. That is a statement which not a single one of us can be induced to believe by any amount of human logic. I will give you an illustration of this. Some years ago I gave a lecture in Bradlaugh's Hall on the subject of human responsibility. We have on such occasions a discussion. Well, an atheist got up to answer me. He proceeded during about ten minutes to argue that he had come there and mounted that platform under an overwhelming necessity, which he could not help; that I in like manner was under an overwhelming necessity to go there and lecture, and that the audience had gone there under similar circumstances. Now I found that there was no occasion to expend more than five or six sentences in answering him, because the whole of the auditory turned round and laughed in his face. I am not quite sure that it would not be judicious in such cases to follow the general principle which the late Lord Melbourne laid down: whatever his defects, he was certainly a very shrewd, worldly-wise man. When an objectionable or stupid proposal was started, he was in the habit of saying: "Cannot you leave the thing alone?" I think we might almost say the same with regard to Messrs. Huxley, Tyndall, and others, and follow this good advice, and leave these men to commit moral and intellectual suicide; for that is really what it comes to. There is not a single sentence which Professor Tyndall has uttered in the speech here referred to which does not absolutely contradict the principles he is laying down. Let us take the passage which is given in this paper, on page 93, and upon which he dwells at great length. "Amid all our speculative uncertainty, there is one practical point as clear as the day, namely, that the brightness and the usefulness of life, as well as its darkness and disaster, depend, to a great extent, upon our own use of this miraculous organ," *i.e.* the brain. It seems, then, according to Professor Tyndal, that there is a *we* who use the brain. Yet, according to the same authority the brain is myself. It is therefore absurd on his principles to talk of the use we make of the brain. If we are nothing but a chain of conscious impressions linked together by an irresistible necessity, we must go on grinding out results for ever, which we cannot help grinding; but in asking us to accept such a theory he invites us to part company with our consciousness and our common sense. Are we to believe that all the activities in the city of London on this very day are nothing but a number of series of inevitable necessities? It is impossible to believe this by any amount of logic he can adduce in support of such a proposition. The great danger to be encountered is this. Professor Tyndall has a great scientific reputation, but here he is dealing with questions he has never studied any more than I have studied the special scientific questions with which he deals. He proceeds to utter before promiscuous auditories a set of oracles on questions which he has never studied. The auditories whom he addresses, for the most part of semi-educated people who go to hear him in consequence of his high character in matters of physical science, are apt to forget that

he is as ignorant as they are on most points of mental and moral science. They accept him as a great authority, and thus a great deal of nonsense is swallowed by a large number of people as scientific truth. I don't see how it is possible to meet him in this respect, except by sending a body of lecturers after him. For my own part, I think great advantage might be derived if a set of caustic tracts were published, taking up these questions. The only way of dealing with these matters is to appeal to the hard facts of every-day life ; if this were done, I say that, whatever powers of reasoning on logic or science Professor Tyndall might bring to bear upon this question, he would commit a moral and intellectual suicide in attempting to prove that he himself is simply impelled by overwhelming necessity to contradict the great facts of consciousness (cheers).

Mr. D. HOWARD.—I have heard this paper with a rather special interest, because the great fact of its being written by a man, and a very able man, living in the full freedom of American thought, which some of us may think verges on licence, gives it a special interest. The accusation might be brought against most of us that we are too fond of our old ways, and not prepared for the new truths which these preachers, of what I suppose they would consider a new revelation, would give us. It is perfectly true that most of us do not desire a new revelation, but would rather say that the old is the better ; but if there could be a free unbiassed field for anything quite new, I think you would find it on the other side of the Atlantic, where there is no prejudice in favour of the old, but, if anything, an over-prejudice in favour of the new. This, I think, does give a special value to the full, able criticism which we have here of Professor Tyndall's paper. To find how thoroughly his novelties are no novelties at all to able thinkers on the other side of the Atlantic, to find that there is nothing that can turn a clear head living amidst all the activity and novelty of American thought, is a very satisfactory thing, and one well worthy our attention in dealing with this question. I must say that I do most fully agree with the reply made so ably by Mr. Row, that it is better to leave Prof. Tyndall to himself. It is undoubtedly one of the painful facts of the present time, that there should be so much of atheistical thought amongst us, but yet it is not new. It is the same old story ever since thinking began. There is one thing which is most astonishing, and that is, how a man of Prof. Tyndall's abilities, and with all the premises before him, can come to such utterly false conclusions. There is only one interpretation of this that occurs to my mind, and that is fatal to Prof. Tyndall's whole theory. It is that he will not see. One of the most extraordinary things, even in material science, is the remarkable power of the will to abuse the judgment. A man cannot and will not believe on the clearest evidence what the doctor tells him about his own health. He will not believe the evidence of his own senses as to some great catastrophe. He will not believe that ruin has come upon him. What does this show ? If thinking is a mere function of the brain, do we find that phenomena are obstinate, do we find that our balances cannot and will not turn for no reason whatever ? I never

found it so in my limited experience. We find one thing, namely, that material forces act invariably, we find that the mind will not act as it ought to do. The unbiassed man sees a thing perfectly clearly which the biassed cannot and will not see; and this shows that there is something more powerful than the function of the brain. The immaterial, undefined, unscientific will acts, after all, more powerfully than the material brain, and I can only say that the obstinate refusal of some of these great scientists to see how utterly unscientific they are when engaged upon theological questions, is one of the most curious proofs that there is a will, and that that will is utterly contrary to the mere physical laws, because it has an utter want of that reason which is found in the material world.

Mr. J. ENMORE JONES.—After reading this paper yesterday I thought, Why is it that Prof. Tyndall has taken the views he has expressed? I knew that he was reared at the feet of Robert Owen. I knew he was chemical tutor in Owen's educational establishment in Hampshire. What a lad gets into his brain when a lad, often continues right through his life. I therefore feel that his theological views having been saturated, as it were, into his very life's core by Robert Owen, who was, you know, an atheist for a considerable time; that may have influenced him in his thinkings and his doings. At the same time I cannot find fault with Tyndall, because he is a splendid examiner of the materials which the Creator has created. Tyndall is doing a mighty good, and if we will attend to what he is discovering, I have no doubt but that we shall perceive he is laying a foundation which will be of great use to the Church. In future time this will be seen. I do not see that the paper proves anything.

Rev. C. L. ENGSTRÖM.—I should like to say a few words upon one point. I think that Prof. Tyndall has warred against good sense. Suppose I held his views and were arguing with one who held the views I really hold, I should be bound to say, "You who believe that the world has not existed more than a few thousand years, must regard the instincts which are in yourself as implanted from without; but I, who hold the world to have existed for endless years, must see that every universal instinct in the human heart or mind must have grown up from an agreement with the phenomena surrounding it; and therefore, whenever I find such a universal instinct as a belief in God or a belief in free will, I, holding the development theory, must regard this as not implanted by some being for injurious purposes, but as the result of my nature having been brought, during millions of years, into exact accordance with surrounding facts. And therefore, every universal instinct, including belief in God and belief in free will, is, if the development theory be carried to its fullest extent, shown to be absolutely and necessarily true."

Rev. J. FISHER, D.D.—I regard this as a very important paper. It has been said that Dr. Porter has proved nothing; but I hold that he has proved a great deal. I think that the secret with regard to Prof. Tyndall's launching out into various branches of philosophy, metaphysics, and theology, and making such sad blunders, is that it arises from what is

brought out in the second page. The paper eulogises both Tyndall and Huxley, one as physicist and the other as a physiologist. It cannot be too highly commended in this respect. They are quite at home in their proper departments. Prof. Tyndall is clear in physics, but in no other thing which he throws out. Here is what the paper says: They have "the honour of having demonstrated, each in his own way, that a discipline of classical culture, or of early literary studies, is by no means essential to the training of an effective popular speaker or lecturer upon the severest topics of science." One has embraced physics and the other physiology, and this is the reason why they go so far astray upon these points. Had they studied in Oxford or Cambridge, or in any other of our universities, they would have had both more modesty with regard to those who labour in other departments of literature, and would not have made so many mistakes in their own. Had they studied logic under Whately, or in some other school where they would have been trained in a similar way, they would have made better definitions, they would have used more precise language, and they would have reasoned from true premises, and would have drawn full and true conclusions. But their definitions are all wrong. We have been told (page 90) that we should protest. I think we may join in the protest at page 82, where a definition is given of the human body as a machine. A definition should include the whole. A machine is not an organism. An organism has life, and grows. The definition, therefore, is wrong, and the premises are wrong. How, then, can they bring forth truth from such premises and such definitions? I think it is the early training of these men that has been defective. They have gone into matters they have never studied. They have literature and theology and wrapped them round their science, thinking that all must be science, all must be physics, all must be physiology.

Mr. E. R. GAYER.—There is just one sentence in this very able paper to which I must take objection. It is on the top of page 93: "If this agent or force within is nothing more than an idealized abstraction, this abstraction discoursed most eloquently from the chair of the Midland Institute on the 1st of October." I think the writer has made a mistake in introducing this sentence. This, it appears to me, is no answer to Prof. Tyndall's position. It is precisely the same, to go back to Dr. Johnson, as the answer Dr. Johnson thought he had given to Berkeley, when he told him if he only went and knocked his head against the wall he would soon perceive whether it was a solid or not. That was perfectly absurd, and showed that Dr. Johnson did not understand the Berkeleian theory. This, I say, is equally absurd. The true answer would be, "If you say that mind and soul are mere abstractions, how can you show that these batteries and forces, and different things of the realistic properties of which you speak, are not abstractions also"?*

* Mr. Gayer, in his speech, added:—"The only other objection that occurs to me has reference to two words on page 87, where Prof. Porter says his body

Rev. Mr. GORMAN.—I rise with some hesitation and diffidence, in the absence of the writer of this paper, to say a few words on the principal question, which has been put before us with so much skill and fairness. The last speaker, it seems to me, has not quite clearly caught the precise point of Professor Porter's reasoning. The argument is plainly a *reductio ad absurdum*, exactly similar in its purport to what I must regard as the very conclusive answer of Dr. Johnson, to which reference has been made. No one is bound even to try to understand flimsy and unintelligible hypotheses such as that of Bishop Berkeley, or any other form of visionary idealism which manifestly contradicts the plainest dictates of common sense. To this principle of common sense, against all forms of unreasonable speculation, every one has the right of appeal as the last resort. The principle which Professor Porter evidently had in his mind was the seemingly simple, but really most profound saying of Bishop Butler—"abstractions can do nothing." And this is, in fact, the principle which lies at the root of the whole discussion. To any mind that has firmly grasped it, the exposure of Professor Tyndall's fallacies becomes a very easy matter. His speculations, for the most part, as soon as he leaves his own peculiar line of study, are nothing but abstractions—the most empty of abstractions, woven together dexterously, under the influence of a fervid imagination. They have nothing to do either with a rational psychology or with philosophy in general, much less with the sacred mysteries which lie within the sphere and dominion of theology, the queen and mistress of all the sciences. It cannot be too often repeated in commenting on the eloquent and highly imaginative lucubrations of that class of physicists of which Professor Tyndall is a type, that from the point of view of mere physical science, it is, to say the least, unbecoming, if it be not an impertinence in them, to speak magisterially upon questions which lie entirely outside the field of their special studies. If it seem good to them to ascend to the higher level of intellectual and spiritual thought, they are bound to assume the truth of those rational first principles and axioms which all wise men, in ancient and modern times, have agreed to accept as starting points in the study of the deepest problems of nature and life. As soon as they do this there will be some hope of our coming to an understanding with them. Our controversies will then have a chance of ceasing to be what, for the most part, they have

grows by 'cellular accession from living food.' By the way, I am not quite sure whether it is Prof. Tyndall or Dr. Porter who says this; but whoever it is I cannot understand it. Unless a man live solely on oysters or cheese, I cannot understand how this is to be explained." To this Dr. Porter replies:—"To relieve my critic from the imagined necessity of being driven to the necessity of living solely 'on oysters and cheese,' by the logic of his interpretation of the phrase 'cellular accession from living food,' I would say that by *living food* I meant food, or pabulum, which by the action of a living agent has been prepared to be assimilated in 'cellular accession,' and in that sense made *living*."

hitherto been, mere logomachies. As long as certain physicists choose to remain on the low naturalistic level which they have so persistently occupied in the past, we must say to them that any rational notion of the very existence of a purely intellectual and supernatural order of things, must from the nature of the case remain, for them, a sheer impossibility. Controversy, under such conditions, is little else than wildly beating the air. I acknowledge with all due respect the high value of the definite formal teachings by men of science, who by their labours and achievements within their own line of study have proved themselves entitled to confidence. I am willing to use what powers and opportunities I possess to learn from them what they have to teach of new and true. But the opinions of these men outside their own sphere have no special value. That some distinguished physicists should show deep and bitter hostility to what all Christians regard as most sacred, is as deplorable as it is astonishing. But it would not be candid on my part to suppress the strong conviction I have long entertained, that many leaders in physical science who are manifestly, whether they know it or not, the ardent devotees of principles which necessarily lead to mere naturalistic atheism, have been more or less driven into this strange frame of mind by the pseudo-theology which for so many centuries to the present hour has usurped the name and place of Christian truth. I do not hesitate to assert that the clergy and other religious teachers have much to answer for in this respect.

PRESIDENT NOAH PORTER'S REPLY.

I BEG leave to express my thanks to the gentlemen who have commented so kindly upon my critique of Professor Tyndall's address at Birmingham, and to ask their attention to a brief explanation of what I did, and what I did not, propose to accomplish in writing it.

I did not propose to discuss any matter which was not furnished by the discourse itself, least of all to write an exhaustive disquisition upon the Professor's philosophical or theological theories, or the mischievous tendencies of either, but to confine myself to the positions taken in the discourse itself, and to subject its statements of fact, its suggested analogies, and its logic to a close, though courteous criticism. The methods of reaching the truths of physical science ought by this time to be capable of definite statement, and of decisive application to the important questions which are at present so earnestly discussed. Professor Tyndall has himself given to these methods special

and earnest attention, and he would be the last man to complain when his own logic and inferences are tested by them.

It seems to me also that argument and criticism should be more largely used than they have been by Christian theologians and philosophers in their well-meant and much-needed efforts to arrest the progress of the Atheistic ways of thinking, which at the present day are at once so plausible and so superficial, so arrogant and yet so unscientific. I am confident that in my own country, the most effectual method to oppose these tendencies is to subject them to a candid, yet thorough scrutiny, to concede every position and somewhat more than a truly scientific thinker would venture to maintain to assert, and to expose every failure of experiment or logic with a fearless spirit. Simple protestations or denunciations, however earnest and fervent, will avail little against those solid squares of self-complacent agnosticism and denial, into which so many teachers of science have succeeded in gathering their disciples. But sharp and penetrating arguments are powerful agents when uttered in a candid and truth-loving spirit.

I think we have some advantage in this country, in that to a considerable extent thus far our higher institutions of education and research have recognised the scientific study of nature as a means of culture equally important with the study of the humanities, and have aimed to train their pupils in both directions after the methods which are appropriate to each. Theologians and scientists are for this reason forced to consort with one another on an equal footing, and often in familiar relationships, except so far as new theories and methods of education have separated them by the establishment of special schools and colleges that are limited to mathematical and physical culture. Notwithstanding these advantages, we are beginning to experience serious evils from strong tendencies to intellectual separation and alienation on the part of both theologians and scientists. So long as both parties are forced to plead the cause of truth, whether it be theological or scientific, at a common tribunal, so long shall we be able to teach and to learn from one another.

I take great pleasure in saying that Professor Tyndall is a personal friend whom I have had the pleasure of meeting as the guest of our college, and that he has acknowledged in a most cordial manner the courtesy as well as the severity of my criticisms. While as a scientist, in some of his moods, he moves me to wonder, as a poet and a man he seems to me not infrequently to utter the sentiments of one who ought not to be far from the kingdom of God. The pupil who could so beautifully describe, and so fervently respond to the child-like prayer of his great master Faraday has the stuff in him into which may yet be kindled a rational and fervent faith upon the altar and within the sanctuary of true science.

APPENDIX.

THE *New York World*, of December 4th, 1878, in a leading article upon President Porter's paper, makes the following remarks [ED.] :—

“A little more than a year ago Professor Tyndall delivered an address before the Birmingham and Midland Institute, of which he was president, and in it—according to his custom of conveying to his audiences not only facts, but the deductions therefrom which seem to him legitimate—he presented the conclusions to which he had been led through his study of nature. To this address Dr. Noah Porter, the distinguished president of Yale College, replied on Monday last in the Victoria Institute, in London, in a paper which will be found elsewhere in to-day's *World*. Dr. Porter touches the most sensitive part of scientific men who speak beyond absolute knowledge, and in doing so lashes over the Professor's shoulders many a writer who sees in matter promises and potencies as fair as those of which Mr. Tyndall caught an apocalyptic vision in his celebrated Belfast address. From the doctrine of the correlation of the physical forces, Professor Tyndall had deduced the conclusion that the order and energy of the universe were inherent, and not imposed from without—‘the expression of fixed law, and not of arbitrary will’—so that all which exists, whether spiritual, mental, moral, or material, is subject simply to mechanical laws. The human body, according to the views of Professor Tyndall, is a mere machine, and therefore cannot generate force. This position is opposed by Dr. Porter, on the ground that within the human body the nerves perform work additional to any that is implied in either the generation or transformation of force, and that that work is seen in their additional function of directing force to the accomplishment of certain ends. In other words, he brings his argument to bear directly on the question whether, when the human body is considered as an entirety, something is not found acting within it in a way which shows that it is not simply a machine, but a living body, some of whose functions must lead us to believe that it is in part governed by something which is not matter, nor belongs in the category of the correlated forces, nor is a resultant of them all or of any of them—in short, whether mind and matter do not exist as separate entities, and the former does not act upon the latter within the compages of our flesh. Besides this, if, as Professor Tyndall is fond of insisting, strict science is now impossible unless the relations between phenomena can be expressed quantitatively and in numbers, he who holds that the body is simply a machine is bound to show that its laws can be expressed and formulated mathematically—a position which no physiologist now dreams of attempting to maintain, since, as Du Bois Raymond said six

years ago, we are still 'hopelessly in the dark' in regard to many if not most physiological processes.

"The points thus made against Professor Tyndall are, therefore, that by his own definition of science there is no science of the intricate workings within the body, and that he has drawn conclusions in regard to man which are not justified by the present state of our knowledge. By failing to take into consideration the undoubted power of directing force which resides in the nerves, he has also avoided the really difficult and much disputed question concerning which materialists are at variance with men who hold that the capability of directing the muscles to certain ends, which is so obvious in man, does not reside in the matter of which the muscles are made, or that the nerves are mere 'valve openers' to supply the muscles with force. The statement that emotions like fear and terror are caused simply by the physical impact of light coming from fearful objects upon the retina, is, in Dr. Porter's view, but an assumption, and in joining issue with Professor Tyndall, he holds—justly as it seems to us—that emotions arise not from external objects, but from the mind of the man who contemplates them. Still further, the mind may contemplate itself within its own order, and must therefore be conceived of as existing as really as anything, the image of which can impress it through the eyes.

"Men of science are certainly not to have the whole round of man inclosed within the boundaries of physics and physiology without bold opposition on the part of people who believe that metaphysics are not sheer moonshine, and outside of metaphysics they have of late received severe blows from men who fight merely with the weapons afforded them by logic. Whatever may be thought of the ultimate merits of the case on 'other grounds than those of logic, it seems that at present Professor Tyndall has decidedly the worst of the argument."

ORDINARY MEETING, JANUARY 6, 1879.

THE REV. R. THORNTON, D.D., VICE-PRESIDENT, IN THE
CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced:—

MEMBERS:—Rev. Mark W. Bird, Haiti ; E. J. Statham, Esq., C.E., A.I.C.E.,
New South Wales.

ASSOCIATES:—Rev. W. Guest, F.G.S., Kent ; Rev. C. O. Mules, M.A.,
New Zealand.

Also the presentation of the following works for the Library:—

“Proceedings of the Royal Society.” *From the same.*

“London Quarterly for 1878.” *A. McArthur, Esq., M.P.*

“Experience and Revelation.” By J. Coutts, Esq. *From the Author.*

The following paper was then read by Mr. T. Karr Callard, F.G.S., the author being unavoidably absent.

*THE LAPSE OF TIME SINCE THE GLACIAL EPOCH
DETERMINED BY THE DATE OF THE POLISHED
STONE AGE.* By J. C. SOUTHALL, ESQ. A.M., LL.D.,
(Richmond, Virginia, U.S.A.).

THERE have been various announcements within the past ten years of the discovery of traces of man in the miocene, pliocene, and glacial strata. The Abbé Bourgeois still contends that he has found worked flints in a bed of miocene date at Thenay ; M. Delaunay thought he had discovered, in 1869, traces of the hand of man in certain markings or cuttings on a rib of the *Halitherium fossile*, a well-known miocene species ; M. Desnoyers announced the discovery of similarly notched bones, belonging to the *Elephas meridionalis*, *Rhinoceros leptorhinus*, and other extinct animals in a pliocene bed at St. Prest ; Professor Ramorino made a similar announcement with regard to some bones from the pliocene strata of the Val d' Arno ; a human fibula, as was stated by Professor Boyd Dawkins, was found some years since under glacial clay in the Victoria cave, in Yorkshire ; three or four sharpened sticks, alleged to have been pointed by human tools, were found yet more recently in an inter-glacial bed in Switzerland ; besides other instances which it is not necessary to enumerate. It is generally conceded now that most of

these cases must be abandoned, while as to the rest, they are by no means to be relied on; in fact, as the evidence now stands, the careful geologist does not recognize any traces of the existence of man prior to the close of the quaternary period. As the glacial epoch died away, man appeared, and his relics are found in the ancient gravel-beds of the river-valleys of Europe and India, and in the bone-caves of Europe, associated in both cases with the bones of extinct animals, such as the mammoth, rhinoceros tichorinus, reindeer, &c. Since these gravels were deposited in their present position, most of the peat-beds of Europe have been formed, and great changes have taken place in the physical geography of the country. These facts, and the great mass of gravel and loess under which the flint axes are buried, give the appearance of great antiquity to these relics, and have created the present prevailing belief in the vast antiquity of the human race. My own opinion is, after bestowing a great deal of attention upon these phenomena, that they can all be explained in accordance with the recent appearance of man in Europe; but in the present paper I do not propose to go into the subject, save for the purpose of calling attention to a single point. It is admitted that the cave-earth and the river-gravel are post-glacial, and that they were deposited just after the formation of the boulder-clay and the retirement of the ice from the regions which were affected by the glacial influences. If, therefore, we can find any clue to the date of the glacial epoch, we can fix approximately the date of man's appearance in Northern and Central Europe. Various attempts have been made to fix the date of the ice age by calculations based on the depth, and rate of deposit, of the quaternary alluvions, and the rate of recession of the great cataracts of the Niagara and the Mississippi. MM. De Ferry and Arcelin have made such a calculation from the relics of the iron, the bronze, and the stone age, found in the alluvial deposits of the valley of the Saône. By independent observations both of these distinguished archæologists ascertained (as they believed) that the relics of the palæolithic age found in this valley are some 6,000 or 8,000 years old. M. René Kerviler has made similar observations at the mouth of the Loire, and arrived at about the same result. In America, Professor N. H. Winchell has calculated the rate of recession of the falls of St. Anthony, on the Upper Mississippi, and estimates that these falls have been from 6,000 to 8,000 years in cutting their way back from Fort Snelling, where the cataract was first formed at the close of the "second" glacial epoch.

2. The most satisfactory observations of this character have, however, been made by Professor Edmund Andrews on the ancient beaches of Lakes Huron and Michigan, in the United States, which were formed after the close of the glacial epoch. This calculation was based on the recession of the bluffs on the lake-shore, and on the amount of the sand thus washed away by the waves on the north, and deposited at the southern extremity or head of the lake. Dr. Andrews made a calculation based on each of these data, and the result was about the same in both cases, which was, that the total time required for the formation of all the beaches (including the present) has been from 5,290 to 7,490 years.

3. It is, not, however, to any of these calculations that I propose to call the attention of this Society at present; to my own mind there is a simpler and more convincing method of solving this question than any of these, with regard to all of which there may be, in a greater or less degree, a residuum of scepticism arising from a want of implicit confidence in the accuracy of the observations.

4. I propose to fix approximately the date of the glacial epoch without going into any calculations of this kind, but resting the determination on one single, well-ascertained fact, and I believe I can do so to the entire satisfaction of every impartial and unbiassed mind which will lend its attention to the subject.

5. Before proceeding to elucidate the point I have in view, I may mention that the peat formations of Europe present a strong presumptive argument for the recent date of the gravel deposits of the river valleys in which the palæolithic remains are found. This peat is superimposed directly on the gravels, and no doubt commenced to form immediately on—or very soon after—the subsidence of the waters which deposited the loess and gravels which are found high up on the slopes of the valleys. The age of this peat will probably give us the time which has elapsed since the palæolithic age. At the bottom of the peat and silt formations of the Somme valley, M. Boucher de Perthes found the traces of a pile-dwelling, resting immediately on the gravels. The “lake-dwellers” had succeeded the cave-folk of the palæolithic epoch. There is no geological formation to indicate any interval between the two periods, although it is by no means unreasonable to suppose that a brief interval—possibly a few centuries—had passed. The relics found at the bottom of the peat are none of them more ancient than the neolithic age. Much of the peat of Europe we know to be no older than the Roman period.

Objects of metal have been often found in the French and Irish peat at great depths, and at Abbeville, as we are told by Sir C. Lyell, a boat loaded with Roman bricks was found in the lowest tier of the peat. The erect stumps of the beech, three or four feet high, are frequently met with also in the peat-beds of the Somme valley, showing that they had formed with sufficient rapidity to cover up these stumps before they had time to decay. Now, the stumps of the beech, exposed in a damp situation, are especially perishable, and will not stand without decay more than fifty years. Even the stumps of the oak will not last under such circumstances more than one hundred years. The peat, therefore, at Abbeville, must, in some cases, have formed at the rate of three feet in fifty years, or six feet in a century. This may, however, have been under peculiarly favourable conditions, and much of it may have formed more slowly. At the rate of one foot in a century, as the depth in some places is thirty feet, it may all have been formed in 3,000 years—and I doubt if it is older than this.

6. M. Belgrand has pointed out that none of the peat could have been formed during the prevalence of the palæolithic floods, which, he remarks, were extremely violent, and when, he says, the amount of rainfall was so great, that it rolled on the surface of the most permeable soils. M. Belgrand assigns as a reason why the peat could not have formed during the palæolithic epoch, that it never grows in muddy, turbid water; and, he adds, that this fact proves further, that the change from the large rivers of the palæolithic age to the small rivers of the neolithic age, must have taken place *suddenly*. If, he observes, the change had been a gradual one, the valleys would have been filled, not with peat, but with gravel, sand, and alluvium. There is no peat in the valley of the Marne, because, owing to the impermeable nature of a part of its course, it is subject to violent floods of muddy water. So the Seine valley, down to Montereau, contains much peat, but below this point, where it is joined by the Yonne, no peat occurs, because the Yonne, like the Marne, receives its waters from an impermeable district, and is subject to similar floods of muddy water (*Le Bassin Parisien aux ages anté-historiques*).

7. If M. Belgrand is correct,—and Professor Busk states that he has enjoyed unusual opportunities for studying this subject,—the transition from the palæolithic to the neolithic age must have been abrupt, and we must decline to accept the common theory, that there was a great hiatus or gap between these periods.

8. The opinion that a great interval was interposed between the first and second stone ages was based on the alleged change of climate, as evidenced by the presence of such animals as the reindeer in the palæolithic caves and gravels, on the disappearance of such animals as the reindeer, the cave-bear, the cave-hyæna, &c., and the introduction of a new fauna, and on the changes which have occurred in the coast lines and the interior lines of drainage. But it is now admitted that the reindeer was found in Germany in the time of Cæsar (*Cave Hunting*, by Prof. Dawkins, p. 73); the cave-lion, cave-hyæna, and cave-bear are recognized as belonging to existing species; and it is well known that the coasts of Sweden, Denmark, and Norway have been elevated from 200 to 600 feet since the waters of the adjacent seas acquired their present milder temperature—that is, since the close of the glacial epoch, which (having said so much by way of preliminary about the peat), as I shall now proceed to show, corresponded in Scotland and Scandinavia with the inauguration of the neolithic age, and the elucidation of which point is the special aim which I have in view in the preparation of this paper.

9. If I can show that the glacial epoch came down to the date of Robenhausen and the Danish shell-mounds, I shall have brought that mysterious geological episode within the well-defined limits of chronology, and shall dispel the illusion of the 800,000 years given by Sir C. Lyell, in the tenth edition of his *Principles*, or the 200,000 years given in the last edition of that great work, as the date for the retirement of the ice sheet.

10. We are told by Sir C. Lyell and other writers on the subject that there are no traces of the palæolithic age in the North of Europe—that is to say, in the north of England, in Scotland, in Norway, Denmark, and Sweden. In these countries the earliest traces of man belong in every instance to the neolithic or polished stone age; nor, excepting a few cases in Scotland, and one or two in Ireland, have the remains of the mammoth or rhinoceros been found in these countries. We find thousands of stone implements of the second stone age, and innumerable bones of the fauna of the second stone age, but we never meet with any of the palæolithic tools and weapons, and only occasionally, in the Scotch glacial deposits, and in one or two of the caves of Ireland, with the remains of the great extinct animals. "It has been estimated," says Sir C. Lyell, "that the number of flint implements of the palæolithic type already found in northern France and southern England, exclusive of flakes, is not less than 3,000. No

similar tools have been met with in Denmark, Sweden, or Norway, where Nilsson, Thomsen, and other antiquaries have collected with so much care the relics of the stone age. Hence it is supposed that palæolithic man never penetrated into Scandinavia, which may, perhaps, have been as much covered with the ice and snow as the greater part of Greenland is at present." The same statement is repeated in *Archiv für Anthropologie*, where we read that "neither in Scandinavia nor in North Germany have we yet discovered the slightest trace of palæolithic man . . . Scandinavia and North Germany were then covered by the ice" (*Meeting of the Anthropological Society in Munich*, 1874; *Archiv*, August, 1875; *Correspondenz-Blatt*, s. 18).

11. It is clear, therefore, that man was kept out of Scandinavia and Scotland by the ice; when he was permitted to advance, he advanced. When was this? We know by the character of the most ancient human implements found in these countries—in the famous peat-bogs of Denmark, for example,—that it was in the polished stone age. The polished stone age had already set in when the ice retired from Denmark and Sweden, the north of England, and Scotland. Given the date of the polished stone age, and we have the date of the close of the glacial age.

12. The glacial conditions which excluded palæolithic man from the North, excluded him at the same time from Switzerland and the elevated portion of Carinthia, and from Styria. "The farther one recedes," says Count Wurmbrandt, "from the mass of the Alps, the greater is the chance of finding in the caverns traces of palæolithic man."

13. It is the lake-dwellings, not the bone-caverns nor the implement-bearing gravels, that we find in the Swiss mountains. The men of the polished stone age settled at Robenhäusen, and Wauwyl, and Meilen, at the same epoch that they crossed the Elbe into Denmark, and established themselves in the valleys of the Forth and the Clyde.

14. What was the date of the polished stone age? It corresponds with the date of the lake-dwellings, with the period of the shell-mounds, with the age of the older stone-graves, and with the earlier stages of the peat. Now, at one of the oldest of the Swiss lake-dwellings—Robenhäusen—and that in the lower beds, we already encounter traces of bronze. At Wangen we find great quantities of corn, baked cakes of bread, flax, and perforated stone axes. At Wauwyl we find a glass bead; at Moosseedorf, remains of the dog, pig, sheep, goat, and cow; at Meilen, a bronze armilla and a bronze celt.

In the shell-mounds the fauna implies a date rather more recent than that of the lake-dwellings.

15. If we desire specific figures, the archæologists have undertaken to give them to us. The calculation of M. Morlot, based on the position of the relics found in the gravel cone at the mouth of the Tinière, and accepted by Sir John Lubbock, mentions 6,400 years as the time which has probably elapsed since the stone age was in progress at that point. M. De Ferry estimates the date to have been from 4,000 to 5,000 years ago. M. Arcelin fixes it at between 3,600 and 6,700 years ago. Professor Worsaae, in his *Primeval Antiquities of Denmark*, thinks it was, perhaps, some 3,000 years ago.

16. It is very certain that the more advanced races in Italy were at this time in the possession of the metals. We know this because we find bronze, and glass, and Mediterranean wheat at the oldest of the lake-dwellings.

17. It would in my judgment be a liberal estimate to allow 4,000 years as the lapse of time since the foundation of Robenhäusen and Meilen; and that is (approximately) the date of the close of the glacial epoch in Scandinavia and Scotland.

18. When the ice-line shut out man from the countries under consideration, palæolithic man, along with the mammoth, and the cave-bear, and the reindeer, lived in the south of England, in France, and in Germany. The glacial conditions had terminated in this southerly region, but still continued in Denmark and north of about 54° latitude in England. Palæolithic man was thus *post-glacial* as regards the region which he inhabited, but lived during the continuance of the glacial epoch in the north. The closing storm of the quaternary period terminated the glacial epoch in the north, and was characterized in the non-glaciated region to the south by the *palæolithic flood*, by which southern England and the northern part of the continent were submerged at least several hundred feet. After this we find at least very rare traces of the mammoth (although the reindeer still lingered until the beginning of our era), and we enter upon the inauguration of the polished stone age—man advancing into Scotland and Scandinavia.

19. The transportation of erratics continued in Sweden down to a yet later date. Sir Charles Lyell observed near Upsala a ridge of stratified sand and gravel, containing a layer of marl evidently formed at the bottom of the Baltic by the slow growth of the mussel, cockle, and other marine species, all of which were of dwarfish size, like those now inhabiting the brackish waters of this sea. These dwarfish shells are not found in the North Sea, nor are they found in the

Danish shell-mounds. The exclusion of the waters of the North Sea from the Baltic, with which they formerly communicated by a strait across southern Sweden, caused the waters of the Baltic to lose a great proportion of their salt-ness, and occasioned the deterioration in the marine fauna on the east of Sweden. This change in the size of the marine shells has occurred since this strait was closed, and since the creation of the shell-mounds on the Danish coast. Now, the ridge in question, observed by Sir C. Lyell, is 100 feet above the Gulf of Bothnia, and on the top of it repose several huge erratics, which must have come into their present position since the Baltic was divided from the North Sea, and since the epoch of the Danish shell-mounds, in one of the oldest of which an object of bronze has been found.

20. A similar case to this has been observed in Scotland by Mr. James Smith, of Jordanhill, who found a large boulder on the lowest ancient beach of the west of Scotland, which in his opinion could only have come there on floating ice. In the estuarine silt of the corresponding beach on the east coast have been found the bones of the Greenland whale associated with human implements. The presence of this Greenland whale corroborates the testimony of the boulder as to the Arctic character of the climate on these coasts at this time, and we are enabled to form some idea of the probable period when this severe climate prevailed in Scotland from the character of the objects found in the silt of the Carse of Stirling, and with the ancient canoes dug up from the banks of the Clyde. Some of these objects must necessarily have come from the more civilized regions of the Mediterranean.

21. The recent transportation of these erratics illustrates and strengthens my main argument for the recent date of the glacial epoch; for while this epoch had at this time passed away, the seas were still invaded by floating ice, and the climate of the Caledonian coasts had by no means become what it is now. And we learn that no great lapse of time is necessarily involved in such a change of climate.

22. I have mentioned that in Switzerland, among the mass of the Alps, where the ice lingered as late as it did in the north, there are also no traces of palæolithic man, and that in proportion as we recede from this glaciated area we encounter the indications of the presence of man. Now, there is just outside of this Alpine region, near the eastern extremity of the Lake of Constance, a station of palæolithic date, called Schussenried. The fauna and flora observed here were Arctic in character, and the only remains of the extinct animals were

the worked horns of the reindeer. These, we are told, with needles of bone and objects manufactured of nephrite were found "in the glacial clay." The palæolithic hunters had advanced up to the margin of the ice; they left their relics, mingled with the remains of Arctic plants, to be buried beneath the glacial clays. The date of this occupation was, no doubt, just prior to the melting of the Alpine glacier. When that occurred, those who succeeded them advanced into the now habitable valleys of the Swiss mountains, and constructed their pile-villages in the lakes. The settlers at Schussenried had come, as we may suppose, from Asia, and had either brought with them the objects of "nephrite" which (as in the cave of Chaleux, in Belgium) were found among their relics, or they had obtained them by barter from other wanderers from the region of Turkestan or the yet more distant shores of the Lake of Baikal. This nephrite is found nowhere in Europe, and its presence at Schussenried and Chaleux proves conclusively that the cave-men of Europe had relations with the Turanian tribes of Central Asia. We find it again, in numerous instances, in the stone age lake-dwellings, showing that the lake-dwellers also had wandered originally from the same distant homes. Is it likely that this traffic between Europe and the Orient existed 100,000 years ago?

23. There is a cave on the northern frontier of Switzerland, near Schaffhausen, which bears the same aspect as Schussenried, and where palæolithic man seems, as it were, to hover on the confines of the neolithic age. I refer to the Kesslerloch. It was here that was obtained, mingled with the bones of the mammoth, musk-ox, reindeer, glutton, lion, &c., that beautiful drawing of the browsing reindeer which is given in M. Conrad Merk's work on the excavations which he conducted at this point; and here the same explorer obtained from the same palæolithic beds the bones of the tame ox, the tame pig, and probably the dog. The remains of the dog were also obtained at the neighbouring cavern of Freundenthal, while "a good deal of pottery," we are told, was found in the cave near Herblingen, in the same region. At Veyrier, on the shores of the lake of Geneva, another palæolithic cave, we observe the absence of the mammoth and rhinoceros, and the presence of the domesticated ox. The fauna is, however, as at the Kesslerloch and Schussenried, an Arctic fauna. It consisted of the reindeer, horse, ox, hog, stag, chamois, marmot, Alpine bear, wolf, &c.

24. These caves indicate that in Central Europe palæolithic man stood outside of this glaciated area of the Alps, advancing

gradually to the foot of the glacier, and possessing by the time he reached the confines of Switzerland some of the domestic animals, vessels of pottery, and beautiful weapons; executing drawings and carvings superior to those from the caves of Périgord; and maintaining commercial relations with his distant kinsmen in Asia. It was the closing years of the palæolithic age; when we encounter man in this region again he has become a lake-dweller; a great storm has passed over Europe; new settlers, doubtless, have come from the great Mongol hives; the mammoth has disappeared—not absolutely overwhelmed, we may suppose, by some sudden catastrophe, as in Siberia, but—gradually exterminated by the new climatal conditions.

25. It is not only not improbable, but it is highly probable, that the men, as well as the animals, of the palæolithic age occasionally passed into glaciated areas, just as we see now on the coasts of Greenland. It may be that this is the explanation of the presence of the bones of the hyæna, mammoth, &c., in the Victoria cave, just beyond that frontier-line which I have indicated in the north of England. Here, too, I may mention, all under the glacial clay, as Mr. Tiddeman reports, were found also the bones of the goat (some of them apparently cut) and the *Bos longifrons* or Celtic short-horn, analogous to the presentation at the Kesslerloch and Freudenthal.

26. Thus, too, we account for the presence of the mammoth and the reindeer in the so-called inter-glacial beds of Scotland.

27. It was mentioned by one of the speakers—I forget now who—at the Stockholm Congress of Archæologists in 1874 that, astonishing as it appeared, several polished stone implements had been found in the boulder-clay somewhere in Sweden. The case is doubtless reported in the proceedings of the Congress. The statement was received with incredulity; but it is no more impossible than that some Eskimo weapon should hereafter be found in a similar deposit in Greenland. Observe, however, that it was a man of the polished stone age who had ventured into this region of the ice. If the case may be relied on, it throws fresh light on my argument for the contemporaneous existence of the glacial epoch and the age of polished stone; it proves that the polished stone age was well under way, and that the men of that period waited with impatience for the still reluctant ice to relax its grasp on the Scandinavian peninsula—or rather, as southern Sweden was then, the isle of Scand.

28. The only possible answer that can be made to all this is, that there was a great chasm—a lost interval of vast duration—between the palæolithic and neolithic ages; that man

suddenly vanished from Europe at the close of the palæolithic age, and did not re-appear here until the neolithic age, when he entered Europe for the second time with some of his stone implements polished. In the interim there is no trace of man or beast. The statement is sufficient to refute the hypothesis. It supposes that (say) 100,000 years ago man (who had previously spread over nearly the whole continent) was annihilated in (or driven out of) Europe; and that he did not again set his foot here for about 95,000 years, when he suddenly appeared in sufficient numbers to re-occupy his deserted hunting-grounds, and to advance even farther north. Now, of course, it is necessary to explain in some sort where man was during this interregnum of the race in Europe. Why was Europe abandoned? Was it uninhabitable? Was there a similar interval in India, where we are told palæolithic implements have been found, and in America, where it is claimed they have also been found? Was the climate of Europe more severe than it had been in the Reindeer Epoch through which man had just lived, and which, according to archæology, was the most brilliant era in palæolithic times? Or did the being who presses now close upon the Pole, in Greenland and Siberia, find Europe too inhospitable during this 95,000 years for the adventurous spirit of a single colony?

29. There is no trace of the fauna of such a period. Where are the remains of the animals that lived in Europe during these 900 centuries? Or, did the beast of the field, as well as man, abandon the continent? Europe, we know, was by no means without its mammalian fauna, even during the terrible Reign of Ice; and the bones of the mammoth and the reindeer are found, we are told, even in the till of Scotland. Neither frost nor flood expelled or exterminated animal life then, and why should the country have been uninhabited after the glacial and post-glacial epochs when their harsh conditions had passed away?

30. Nor are there any geological formations corresponding to any such period. On the palæolithic beds of the caves rest the neolithic beds; and on the gravels rests the peat.

31. A good deal has been said about the change in the fauna; but the present fauna of Siberia is almost identical with that in the same region in the days of the mammoth, and the change from the severe climate of the post-glacial epoch to the present mild climate accounts for the absence of many of the animals common in Europe at that time. As for the animals now peculiar to warmer regions, the cave-hyæna and the cave-lion are both admitted now to belong to existing species; and the remains of the former (as well as the African

lion) have been found in neolithic caves in Spain, while the lion was still found in Europe after the Christian era. The reindeer, the great Irish elk, the Norway elk, the urus, and the aurochs survived to historic times.

32. The animals of the African continent also had access to the European continent at or just before the date of the palæolithic age, as those of Asia had access to America at Behring's Straits, which communication has since been interrupted.

33. So that the fact, therefore, remains, that Neolithic Man was the first who was able to penetrate into Denmark and the North of England, Palæolithic Man having lived previously up to that line. It is admitted by both parties that the Ice was the barrier to palæolithic man. Which is most probable, that man advanced at once, as soon as the ice retired, or that he waited, restrained by some inexplicable cause, tens of thousands of years after it had retired, before he made that advance? I contend that the ice was in these regions down to the neolithic age; the advocates of the antiquity of man contend that it disappeared 100,000 years ago. On this latter theory, what prevented man from advancing? It is to be remembered that the men of the so-called Reindeer Age were extremely intelligent savages, and even if they were suddenly destroyed or driven to another continent, it is not credible that they had no successors in Europe for nearly a hundred thousand years. This would be a missing link in human life indeed.

34. Now these remarks do not imply that there was no line of demarcation between the palæolithic and neolithic ages; there is a very distinct line. There were great disturbances at this time, not only in Europe, but in America and in India and Siberia. The loess deposit in the river-valleys of the United States and Europe testifies to this, as does the sudden destruction by some great flood of the mammoth in Siberia. Perhaps there was a great deal of rain in Europe, incident to the breaking up of the glacier in the North. It may have been these continued rains which led to the destruction of the mammoth in Europe, and even man may have been temporarily driven from the continent. I only contend that there was no great lapse of time—ninety or a hundred thousand years. The destruction of the mammoth in Siberia and the preservation of his remains show that whatever occurred, occurred quickly; there were great forces at work, and the action was violent and paroxysmal. The same indications, as already observed, are given by the volume of the loess and the gravel in Europe and America.

The CHAIRMAN.—I am sure I may convey the thanks of the Institute to the author and also to the reader of this most interesting paper.*

Mr. DAVID HOWARD, F.C.S.—I cannot but think that a very strong protest is needed, such as this paper in a measure affords, against the modern habit of throwing in a few hundreds of thousands of years, whether they are wanted or not. It seems to me that the modern tendency, especially in regard to geological matters, is to refer to periods of hundreds of thousands of years in the same indefinite sense whereby in old indictments a man was stated to have called sundry—that is, ten thousand—people to assist him in his evil deeds. Undoubtedly in the study of geology we necessarily have to deal with enormous periods—periods so vast that they entirely overwhelm our knowledge of time; but it does seem somewhat childlike, because the sense of time is almost lost in the vastness of it, at once to rush into wild numbers which have no meaning. One knows very well that the old Greeks and the modern child, when they get a little way in counting, at once resort to the “myriad” of Homer. When it gets beyond the hundreds, the child has got quite beyond all notion of figures and addition, and I am a little afraid that there is something of the same tendency in modern thought on scientific matters. We get to a period which goes beyond history, and at once jump into myriads. We do not trouble our heads as to the exact counting of Homer. We do not suppose that he seriously meant what we do by the precise words he uses as we repeat them. I

* Mr. S. R. Pattison, F.G.S., writes as follows in regard to the paper:— I wish to offer a few observations, not to the general scope or conclusions of Dr. Southall's important paper, but to one portion of his argument. He states that the glacial epoch in Scandinavia is contemporaneous with the first flint-tool period. This may have been so. Then, that the second, viz., the polished stone period, occurred as soon as the ice had been removed still further north. This also is most probable. He rightly thus brings down the close of the glacial epoch into the domains of history. But he further says that although there is a very distinct line of demarcation between the two periods, yet the one very quickly followed the other. Now, this, I think, is a weak proposition in a good argument. Whoever studies the gravels and brick-earth of the paleolithic age in the ground below where we now stand, in the valley of the Thames, will see that great intervals of quiet deposit intercalate with other periods of disturbance of local and great action. There are successive platforms of life, indicated alike by shells and bones. I believe that in one of these quiescent stages man first appeared here. He was both heralded and succeeded by floods and “moving accidents.” The statement of this, and assigning adequate time, does not require, on the whole, more time than the Mosaic account by inference gives, and thus I beg to offer my thanks for the main argument of Dr. Southall. It is constructed on the lines which the thought on the subject is taking, viz., the bringing down the epoch of the great mammals and of the advent of man, rather than the piling up ages for the latter, and I am glad the Society has had so clear and full a statement of the case. I have offered my remarks to save the wholesale condemnation which might be uttered, on the ground of the untenable (as I think) hypothesis of a distinction between the first period and the epoch of disturbance, which I hold, on the evidence, to have been a portion of it.

cannot help thinking that the future geologist will treat the hundreds of thousands in the very same way. This paper does seem to show very clearly that the glacial period is by no means such a very distant one as many are inclined to suppose. It has struck me in past times in Switzerland, and very forcibly during last summer, when I specially examined one or two of the Swiss valleys, that it is almost inconceivable that any stone whatever can have resisted the action of the weather for the vast period said to have elapsed since the glacial period. If we compare the markings of the stone at the foot of the Mer de Glace, where the glacier has melted away, with the markings of the Ober-Hasli Thal, it is hardly conceivable that the stone can have been left marked by the glacial period, which we find almost as distinct and fresh as the stone which was covered by the glacier only seventeen or eighteen years ago. Undoubtedly granite will stand a long time, of which we have evidence in Cleopatra's Needle, beneath us; but I do not think one hundred thousand years will leave many markings upon it,—(Hear, hear,)—and I cannot think that the granite of the Höllen Platten will stand as long. In the upper part of the Maderaner Thal you have the glacial markings in the most wonderful perfection in the mountain limestone; but I do not think the mountain limestone will stand for a hundred thousand years. The channel markings are wonderfully fresh in this limestone, and we can hardly believe that it is even four thousand years since the glacier has channelled these stones. If we look back to the time, only about eighteen years ago, when the glaciers were rapidly advancing, into these valleys, and find now that two or three miles of glacier have melted away, leaving these beautifully marked stones, and if we consider that there had been but little change in climate there, or in the rest of Europe; we may see how very little change would be required, not merely to alter the glaciers, but almost to sweep them away. I think I am right in saying that the Upper Grindelwald glacier has sunk 150 feet; what, then, would another 150 feet do? It would leave many of the glaciers things of the past. One hundred and fifty feet thick of ice has disappeared with no change of climate, and a very little change of climate would sweep away the great Aletsch Glacier, and the Mer de Glace, and the Grindelwald Glacier. On the other hand, does it not seem possible that with but little change of climate the glaciers might descend and fill the valleys, reproducing the glacial epoch? I do not see any real proof that the glacial period of Switzerland was distinguished by such stupendous climatic conditions as is ordinarily supposed. The change might be consistent with the habitability of the greater part of Europe, and with hardly more variations than we see at present going on in Greenland. Do not let us forget that the glacial epoch is still going on in Greenland. A great part of Greenland has recently ceased to be habitable, and this points to the possibility of the glacial period, stupendous as it was in itself, co-existing with the life of man in the rest of the world, and possibly at no very distant period. It is quite possible that even within historic periods, even within the time of Nineveh and Babylon, there may have been changes on the vastest scale in

the mountains of Europe, caused by disturbances of climate, which may not have affected our ancestors in Mesopotamia. (Cheers.)

The CHAIRMAN.—Perhaps I may help on the proceedings by making a few remarks in addition to those of Mr. Howard. I find in this paper something like a silent protest against an assumption, which appears to me unwarrantable, on the part of persons who seem to be fond of long periods. Some people apparently revel in very high numbers. They remind me of a scientific man I once heard of. He lived in a country village, about eighteen miles from the principal town. He was always dabbling in astronomy, and it was said of him that he had been so accustomed to speak of miles by millions that when asked by a passer-by the distance to the market town, he answered that he did not think it was much more than eighteen millions of miles. (Laughter.) I think that some of these people much resemble this man. They are so much accustomed to speaking of thousands of millions of miles, that they cannot speak of less than thousands of millions of years. Their minds run entirely upon high numbers. When estimating the age of deposits, they always seem to assume that these deposits were made at a uniform rate. I have never found any proof that they were made uniformly. I do not pretend to be a profound geologist, but I have given a little attention to the subject, and I fancy I have found very distinct proof that they were not made uniformly. If I am right on this point the whole foundation of the hundreds of thousands or millions of years is gone; that which is said to have taken a hundred thousand years to form may only have taken fifteen hundred years. Not only is it unfair to assume that all deposits were made at a uniform rate, it is also unfair to say that they were, in every case, made at any rate at all. M. Belgrand asserts that “the change from the large rivers of the palæolithic age to the small rivers of the neolithic age must have taken place *suddenly*.” I remember the late Mr. E. Hopkins saying, at one of the early meetings of the Institute, that he knew of a very deep formation being made in this way. Whilst travelling in one of the valleys of the Andes he passed over a small plain in the mountains. Passing by the same place within six months afterwards he found that an avalanche had descended, and that there was a deposit on this plain, which, if examined by a geological eye, would have been pronounced to be the work of some fifty thousand years, while, as he said, it had taken only six months to form. I am glad to see in this paper some protest against these modes of reasoning, which I cannot but think unfair and misleading.

Mr. CALLARD.—There is much in this paper with which I agree, and there are some things with which I do not agree. Although I agree with you, sir, and with the last speaker, and with the author of the paper, that there is no evidence as to 800,000 or 200,000 years back being the time of the glacial epoch, yet these figures are not taken at haphazard, as might be thought from the remarks that have been made. They are based on the theory that the cause of the glacial epoch was a great eccentricity of the earth's orbit. It became an astronomical question at what period we had these great eccentricities. Astronomers

worked out that we had two great eccentricities, one 800,000 years, and the other 200,000 years back, and if the hypothesis had been correct, we had some data for fixing these glacial periods. I have on a former occasion attempted to prove that the eccentricity of the earth's orbit would not occasion the glacial epoch, and that therefore these data have nothing whatever to do with the question. But, whilst I agree with the author of the paper that 200,000 years ago is not the period we are obliged to accept, yet I hesitate in accepting the conclusion of Dr. Southall that the period was as recent as he puts it, the vast changes that have taken place leading me to hesitate. For example, the paper refers to the palæolithic flood which would have swept across Southern England and Northern France—that palæolithic flood which it is assumed deposited the gravels. A flood carrying these gravels is more in accordance with what I have observed, than these gravels being river deposits. Yet I must remark that the time at which these gravels could have been swept across England and the North of France by the palæolithic flood was a time when the Straits of Dover were not in existence, and the geological convulsion necessary for the sweeping of these gravels across England and France, connecting it also with the alteration that has taken place in the Straits of Dover, makes me hesitate in supposing that this could have taken place as recently as the author puts it, for it would bring it to about the time of Abraham. I have not been accustomed to think that such great changes have taken place at such a recent period as that. The author of the paper says :—"If I can show that the glacial epoch came down to the date of Robenhausen and the Danish shell-mounds, I shall have brought that mysterious geological episode within the well-defined limits of chronology" (par. 9). If we take the date of Robenhausen, the author of the paper has put it at four thousand years back,—I do not think he ought to put it further back—Robenhausen is one of the oldest of the Lake Dwellings, and antiquarians have been accustomed to speak of it as of great antiquity. I visited it during last autumn, and, in conjunction with the famous antiquary, M. Messikommer, who resides in that neighbourhood, did some dredging. Judging from the things we brought from the bottom, I should not think Robenhausen a place of vast antiquity. We brought up pieces of pottery, also portions of woven cloth. The people who had inhabited Robenhausen knew something, therefore, about the loom. When I reached home I met with some remark about metal having been found there, and crucibles. I wrote to M. Messikommer to know whether he had met with anything of the kind, and his reply was in the affirmative, but he said the metal he had found was not larger than the head of a pin, it was copper, and was in a crucible. This was enough. If the metal were as large as the head of a pin and he had found it in what was really a crucible, I was satisfied. There were also five other crucibles. When we find six crucibles among the things belonging to these lake dwellings, we must conclude that they knew something about metals, and if they did, this fact takes them out of the stone age. Now the conclusion of the author that the glacial epoch lasted up to the polished stone age, is based upon the

non-finding of palæolithic implements in Denmark, Sweden, Norway, and the North of England. I put one of these implements in my pocket, thinking that as we were to talk of the subject it would be as well that you should see the sort of stones we were to speak about. This implement (*holding one up*) came from the Somme Valley, and a very good specimen of the flint implement it is. The conclusion that palæolithic man did not reach those northern parts is based upon the fact that these implements are not found there, and the same argument is adduced with regard to Switzerland, where, owing to the altitudes, of course it would be much colder. The conclusion is that they are not found there, because the ice kept palæolithic man out. That may be the reason, but we are not tied up to it. There may be some other reason, and I am inclined to think there is another reason. There is a tendency at the present day to confound those periods which are called palæolithic and neolithic. We get a fair definition given to us, and in working it out we depart from it. I should like to read the definition, because it would help us on the subject, and because so very much depends upon it. Mr. Alfred Wallace, in an address given to the Biological Section of the British Association, which met in Glasgow in 1876, says: "As we go back metals soon disappear. We find only tools and weapons of stone and bone. The stone weapons get ruder and ruder, pottery and then bone implements cease to occur, and in the earliest age (*i.e.*, the palæolithic) we find only chipped flints of rude design though still of unmistakable human workmanship." Now, will you refer to paragraph 22:—

"Now, there is just outside of this Alpine region, near the eastern extremity of the Lake of Constance, a station of palæolithic date, called Schussenried. The fauna and flora observed here were Arctic in character, and the only remains of the extinct animals were the worked horns of the reindeer. These, we are told, with needles of bone, and objects manufactured of nephrite, were found 'in the glacial clay.' The palæolithic hunters had advanced up to the margin of the ice; they left their relics, mingled with the remains of Arctic plants, to be buried beneath the glacial clays."

I would ask, Why does the author call these hunters palæolithic? Why does he call these relics palæolithic? There is no palæolithic implement amongst them. The implements found there, we are told, are needles of bone and implements of nephrite, brought from a considerable distance. They are not palæolithic implements, and therefore I object to this station being called a palæolithic station at all; it is not a palæolithic station, it is a neolithic station. Again, in paragraph 23:—

"There is a cave on the northern frontier of Switzerland, near Schaffhausen, which bears the same aspect as Schussenried, and where palæolithic man seems, as it were, to hover on the confines of the neolithic age. I refer to the Kesslerloch."

But no palæolithic implements are found there. You do find a beautiful drawing of a reindeer browsing, but that does not belong to the palæolithic age; and I may mention that in Schussenried there were found pottery and a portion of a rope made of the bast of the lime-tree, and also a perforated red bead, like coral. These may seem very slight things to mention, but

they are all-important upon this question : as to whether this is palæolithic man we are dealing with. Bear in mind that in the palæolithic period we only find chipped flints of rude design, and we have got behind the time of pottery and bone implements. I do not blame Dr. Southall, he quotes what others have said ; but I repeat that the things spoken of are not palæolithic at all, and that the district over which palæolithic implements are found is very much more limited than this paper would lead you to suppose. Dr. John Evans, who is perhaps the greatest authority on this question, published in the year 1872 a book on the flint implements of Great Britain. He said there had been no trace up to that time of any flint implement of the palæolithic type being found north of the river Ouse and its tributaries ; and Mr. Flower, in a paper read before the Anthropological Society in the same year, stated that the farthest north at which any of these implements had been found was in the Wash, and in its neighbourhood. I think the argument in this paper would have been stronger if Mr. Southall could have said that flint implements were found everywhere except in those places he has named, where the ice may have been supposed to have kept man out. But it is not so. If I were asked where flint implements are to be found I should say : " In the gravel and in the gravel drift, and nowhere else." They are found in the Somme Valley—this one came from the Somme Valley ;—they are found in the neighbourhood of Salisbury, but it is in the gravel again ; in the Ouse they are found, but still in the gravel ; in Norfolk and Suffolk, at Brandon and Hoxne they are found,—indeed, wherever found it is always in the gravel or the gravel drift. Palæolithic man was unlike neolithic man, who travelled about and carried his implements with him ; palæolithic man, if there was such a being, and you must allow me the doubt, made his implements in the gravel, and where he made them there he left them, and not one has been found anywhere else. Such being the case, it gives me some ground for raising the question whether the non-finding of the implements in Scandinavia, in Denmark, and in Scotland, was not owing to the fact that there was no man to take them there, and that neolithic man is the first evidence we have of man at all in Europe. (Cheers.)

Rev. J. JAMES.—There is one remark I wish to make as to the way in which many geologists when making their calculations have ignored other sciences. Astronomy, no less than some other sciences, ought to be taken into account by them. It certainly should, I think, be considered the great sin of modern men of science that they limit themselves to a particular branch and ignore all others. Physical science they boast of, and they confine themselves to it, whereas it seems to me to be not a matter of boast but rather of shame that they should ignore the other recognized sciences.

Rev. A. F. MUIR.—I wish to make a few remarks, in the capacity of an inductive reasoner, as criticising the conclusions at which scientific men have arrived on this question. It seems to me that the induction has been altogether too narrow, that it has been confined to a certain class of phenomena to the exclusion of others. Mr. Callard has fittingly said that astronomical data bear very importantly upon this question, and

in most reasoning on this subject they are entirely ignored. Might it not be suggested, that not only astronomical but other data, which may not at present seem to bear so much on the question, might come into play upon it in the same way, and that the proper spirit would be one of delay, waiting till we had sufficient data on which to proceed? I will give an instance of how I have seen that recent investigations are affecting this question. In the current number of *Scribner's Magazine* there is a very interesting paper by a Californian naturalist upon lakes, which he classifies. The lakes of which he speaks are chiefly those in the neighbourhood of the Yosemite Valley. Among the mountains of that region a most interesting study of the genesis of lakes may be made. He states that the silting-up of many of these glacier-formed lakes is a matter of very short duration—that it is done comparatively quickly. The writer gives a plate showing how the margin of a lake, which a few years back had evidently had steep rocky shores dipping into the water, was now gradually being fringed with meadow-land, formed by the silting of the mountain sides, worn down by streams and atmospheric action; and in all probability in a few hundred years, if so many, that lake will be entirely filled up. Consequently we infer that in similar situations, as in Switzerland, where these lakes have been formed and wholly or partially filled up, leaving a deposit of mud or gravel, the remains found therein cannot have been so very ancient. There are other arguments of great importance to prove that there is, as Mr. Callard suggests, no such being as palæolithic man. It seems to me that the society would have gained very much if Mr. Callard had communicated the ideas I have heard from him in private, when he has gone further than in what he has said to-night, and I think with very good reason.

The meeting was then adjourned.

MOUND-BUILDERS IN AMERICA.

“One of the most interesting questions in American archaeology has long been that of the age of the ‘mound-builders.’ Modern views seem now opposed to a prehistoric date for these people. Amongst other American workers who have inclined to the more recent date of these structures may be mentioned S. F. Haven, who considered the ancestors of the present Indians to have been the authors of these erections, and Dr. P. J. Farnsworth, who believed that the mound-builders were identical in race with the historical Indians of North America. On this subject a paper read before the Congrès International des Américanistes, 1877, by M. F. Force, has just been reprinted in pamphlet form by Clarke & Co., Cincinnati, 1879, entitled, ‘To what Race did the Mound-builders belong?’ The following are some of the author’s conclusions:—That so far as indications are given by the growth of vegetation it is not necessary to hold that any of the works were abandoned more than one thousand years ago. That the absence of all tradition concerning the mounds among the recent Indians is no proof of their great

antiquity, as Indian tradition is short-lived and evanescent. Although the advent of De Soto with his armed followers, pillaging and ravaging the country, must have been calculated to make a deep impression, yet, when Europeans visited the country a century and a half later, they found not a vestige of a tradition of De Soto. Finally, Mr. Force considers that the mound-builders were tribes of Indians, more advanced than the Algonquins or the Dakotahs, but much less advanced than the Aztecs or the Peruvians, and on the same plane with the Pueblo Indians, and that they were living in full prosperity in the time of Charlemagne. Mr. Force reviews the evidence as to their antiquity derived from an examination of crania from these mounds, and endeavours to prove that either the skulls were not obtained from the mounds under consideration, or in other instances would not bear the conclusions based on their examination."—*Nature*, 27 Feb., 1879.—Ed.

DR. SOUTHALL'S REPLY.

[COMMUNICATED.]

I AM inclined to think that Mr. Callard is right in his idea that the so-called flint implements obtained from the river gravel are natural, and not artificial, forms. I have suspected this to be the case for several years, but it is as yet by no means proved. The archæologists will not listen to any such suggestion; I therefore did not raise this question.

My object, setting out with the artificial origin of these forms as a *concessum*, was to show that we have in the areas over which these implements are distributed in Europe, a clue to the date of the Glacial Epoch. The gravels in which they occur are admitted to be Post-glacial, and the implements are therefore, of course, posterior in date to the close of the Glacial Epoch. Beyond a certain line in the north of Europe they do not occur: I undertook to show that this was due to the fact that palæolithic man was kept out of Denmark and Scotland by the ice, and that man advanced into these regions when the climatic conditions permitted him to do so—namely, at the beginning of the Polished Stone Age. And I then pointed out that this gives us the date of the retirement of the ice in Denmark and Scotland—that it corresponded with the beginnings of Robenhausen and Moosseedorf.

But Mr. Callard here interposes the objection that these flints in question are not artificial in their origin, and would infer that the argument presented by me is, therefore, unnecessary, as well as unsupported by the fact assumed or accepted as true.

If Mr. Callard is right in this view of the non-artificial origin of these flints (and I think it not improbable that future investigation will show that he is), then the antiquity of man ceases to be connected in any way with the age of the river-gravels, and we get rid of the most difficult point in this whole discussion.*

* If these so-called implements were really manufactured by some primeval race of men, they ought to be found under varying conditions and in all locali-

But, supposing this to be the act, in that case we have still to deal with the *Bone-Caves* of the so-called Palæolithic Age, which occur all over Central

ties. But in Europe they [are always, I believe, found (1) in the *river-valleys*, or associated in some way with the floods of the Post-glacial epoch. They are always associated also with beds of *sand*, generally beneath such a deposit. 2. They are always of *flint* (in a few instances, perhaps, of *chert*), and have been washed from the beds of *chalk* which are found in the Somme Valley, at Hoxne, at Bury St. Edmund's, at Brandon, at Herne Bay, at Reculvers, at Fimber, at Fisherton, &c. 3. The specimens which are offered as spear-heads, axes, &c., have been selected from hundreds of other fractured or worn flints, admittedly of non-artificial origin, and which pass insensibly into the more perfect forms. 4. *No other* implement or utensil has ever been found with these rude flints. If man left these implements in the river-valleys, every other trace of him has perished; there are no implements of bone, horn, ivory, wood, no trace of pottery, charcoal, clothing, ornaments, pigments, nor any of those relics, other than stone, which abound in the caves.

In precisely the same geological position similar implements have been found in old river-beds in India; the only difference being that the material here is quartzite instead of flint.

In the valley of the Delaware, United States, in the same geological position, similar forms of a stone called *argillite* have been recently found. Here, as in Europe, the chipped pebbles occur in great numbers, more or less nearly approached in form to the accepted specimens, which accepted specimens are called out as the artificially-formed ones from hundreds of inferior specimens admitted to be mere natural forms.

In the Upper Mississippi Valley, near the Falls of St. Anthony, in Minnesota, Prof. Winchell has found in the past three years, in a *Pre-glacial* deposit, certain chipped fragments of *quartz* and *chert*, some of which have been pronounced to be "unquestionably" of artificial origin. These implements, however, "vary in thickness, from that of *paper*, and the size of one's *finger-nail*, to one and two inches across, of irregular angular forms"; and out of "three quarts" of these chips gathered, there were only "eight" specimens "that could be thought to have a designed form." It is also stated that in one instance, near the mouth of Little Elk river, "the veins of white quartz from which these chips were originally derived, were observed to split into angular pieces similar to those taken from the surface sand of the plain, under the action of moisture and frost." (*Geological and Natural History Survey of Minnesota*, 1877, p. 57.)

Innumerable fragments of broken flint are found, according to M. Zittel, in the Libyan Desert, which, as he remarked at the Stockholm Congress of Archæologists in 1874, have been fractured under the action of the sun. A certain proportion of these specimens appeared to him (in which opinion M. Desor concurred) to have been shaped by the hand of man.

There is one other remarkable locality where fractured stones occur in great numbers, some of the fragments closely resembling the so-called palæolithic flints from the river-gravels of Europe. In the volume of Hayden's *Geological Survey of the Territories (U.S.A.)* for 1872, there is a paper by Prof. Joseph Leidy, giving an account of the "Remains of Primitive Art in the Bridger Basin of Southern Wyoming," at the base of the Uintah Mountains. The flat-topped hills or terraces occurring in this basin are familiarly known as *buttes*, many of which are covered with drift materials, partly from the Uintah Mountains, and partly composed of the harder materials from the terraces themselves. The mountains have furnished materials of sandstone and quartzite, while the buttes have contri-

and Western Europe, as well as in Italy and Spain, but *never* in the more northerly parts of Europe, that is to say in Denmark, Scotland, Sweden, or Norway, or beyond a certain line in the north of England.

It will not affect my argument whether we call these primitive cave-men palæolithic or neolithic; we never find their traces in the North of Europe. We find neither the implements which characterise the lower beds of the caves of Périgord, or Belgium, or England, nor the bones of the extinct animals—I mean the mammoth, the rhinoceros, the cave-bear, the cave-hyena, the musk-ox, &c. Why is this? I must give the same reason that I gave in the other case—both man and brute were kept out by the ice. The climate in the North did not permit the cave-men of the Mammoth—or, if it is preferred, the Reindeer—epoch to advance. The ice still lingered in Denmark and Scotland. When did it retire? It retired, as is evidenced by the most ancient relics found in these countries, in the Polished Stone Age. And we arrive at precisely the same conclusion which we reached before.

In the caves of the so-called Palæolithic Age no polished stone implements are ever found, and as archaeologists use the terms neolithic and polished-

buted fragments from thin seams of brown and striped jaspers, and black, yellowish, and grey flints, and not unfrequently nodules of chalcedony and agate. Some of the plains are thickly strewn with these splintered stones. Some of these specimens Prof. Leidy pronounces to be unquestionably "rude implements of art;" while, as he remarks, "the vast numbers of similar stones to be found on the plains and buttes near Fort Bridger, and their gradation to undoubted accidental fragments with which they are mingled, alone renders it improbable that they should be considered as such." The learned professor figures a number of the specimens, which bear a strong resemblance to the palæolithic types.

It is very evident from these facts that the great bulk of these fractured stones—flint, chert, quartzite, argillite, jasper (all with the exception of argillite, varying forms of quartz, or pure silica)—are of non-artificial origin, and the presumption, to say the least, is very strong that *all* are so. If nature can produce the chippings (as is unquestionable) which appear on the flint and argillite nodules, where is the process to stop? If she can produce a specimen that is so much like the so-called artificial specimen that it can hardly be distinguished from it, why may she not have originated both specimens?

I will add only one other remark. It is well known that flints, believed by many archaeologists from their artificial appearance to have been shaped by the hand of man, have been found in Pliocene and Miocene deposits, as, for example, in the Pliocene strata of the valley of the Tiber, and in the Miocene strata near Pontlevoy, in France. Now these flints, if their stratigraphical position is correctly described, are undoubtedly non-artificial, and if so, the quaternary flints of the Drift gravels are also probably non-artificial.

I present these considerations as an argument going to show that Mr. Callard is correct in his views on this point, but I doubt if they will appear conclusive to all minds; they are certainly not so regarded by archaeologists like Mr. Evans and Mr. Boyd Dawkins, and for the present we must be content to await additional light on the subject. They open up a most interesting line of investigation, which I trust will be followed up by such competent observers as Mr. Callard.

stone as interchangeable and equivalent to one another, I object to the application of the term "neolithic" to this period. When we descend to a later period—that of the Lake-Dwellings—we encounter at once the polished implements, as we do in the peat-bogs of Denmark and in the cairns of Scotland.

The faunas, too, in the two cases are entirely different : in the oldest bone-caves of France, England, Germany, the fauna consists of the mammoth, the rhinoceros tichorinus, the cave-lion, the cave-bear, the reindeer, the musk-ox, the urus, the aurochs, the horse, &c.; in Denmark, and Scotland, and Sweden, the fauna associated with the earliest remains of man consists of urus, aurochs, red-deer, brown bear, sheep, tame ox, wild boar, fox, dog, &c., the same as the fauna which occurs in the peat of the Somme Valley and in the Swiss lake-dwellings.*

It may be said that the bones of the mammoth have been found in Scotland : this is true ; but they have been found in the Glacial formation denominated the till, showing that the animal penetrated into this region in the midst of the Ice Age—wandered off occasionally, no doubt, from the more genial regions farther south, where he existed at that time as the contemporary of man. It was probably only an occasional straggler that crossed this inhospitable line ; and it is possible, as I intimated in my paper, that man may have done the same thing. But this was the exception, not the rule ; all that I meant to insist on was, that in general the ice and the snow in these northerly regions constituted a barrier to the men and to the animals who left their remains in such caverns as Moustier, La Madelaine, Chaleux, Kent's Hole, and the Kesslerloch, and to point out that we find that barrier removed in the Polished Stone Age.

Mr. Callard remarks that he would hesitate to believe that the palæolithic flood can have been as recent as I represent it, because that flood must have occurred at a time when the Straits of Dover were not in existence. I am not sure that the palæolithic flood was not subsequent to the formation of these straits, but, waiving this, I would observe that an elevation of the seabottom some 150 feet would unite England with France at this point ; and I would farther call attention to the fact that the dwarfish shells of the mussel, cockle, and other marine species, occur on a raised beach at Upsala, in Sweden, 100 feet above the sea ; and at Linde, 130 miles west of Stockholm, they are found at a height of 230 feet above the sea. The significance of this fact is this, that these shells were deposited in their present positions since the date of the Danish shell-mounds, where the marine shells are much larger. The mussel, and the other species represented in the Kjökken-möddings, were much larger than they occur now in the waters of the Baltic, because these waters were at that time much more salt than they have been since the broad channel was closed which formerly connected

* The remains of the reindeer are found occasionally in the peat-bogs and in neolithic caves, but it is a rare occurrence ; during the "Reindeer epoch" the animal seems to have abounded all over Central and Western Europe.

the North Sea with the Baltic along the line of the lakes Malar, Hjelmar and Wenern. Those straits were open when the Danish fishermen occupied the sites of the shell-mounds, and the date of these shell-heaps is proved by the fauna to be fully as recent as that of the lake-dwellings. Indeed, in one of the oldest of them (near Kallundborg) objects of bronze have been found. Since this date—which was hardly more than 3,000 years ago—the straits referred to have been closed, and the land at Linde, in Sweden, has risen 230 feet.

I may add, that the coasts of Norway have risen 600 feet since the temperature of the adjacent seas was very nearly what it is to-day.

If these changes have occurred within so recent a period, why should there be any difficulty about the Straits of Dover? The elevation of the land at Linde must have occurred since bronze implements found their way to Denmark—that is to say, within 3,000 or 3,500 years.

ORDINARY MEETING, JANUARY 20, 1879.

THE REV. R. THORNTON, D.D., VICE-PRESIDENT, IN THE
CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

MEMBER :—W. H. Anderson, Esq., C.E., Ceylon.

ASSOCIATE :—Rev. H. Brass, M.A., F.G.S., Red Hill.

The following paper was then read by the author :—

FINAL CAUSE; a Critique of the Failure of Paley and the Fallacy of Hume. By JOSEPH P. THOMPSON, D.D., LL.D., of Berlin.

IN his "History of English Thought in the Eighteenth Century," Mr. Leslie Stephen pays an earnest and impartial tribute to the two writers of that period, who were the foremost disputants upon the doctrine of a final cause in Nature as proving the existence of God,—David Hume and William Paley. Of Hume he says :— "We have in his pages the ultimate expression of the acutest scepticism of the eighteenth century,—the one articulate statement of a philosophical judgment upon the central questions at issue."* And again :—"Hume's scepticism completes the critical movement of Locke. It marks one of the great turning-points in the history of thought. From

* Chap. vi. sec. 3.

his writings we may date the definite abandonment of the philosophical conceptions of the preceding century, leading, in some cases, to an abandonment of the great questions as insoluble; and, in others, to an attempt to solve them by a new method. Hume did not destroy ontology or theology, but he destroyed the old ontology; and all later thinkers, who have not been content with the mere dead bones of extinct philosophy, have built up their systems upon entirely new lines."*

Of Paley Mr. Stephen says:—"The Natural Theology lays the basis of his whole system. The book, whatever its philosophical shortcomings, is a marvel of skilful statement. It states, with admirable clearness and in a most attractive form, the argument which has the greatest popular force, and which, duly etherealized, still passes muster with metaphysicians. Considered as the work of a man who had to cram himself for the purpose, it would be difficult to praise its literary merits too highly. The only fault in the book, considered as an instrument of persuasion, is that it is too conclusive. If there were no hidden flaw in the reasoning, it would be impossible to understand, not only how any should resist, but how any one should ever have overlooked the demonstration."†

In the history of polemics there is hardly another instance of such collapse of popularity as has befallen the book, the style and method of which Mr. Stephen has here so justly praised. The argument of Paley was regarded by theologians of his time as invincible; and his illustrations from Nature were so attractive to youth that his "Natural Theology" was adopted as a text-book in colleges. Upon the basis of his famous axiom was built up the series of "Bridgewater Treatises," in which anatomy and physiology, astronomy, geology, and various branches of physics were brought to illustrate and establish the evidence of design in Nature. So keen a logician as Archbishop Whately used his acumen to adapt Paley's reasoning to the later discoveries and developments of science; and so careful a physicist as Dr. Whewell led his "Induction of the Physical Sciences" up to the same conclusion. Yet to the present generation, within less than eighty years from its first appearance, Paley's "Natural Theology" is already antiquated as to its once brilliant and conclusive demonstrations, and as an authority is well-nigh obsolete.

Quite otherwise has been the fate of Hume. Mr. Stephen

* Chap. iii. sec. 43.

† Chap. viii. iv. 38.

reminds us that "his first book fell dead-born from the press; few of its successors had a much better fate. The uneducated masses were, of course, beyond his reach; amongst the educated minority he had but few readers; and amongst the few readers still fewer who could appreciate his thoughts."* Add to this that Hume, though deeming himself a match for the philosophers and theologians of his time, had a secret dread of that religious pugnacity in the common people of Scotland which is so quickly roused against an assailant of popular beliefs, and therefore kept back, to be published after his death, his "Dialogues on Natural Religion,"—the book most fitted to provoke that acrimonious criticism which insures literary success. Now, however, within a century of its first appearance, we find this masterly product of Hume's dialectics still acknowledged as the standard treatise of philosophical scepticism. Scotch philosophers since his day have laboured to reform philosophy in the light of Hume's criticism; Kant attempted to refute his scepticism; John Stuart Mill virtually built upon Hume; and he has lately been revived in Germany, with the honour of translation and the prestige of authority. His fame grows with time. This is due partly to the beauty of Hume's style, and the clearness and depth of his reasoning; due also to the decline of theological asperity, and the growth of a tolerant spirit among various schools of thought; and due not a little to the tone of audacity,—or what he himself styled "a certain boldness of temper,"—with which Hume assailed convictions which had come to be accepted as axioms both in philosophy and in religion. And I am of opinion also that no small part of the favour which has accrued to Hume is due to the metaphysical fallacies which have sprung up side by side with the scientific facts which have discredited Paley. The whole history of science discloses a disposition to metaphysical speculation awakened by each new discovery in physical nature. With every fresh deposit of facts upon the borders of science comes a fresh brood of fallacies upon the adjacent borders of hypothesis; and the progenitors of these have a natural affinity for the greatest of sceptics, who was notably the dupe of his own fallacies. This phenomenon of the simultaneous generation of fact and fallacy is itself worthy of scientific investigation. But it is enough to note it here as showing that the failure of Paley's demonstration of God in Nature should not drive us over to Hume's contradiction, which is demonstrably a fallacy.

* Chap. i. 1.

Paley's statement of the doctrine of an end in Nature was from the first open to these two objections.

(1) Instead of formulating a proposition to be proved, or pointing to the sources from which the conviction of its truth arises in the mind, Paley tacitly assumed the thing in question, and wrapped this assumption in a self-repeating phrase which he sought to strengthen by multifarious illustrations.

(2) Assuming that design or contrivance exists in the whole field of Nature, Paley was betrayed into the use of illustrations, sometimes far-fetched, sometimes superficial or lacking confirmation, which wear the appearance of making out a case.

"There cannot be design without a designer, contrivance without a contriver," was the axiom upon which Paley built up his treatise. He does not seem to have been aware,—at least, he takes no notice of the fact,—that Hume had assailed this axiom, and the very illustration of the watch by which Paley so triumphantly asserts it, at the one point at which it might be vulnerable, and if vulnerable, then worthless to Paley's end, viz., that the axiom rests solely upon experience, and holds only within the range of possible human action and observation. Though Hume's assertion is a fallacy, yet he had put it so plausibly that Paley could not afford to pass it by; and by leaving his fundamental premise open to doubt and contradiction, Paley failed to establish the existence of a Supreme Being from traces of design in Nature, however curious and multiplied. Indeed, he himself fell into the common fallacy of begging the question in the very statement of it.

That design implies a designer is as obvious as that thought implies a thinker; but the materialist denies personality to the thinking substance; and to apply the term design to every hint of adaptation in Nature, in the sense of an intelligence shaping matter to an end, is to *assume* the existence of God in the very form of proving it.

It was also an error of Paley that he sought to make out the *goodness* of the end, as part of the evidence of a supreme contriver; or at least to show the preponderance of good over evil in apparent ends. In this endeavour he was sometimes so unfortunate as to throw the weight of his illustration into the opposite scale. Thus, in asserting that "teeth were made to eat, not to ache," he failed to dispose of the fact that they do ache, as an objection to any ruling design in their structure and composition. Their aching is not always due to some violation of nature, since wild beasts in our Zoological Gardens sometimes require dental surgery. It will not quiet the jumping tooth-ache, nor ease a neuralgic nerve to assure the sufferer that teeth and nerves were not made for the purpose

of giving pain. Indeed, it is quite a popular fancy that nerves are demons of evil. The *whence* and the *wherefore* of evil must be taken into view in forming an estimate of the end for which a thing was made, of unity and wisdom in its design, or of any purpose whatever in its existence. But the question of a final cause in things is not to be set aside by some single characteristic or quality of a thing which seems to mark it as useless or even injurious.

That every event argues a cause is an intuitive, not an experimental, conviction of the human mind. Whether the cause is intelligent and purposing, or is only a material or an accidental antecedent, is to be determined by observation and analysis of the thing itself in its place, and its relations. Moral qualities or purposes, suggested by certain properties of a thing as inhering in the Cause,—if Cause there be,—do not necessarily enter into the proof of the existence of an intelligent Cause, which might be either good or evil. Stripping Paley's statement of its verbal assumptions, and setting aside such of his illustrations as are crude or antiquated, his fundamental argument for the Creator as evinced by the traces of design in Nature is not only tenable in face of the more recent discoveries of science, but is illustrated and confirmed by a far richer array of natural phenomena than Paley had ever imagined. We may improve, however, upon his statement of the doctrine of final causes as follows: The perceived collocation or combination of phenomena or forces in Nature toward a given result, produces in the mind the immediate conviction of an intelligent purpose behind such phenomena and forces. This statement, while it retains the essence of Paley's axiom, avoids his logical vice of including in the definition the very term to be defined. A fixed series of events may be mechanical; but the *combination* of several independent series of phenomena toward a distinctive result must be referred to *Thought* purposing that event. Nature with all her forces and material has never produced a single thing that answers to the idea of an *invention*. This is always the product of human intelligence applied to the powers and substances of Nature. The contrivance seen in a machine instantly refers us to the mind as its cause. Thus, electricity is a power everywhere present in Nature; yet electricity has never produced an electrical machine, an electric telegraph or telephone, or an electric light. But though Nature cannot turn her own powers into a practical machine, and the least hint of an adaptation of these powers to the purposes of man suggests the intervention of the human intellect, yet the natural powers which man subordi-

nates to his intelligent uses remain greater and more wonderful than the inventions to which they are applied. Are then the powers and substances of Nature which stand, as it were, waiting for the touch of the inventor's genius to make them available wherever mind shall lead the way, themselves mere things of chance or products of material law with no *intent* in their existence? When made available do they proclaim intelligence, and yet is the marvellous property of *availability* only a meaningless phenomenon of matter? Hitherto the phraseology of the doctrine of design, and the illustrations of the doctrine, have had a certain coarseness of fibre, suggesting a mechanical universe turned out by what Cowper styles "the great *Artificer* of all that moves," and needing the constant oversight of the Maker to keep it in working order. The sublime personifications of the creation in the Bible have been literalized by our matter-of-fact philosophy, as though the differential calculus could measure the astronomy of Job or of the 19th Psalm. But science, by bringing us into nearer contact with what Tyndall has called the "subsensible world," has at once enlarged the sphere of our vision, and heightened its powers. Teleology addresses itself to some finer sense within. It widens its circle without changing its centre. The mechanism of the universe drops away, and we find or feel the *Thought* of the Infinite Mind projecting itself in the actual through finite forms, and combining and comprehending the whole in an ever-unfolding purpose. Hence, we may say with von Baerenbach, "Darwin has not rendered Teleology impossible under any and every form, but has conducted philosophical science to another and the true conception of design."* True, von Baerenbach would find the solution of the universe in *Monism*; but his testimony from a scientific point of view shows that the question of Causality cannot be laid aside, and that, after all sciences, Nature persistently demands the *Wherefore* of her own phenomena.

Zeller, of Berlin, in his paper read before the Academy of Science "upon the Teleological and the Mechanical interpretations of Nature in their application to the universe," seeks to combine the necessary in Nature with the purposive in Reason. "Since, on all sides, the investigation of Nature, so far as it has been carried, shows us a firm linking together of cause and effect, we must assume from the coherence of all phenomena, that the same holds also of those which have not yet been investigated and explained, that everything in the

* "Gedanken ueber die Teleologie in der Natur," von Friedrich von Baerenbach. Berlin, 1878, p. 5.

world proceeds from its natural cause, according to natural laws, and therefore nothing can here be brought in of the intervention of an active purpose bearing upon this fixed result, distinct from natural necessity. Yet we cannot consider these natural causes as barely mechanical; for their effects reach far beyond that which can be explained by motion in space, or resolved into such motion. And if from these same causes along with inorganic nature, life also, and along with irrational life also conscious and rational existence have appeared, not as it were by mere accident in course of time, but necessarily by virtue of their natures, do proceed and ever have proceeded; if the world never can have been without life and intelligence, since the same causes which now produce life and reason must already from eternity have worked, and therefore have produced these continually, so must we call the world, as a whole, in spite of the natural necessity which rules in it, indeed, rather on account of this, at the same time the work of absolute Reason. That this Reason should have been guided in its action by proposed ends, is indeed not necessary.

“Yet, inasmuch as it is one and the same cause from which in the last analysis all effects spring, inasmuch as all the laws of Nature only show the art and manner in which these causes, following the necessity of their existence, work toward many sides, so from the totality of these operations must necessarily proceed a world harmonious in all its parts, a world complete in its way, and arranged with absolute conformity to purpose.”*

A point of still higher moment to the argument Zeller has quite overlooked, viz., that in no case could the mechanical theory be adequate to the solution of the universe. Motion, indeed, might account for all the phenomena of *physics*, with the exception of motion itself. But, after all the facts of *mechanism* are disposed of, there remain the facts and forces of *vitalism*, which refuse to be included under mechanism. Motion cannot originate life, neither can chemistry create or evolve life. We may analyze life into all its constituents and conditions, but cannot detect the life itself. We may combine all the constituents and conditions of life, but cannot produce life. The living organism we know, but the mind demands the cause of life-organization, and sees that this does not

* It is a groundless assumption of Zeller that because life *is* it has always been; an assumption not warranted by the law of scientific induction. The rule of experience by which physicists would bind us forbids such a generalization upon phenomena of which there is no possible record. This is not scientific testimony, but speculative hypothesis.

lie in mechanism. The mechanism of the universe may be concluded within motion and the correlation of forces; but force is a quality, not a cause, and motion demands an origin, and beyond both lie the immensities of vitalism and of intelligence.

Hume attempted to break down the teleological argument by assailing the conception of cause and effect. He maintained that "order, arrangement, or the adjustment of final causes, is not of itself any proof of design, but only so far as it has been experienced to proceed from that principle," and also, that our experience of design, from the operations of the human mind, cannot furnish an analogy for "the great universal mind," which we thus assume to be the Author of Nature. Hence, according to Hume, before we could infer "that an orderly universe must arise from some thought and act, like the human, it were requisite that we had experience of the origin of worlds, and it is not sufficient, surely, that we have seen ships and cities arise from human art and contrivance."

The first position of Hume is refuted by the universal consciousness of mankind. Most assuredly our belief that any particular object in which we perceive the adaptation of parts to each other, or of means to an end, must have proceeded from a designing cause, does not arise out of a previous observation or experience of such cause in objects of *the same class*. Of the millions of men who wear watches, how very few have ever seen the parts of a watch formed and put together! Yet every possessor of a watch is sure that it had a maker; and this conviction could not be strengthened by his going to Geneva and seeing watches made by hand, or to Waltham and seeing them made by machinery.

The first maker of a watch had no "experience" to follow. He used his own inventive skill. The watch existed in his mind before he shaped it in metal. And when the first watch was completed it testified *of itself*, to every observer, of the designing mind and the cunning hand which had produced it. And this because, as Hume himself says, "Throw several pieces of steel together without shape or form; they will never arrange themselves so as to complete a watch." This is not an inference from the study of such a casual heap of steel, but is an immediate and irresistible cognition of the human mind. One does not need to trace the loose bits of steel from their entrance at one end of the factory to their emergence as a completed watch at the other, in order to be satisfied that, at some point of their course, a designing hand has adjusted them to each other. The perceived adjustment

produces this conviction instantaneously; and no amount of experience could render the conviction more certain. The conviction that a particular combination of means for an end is the product of a designing cause, is not at all dependent upon the "experience" of such cause in *like* cases.

Neither does the conviction that adaptation proceeds from design rest upon "experience" in *any* case whatever. That the adaptation of means to an end proceeds from an intelligent and purposing foresight of that end is an intuitive conviction of the human mind. To be convinced of this causal connection the mind requires neither argument nor observation; it could accept no other explanation of the existence of the event. The mind assumes this causal relation of intelligence to adaptation, in those very observations of nature or discoveries of inventive skill which Mr. Hume would include in the term "experience."

As the print of a human foot upon the sand gave to Robinson Crusoe the immediate conviction that there was another man upon what he had supposed to be his uninhabited island; as the impressions of feet, talons, fins, vertebræ, embedded in rock, certify the geologist of extinct races; so does the least token of adaptation at once articulate itself with the conception of design.

In the gravel-beds of the Somme were picked up at first a few flint stones, bearing rude marks of having been shaped for use. No human remains were associated with them. The beds in which they lay were hitherto supposed to antedate the appearance of man; yet these shapen flints produced in every observer the instantaneous conviction that man was there at the period of this formation. When once the eye had satisfied itself that these forms were not the result of natural attrition, were not worn but shaped,—that this flint, however rudely shaped, was *intended* for a knife or a hatchet, this block for a hammer, this pointed stone for a spear,—the mind at once pronounced it the work of man. The adaptation points to design, and the design points to a grade of human intelligence. It does not matter that we cannot divine the specific use of this or that implement; if the object itself shows that it was shaped for *some* use, if it is not merely a stone but an implement, there springs up at sight of it the necessary conviction that this was the work of a designing cause. Hence Hume's appeal to "experience" is fallacious in the general as well as in the particular.

Equally fallacious is Hume's objection to the analogy from the products of human design to the works of a higher intelligence. The scale of the works, the vastness of the

intelligence requisite to have conceived, and of the power to have executed them, have no place in the conviction of design. This arises from the single fact of *adaptation*, whether seen in the wheels of a watch or of a locomotive, in the point of a pin or the lever of a steam-engine, in the antennæ of an ant or the proboscis of an elephant. Could Lord Rosse's telescope itself be projected by a series of lenses to the farthest star within its field, this immensity of adaptation would no more exhaust the principle than does the actual size of the telescope as compared with the eye of a beetle. Size, number, magnitude have no relation to the notion of adaptation, which in and of itself produces the conviction of design.

Moreover, the human mind is the only possible unit by which we may compute the operations of "the universal mind." If we drop the argument from design, and fall back upon ontology, still the finite mind which we know in consciousness is the only agent by which, through analogy, contrast, or negation, we can attain to a conception of the Infinite.

The very observations which Hume would classify under "experience" must be made and recorded by this selfsame mind; and no man has a higher confidence in the scope and the trustworthiness of its powers than the philosopher who attempts to account for the existence of Nature without either a cause or an end. But as our conception of causality and of personality, derived from consciousness, is capable of being projected from ourselves into the infinite or "universal" mind,—just as we can project a mathematical line or circle into infinite space,—so adaptation seen in Nature reflects our conception of design up to the highest heaven and back to the farthest eternity.

The mathematician does not pretend to comprehend the infinities or the infinitesimals which he nevertheless conceives of as quantities in his calculations. It would require his lifetime to count up the billions which he handles so freely on a sheet of paper. The mind which can conceive of infinite number and of universal space without comprehending either, can also derive from itself the conception of a "universal mind." To do complete justice to Hume, I will now sum up his argument and my reply. In his essay on "Providence and a Future State," Hume says:—

"Man is a being whom we know by experience, whose motives and designs we are acquainted with, and whose projects and inclinations have a certain connection and coherence, according to the laws which Nature has established for the government of such a creature. When, therefore, we find that any work has proceeded from the skill and

industry of man, as we are otherwise acquainted with the nature of the animal, we can draw a hundred inferences concerning what may be expected from him; and these inferences will all be founded in experience and observation." Hence he concludes, we cannot "from the course of Nature infer a particular intelligent cause, which first bestowed and still preserves order in the universe,"* inasmuch as we have had no experience of such a cause in Nature, upon which to ground this inference.

At least three oversights or misconceptions are apparent in this statement.

(1.) Mr. Hume overlooks the fact that each man is conscious of a designing faculty within himself, and does not need to be certified of the adaptation of means to ends through the observation of this faculty in other men. There was a time when a first man invented the first machine, or adapted something to his own ends; and surely he had no experience of design in other men to create faith in himself as a designer. He put forth a conscious power; his experience of what he could accomplish confirmed his conception of design, but did not create it. So it is with us all. When we see adaptation to an end, we say at once, Here was an intelligent cause, and this not because we have observed that other men have produced designs, but knowing ourselves as intelligent designing causes, we of course refer adaptation to intelligence.

(2.) This points us to Hume's second oversight; he fails to perceive that the single thing to which adaptation refers us is *intelligence*. It is not man in general as a being or an animal, but the *intelligent spirit* in man that is immediately and indissolubly connected with the notion of adaptation. Man does many things that are purely animal; he eats, walks, sleeps, like other animals, by an instinct or a law of his nature, and we never think of ascribing such acts to an intelligence superior to physical laws and functions. But the adaptation of means to ends we refer directly to such intelligence; and it is this thing of intelligence that differentiates such effects from purely physical sequences by the nature of their causes. Crunched bones on a desert island might suggest beasts of prey, but a *cairn* suggests man. An approach to such adaptation on the part of the beaver, the bee, the dog, the ant, disposes us to clothe such animals with the attribute of reason. And on the same principle,—that it is intelligence and not man we think of directly we perceive adaptation,—do we refer such adaptation in Nature to an intelligence higher than Nature

* "Prov. and Fut. State," vol. iv. p. 168.

and higher than man. It is Intelligence that we associate with adaptation, and we are not limited to intelligence as manifested by man as an animal of skill and industry. In point of fact the great advances of physical science in recent times have been due more to the imaginative and inventive faculty prompting investigation, than to inference from experience. Science itself looks forward, not backward. Its spirit is inquisitive, and its discoveries spring from the desire to know not only *what* is, but *why* it is,—to reach at once the first elements of things and their final cause.

And (3.) Hume has overlooked the fact that when once this idea of the connection between adaptation and intelligence has entered the mind, from whatever source, it does not require to be renewed, but remains always as an intuitive perception; no amount of experiences can strengthen or weaken it, and this for the reason that the conviction of a designing cause does not rest in observations or experiences, greater or less, of man and his contrivances, but lies in the thing of perceived adaptation; it does not require a knowledge of the cause or source of the adaptation. That wherever there is an adaptation of means to an end, there must have been an intelligent cause is an intuition of the mind. This term intuition should not be confounded with the notion of *innate* ideas. An intuition is a self-evident truth; the mind may come to the knowledge of such a truth in various ways, and by many processes; but when once it is perceived, it is seen to be true, as a proposition in and of itself, which no amount of reasoning or of evidence could make clearer or stronger than it is in its own simple statement. For example, the sum of all the parts is together equal to the whole. (A child may learn this, if you please, by trying it; but once gained it is *there*.) Everything that begins to be must have a cause; whatever exists must exist in time and in space. To this class of self-convincing truths belongs this also, that the adaptation of means to an end springs from an intelligent and designing cause. Under these criticisms of common sense and of universal consciousness Hume's elaborate structure falls to the ground.

I am aware that this reasoning involves the interminable controversy between sensation and consciousness as the originator of ideas. But it is clear that external phenomena do not and cannot impart to us the idea of a cause. We cannot see a cause, feel a cause, hear a cause. What we perceive in Nature is never *cause* as a substantial entity, but only the sequence of phenomena. And yet the mind unhesitatingly affirms of every phenomenon which actually comes to pass, that it is not self-originated, but must have had a cause. Whence has the mind this conception of the necessary rela-

tion of an event to a cause? I answer that this is a necessary cognition of the human mind, given in and of the mind itself. The mind knows itself as a cause. It does not matter here whether this knowledge be spontaneous or the result of mental experiences. Of the first origin of cognitions in a child, the first realization of consciousness, we have no possibility of record. But this we know; that there comes to every mind a moment when it awakes to the feeling "I can" and "I will." It knows the Ego in consciousness, and clothes the Ego with volition and with causality. With the blow of a hammer I break a crystal. We say the blow is the cause of the fracture; and this loose use of the term cause is sanctioned by usage. But where and what is the cause? In the hammer? Or in the contact of the hammer with the crystal? Does it reside in the hammer? Or is it developed by the blow? There is no sense nor instrument fine enough to detect it. We see the blow, we see the fracture, but not ten thousand such experiences would enable us to see the cause. The cause, you will say, is the force applied behind the hammer. But that force is not an entity; it is only a quality of the cause, and that cause is the power which is in me put in action by my will. All force is but cause in action. And the sublime doctrine of universal force points of necessity to universal cause, and that cause intelligent. Having its sole idea of cause through the consciousness of itself as a cause, the mind intuitively refers every event to a cause adequate in power and wisdom to the result.

Even upon Hume's own principle, the thing which "experience" has taught us is that the adaptation of means or the collocation of materials *for an end*, must be referred to an intelligent designer purposing that end. And the world has grown so old in the infallibility of this so-called experience, that it accepts the principle as an axiom alike in its application to a watch and to a world. The principle being recovered, we are prepared to apply it more carefully than did Paley to the evidence of Nature to a supreme intelligent Cause.

Teleology is not an invention of Christian theology. In perceiving an end in Nature, and from this assuming a divine Author of Nature, Plato and Aristotle anticipated Paul and Augustine; and we are all familiar with Cicero's reply to the Epicurean notion that the world was formed by a chance concourse of atoms. "He who believes this may as well believe that if a great quantity of the letters of the alphabet, made of gold or any other substance, were thrown upon the ground, they would fall into such order as legibly to form a book, say the *Annals of Ennius*. I doubt whether chance

could make a single line of them. But if a concourse of atoms can make a world, why not a porch, a temple, a house, a city, which are works of less labour and difficulty?"

Many of the witnesses which Paley brought forward to establish the fact of design in Nature have been discredited through the searching cross-examination of modern science; and some have even been so twisted and turned as to lean to the opposite side. But what then? This impeachment of testimony prejudices the jury, but cannot blind an impartial judge to the principles which underlie the case. Much the same has happened in Geology. Many of the facts relied upon by earlier geologists have been modified in their meaning and their relations, or have been quite set aside by the research of later times. Theories have changed with every new master of the science, and the now-accepted theory of Lyell may yet be modified by the results of deep-sea soundings and of explorations in the Sierra Nevada. But no one dreams of doubting that there is in the structure of the earth a foundation for a science of Geology. And so we may trace there a foundation for a science of Teleology, all the more clear because the superficial mechanism of design has been swept away. Indeed, the very terms designer, contriver, smack of the mechanical, the coarse, the vulgar. Professor Tyndall, who certainly has no belief in final cause in the theological sense, is already helping us to finer terms for Teleology itself; and these terms occur in examples best fitted to illustrate the finer meanings and methods of this science. These examples are found in heat and in light.

There is even more of science than of poetry in the saying that coal is "bottled sunlight." For what purpose was coal produced, but that it should serve for fuel; should be made to give back in practical and beneficial uses the heat it had condensed from the sun? And for whose use intended but for man? Nature in her operations has no service for this concentrated extract of ferns and trees. No animal tribes in burrowing or foraging had ever sought out the coal, or applied it to their wants. But when man had need of other fuel than the surface of the earth could furnish him, there lay the beds of coal ready to his hand. Can we resist the conviction that coal was provided in anticipation of the coming of man—stored, so to speak, in the cellar of his future abode? If there were, indeed, such a purpose in the formation of coal, the relation between the purpose and the result is the more impressive because it was so long latent, and required ages for its development. Not fact and form alone, but idea and intent as well, are in process of development. The plan in evolution is also the evolution of a plan. Prof. Tyndall has

given us the very term to characterize this phenomenon. "Wood and coal can burn; whence come their heat, and the work producible by that heat? From the immeasurable reservoir of the sun, Nature has *proposed to herself* the task of storing up the light which streams earthward from the sun, and of casting into a permanent form the most fugitive of all powers. *To this end* she has overspread the earth with organisms which, while living, take in the solar light, and by its consumption generate forces of another kind. These organisms are plants. The vegetable world indeed constitutes the instrument whereby the wave-motion of the sun is changed into the rigid form of chemical tension, and thus prepared for future use. With this *prevision* the existence of the human race itself is inseparably connected." In the terms which I have italicised, Teleology is so etherealized that nothing remains of the grossness of the old conception of the mechanism of the universe. *Prevision* is so much finer than design or contrivance! We no longer require to see either the watch or the world in the process of making; we no longer hear the starting of the machinery; but as in Ezekiel's vision there is a spirit of life within the wheels, and they are borne on mighty wings.

The objection to this illustration, that if coal were intended for the use of man, it should have been evenly distributed over the globe, and upon the surface, seems too frivolous for a philosophical reply. But the reply is given in the whole nature of man, and in the totality of the ends of his existence. Man shall not live by coal alone. The distribution of the earth's products gives rise to that system of industries, to that development of energy, skill, foresight, and invention, and to that brotherhood of humanity which comes of widespread intercourse, which render human existence so much higher than that of brutes.

I am not strenuous, however, for this illustration. I have adopted it because a leading man of science seems driven to teleology to account for the fact of coal. Thus teleology, as in Harvey's discovery of the circulation of the blood, is often the guide of science to higher ends.

My object in this essay is not to prove the doctrine of final causes, but to point out the lines of proof; in the true conception of causality, and in the wise interpretation of those more subtle phases of Nature which science now deals with, and which so transcend the mechanical causes of Paley.

As with heat, so with light. To describe the web of relations subsisting between solar light and the media through which this passes to the human eye, Tyndall has recourse to the same refinement of teleology.

"We have, in the first place, in solar light an agent of

exceeding complexity, composed of innumerable constituents refrangible in different degrees. We find, secondly, the atoms and molecules of bodies gifted with the power of sifting solar light in the most various ways, and producing by this sifting the colours observed in nature and art. To do this they must possess a molecular structure commensurate in complexity with that of light itself. Thirdly, we have the human eye and brain, so organized as to be able to take in and distinguish the multitude of impressions thus generated. The light, therefore, at starting is complex; to sift and select it as they do, natural bodies must be complex; while to take in the impressions thus generated, the human eye and brain, however we may simplify our conceptions of their action, must be highly complex. Whence this triple complexity? If what are called material purposes were the only end to be served, a much simpler mechanism would be sufficient. But, instead of simplicity, we have prodigality of relation and *adaptation*,—and this apparently for the sole purpose of enabling us to see things robed in the splendour of colour. Would it not seem that Nature *harboured the intention* of educating us for other enjoyments than those derivable from meat and drink? At all events, whatever Nature meant,—and it would be mere presumption to dogmatize as to what she meant,—we find ourselves here as the upshot of her operations, endowed with capacities to enjoy not only the materially useful, but endowed with others of indefinite scope and application, which deal alone with the beautiful and the true.*

In how many distinct forms and phrases in the two passages cited, does Mr. Tyndall pay homage to the intuitive conviction of purpose, intention, design as seen in the adaptations of Nature: “Nature has proposed to herself”; “to this end”; “with this prevision”; “atoms gifted with the power”; “prodigality of relation and adaptation”; “for the sole purpose”; “Nature harboured the intention”; “whatever Nature meant.” Tyndall is a master of language, whether as the poet picturing the Alps, or as the philosopher analyzing and defining Nature. In these passages he is the man of science upon his own ground, reporting his observations and experiments. And he tells us that in two of the most delicate, subtle, yet all-pervasive forces of Nature,—heat and light,—he finds everywhere traces of intelligence. Since only intelligence can harbour an intention, can have a meaning or purpose, or act with prevision for an end.

Two parallel incidents in geology will show that the scientific mind intuitively discriminates between Nature and Intelligence.

* Tyndall on Light, Lec. 1.

(1) In digging a well in Illinois, the workmen at a depth of several feet struck upon the trunk of a tree, and under this upon a bit of copper ore identical with that of Lake Superior. The inference was that ages ago the copper had been washed from its native bed, and lodged in the alluvium of the Mississippi valley,—perhaps that the great lakes then had an outlet through the Mississippi,—and over this deposit a forest had grown, which in time was buried beneath the ever-accumulating surface. The whole process was ascribed to natural causes,—the interest concentrating in the question of time. (2) In working the copper-mines of Lake Superior, the miner came upon traces of excavation, of smelting, of rude implements of labour; and the immediate conviction was, *Man* has been here before us,—probably that unknown race who built the mounds in the Mississippi valley had discovered and worked these mines. How shall we account for the difference in these judgments,—the one pointing to Nature, the other to Man? The judgment in each case was spontaneous, and each judgment is accepted by science as correct. The dividing line between them is, that perceived adaptation to an end betokens an intelligent purpose directed to that end. A corresponding instance is familiar to English geologists.

At a considerable depth in the delta of the Nile were found remains of pottery. The immediate conviction was that man was on the soil at the period of this formation. Beyond question the pottery was the work of man; and the geological age of the deposit would determine how far back man existed on the borders of the Nile. When it was suggested that the pottery bore marks of Greek workmanship, the inference was that either by accident it had worked its way so deep, or the Nile deposit had been more rapid than is commonly supposed. The question recurs, how do we make this distinction between Man and Nature? and the answer lies in the one fact of adaptation to an end.

Now, Professor Tyndall assures us that in the single fact of light and vision “we have prodigality of relation and adaptation.” From the point of view of physical science he cannot look beyond the bounds of Nature, and hence he provides the intelligence which adaptation demands by *personifying* Nature. I accept implicitly Tyndall’s testimony to the wondrous fact; and not being under the restriction which the pure scientist must observe, I accept the conviction of my own intelligence that *such* intelligence is above Nature. The principle of Teleology is thus attested by science itself in its most subtle and intricate investigations. Indeed, that principle becomes more patent the farther it is removed from the sensuous into

the *sub-sensible* world. There we touch upon causes, first, mediate, and final. It does not matter that the relation of cause and effect is often obscure. Could we have looked upon our planet in the Carboniferous era, who could have seen reflected in that murky atmosphere the coal-grate glowing in our dwellings, the furnace in our factories? We are living in an unfinished system, an era of the evolution of phenomena, and, as I have said, the development of the ideas that lie at the back of phenomena.

Neither does it disparage Teleology to point to the evil that is in the world. Moral evil is the product of man's free agency. But free will is the highest endowment of a rational creature. The power of moral choice makes man akin to the Infinite and the Absolute; and moral evil is a perversion of this most illustrious attribute of being, and the possibility of perversion lies in the nature of free will, and gives to virtue its worth and its glory. Hence it may be that moral evil is incidental, in respect of divine prevention, to the best possible system.

As to physical evil, this is but partial and relative. Our own experience testifies that this often serves to discipline the intellect of man, to put fibre into his will, and train him to noble and heroic action in subjugating Nature to the service of the human family. The very doctrine of Natural Selection shows of how much worth to man is the struggle for existence as a moral element in the development of character.

Here, too, comes in the fact that the system is unfinished. Things that seem untoward because unknown may have a brighter end: "from seeming evil still educing good."

Science is teaching this, especially in chemistry, by transforming what once was feared as hurtful and hostile to man into some higher ministry of the Beautiful and the Useful, ordered by wisdom and beneficence. What serviceable dyes, what exquisite tints, are evolved from the noisome refuse of coal-tar!

And just this service should science render if Teleology is true. For if there be a Creator, He must be spirit, and apprehensible only by spirit. Hence, the more we are developed in mind by science, and the more we penetrate through science to the silent, impalpable forces of Nature, the nearer shall we come to Him who is invisible; till, with Dante, emerging into the light Eterne, we can say:—

"And now was turning my desire and will,
Even as a wheel that equally is moved,
The Love which moves the sun and the other stars."

The CHAIRMAN said : I think I may, in thanking Dr. Thompson for his temperate, able, and lucid paper, take the liberty of tendering to him our hearty welcome, and say how much pleasure we have in seeing in this room a friend from the other side of the Atlantic.

Right Rev. Bishop PERRY, D.D.—I very heartily respond, sir, to what you have said in commendation of the paper. I am sure it must have inspired all who have listened to it with admiration for the reasoning powers and eloquence of the author. His metaphysical talent is evident throughout the whole. But my wish is to say something on behalf of my old friend Paley (hear, hear), and also to make some remarks on one who, although a very able, is yet a very fallacious reasoner—Hume. With reference to Paley ; our lecturer has referred to the basis of his argument, that “There cannot be a design without a designer,” and has stated that there he has assumed what he should have proved. I think that he rightly assumed it. Paley did not write for materialists ; he did not enter into the argument as to how we get the idea of a designer—he assumed that we had it. The lecturer has spoken very ably of the intuitive conviction that we have of an intelligent and designing cause, and it was on this conviction that Paley proceeded. If I may venture to say so, the statement of the lecturer himself is of the same character. He does not really prove more than Paley ; and his statement, although correct, is expressed in such terms as would not convey a very clear idea to ordinary readers. I do not know whether I am right in appealing to this room as to whether they understand the meaning of “A collocation or adjustment of phenomena or forces in nature toward a given result produces in the mind the immediate conviction of an intelligent purpose behind such phenomena and forces.” If Paley had introduced this phraseology into his book, it would have been out of place. I trust Dr. Thompson will kindly bear with me for making these friendly critical remarks. I believe that, when we see a machine, we have an intuitive conviction that it has been made under the working of some intelligent mind ; in other words, that “there cannot be design without a designer.” Do you not all agree with this ? It is not an undue assumption. I have some difficulty in speaking on the present occasion, because it is nearly fifty years since I looked into Paley and Hume, and unfortunately before I left Melbourne I gave them both to the Diocesan Library ; I speak, therefore, only from recollection. But this, I think, is Paley’s argument : If you find a watch, you would infer that there must have been a watch-maker. So there must have been a maker of the eye ; and as some man must be the maker of the watch, so the Great Creator of the universe must have been the maker of the eye. That is Paley’s argument ; and although, from the want of accurate scientific knowledge, there may be some errors in his book, the argument is, I think, as the lecturer has himself remarked,

thoroughly sound, and is put in an exceedingly clear and forcible manner. Now we come to Hume. His argument is: "That the notion of cause and of design is derived from our observation and experience of nature, and cannot be generalized beyond the sphere of human action and experience." The lecturer says that this is a fallacy, because "in nature we never see a cause, but only sequences. The notion of cause proceeds from ourselves as intelligent and willing actors and powers." "From this," he adds, "we intuitively and necessarily refer the adaptation of sequences to an intelligent and designing cause." And he goes on: "Experience more or less has no concern with this positive condition of the mind from its knowledge of itself." All this is true; but I do not think that the force of the argument will be generally perceived, or that it is necessary for the refutation of Hume's fallacy. My answer to him would be simply this:—that, when we have acquired "the notion of cause and design," howsoever it may have been derived, we intuitively and necessarily extend it to everything that comes under our observation. In the language of Paley, we believe that "there cannot be a design without a designer." Hence as, when we observe a work of art beyond the power of an irrational animal, we infer that man has been at work; so in like manner, when we observe in nature—using the word in its widest sense—works of art beyond the power of man, we infer the exercise of superhuman power and ability. That is my answer to Hume. Without disputing about his premises, I deny his conclusion. With reference to teleology, it appears to me quite clear that, putting aside all metaphysical argument, and taking simply the common sense of man—and that is what we have to attend to in the controversy with sceptics; if we look at the material world, the vegetable and animal world, and further the moral world, we cannot but come to the conclusion, unless our mind be perverted in some way or other, that the world has had a Creator, and that that Creator possesses a wisdom and power far beyond all human conception. The unity in the world—in the whole universe—shows, as the lecturer has pointed out, an adaptation of means to an end. The wonderful combinations we see necessarily lead us up to an infinitely wise and powerful Creator. I am not so sure that we could say a perfectly benevolent Creator. There is much to perplex a thoughtful man in the contemplation of the mixture of evil and good which is in the world. I can conceive of doubt as to the *unlimited* power, or as to the benevolence of the Creator. Here we come to feel our need of revelation. It is only by revelation that we know the character of God, and in some degree understand the doings of God towards us. Even with the Bible in their hands men are subjected very often to extremely great trials from comparing what they see in the world around them with what it tells us of the Creator; and the paper, which has just been read to us, is very valuable in pointing out that the present is an unfinished state; that there is a plan of development, and that we are to look forward beyond the present world. Just one sentence more. With regard to natural religion, its lessons are most plainly taught us by God Himself in the *Book of Job*.

Dr. IRONS.—I came here thinking that I was going to hear something very different from what I have listened to this evening. I must say I have been agreeably surprised, and I think we must all have been pleased with the paper. I myself am grateful for the very complete view of the subject that has been furnished. But yet the essayist is a little unfair to Paley in putting him in the position apparently adopted. (Hear, hear.) Paley was a great man, his work a great work. As an Oxford man, I did not make so good an acquaintance with him formerly as I have since had. We surely all consider him as something more than Dr. Thompson at first represents him to be. He was much more than a mere stater of the position that “where there is design there must be a designer.” When Paley afterwards comes to deal with the truth that the personal God is the Designer, he does not quite satisfy me metaphysically. I do say, however, he affirmed the same truth in his proposition as Dr. Thompson has defended to-night. For I cannot see the least difference between “the adjustment of phenomena for an intelligent purpose” (as in the paper) and “design with a designer behind it.” It seems to me that Dr. Thompson’s words are to the same effect as Paley’s. Paley could not have meant anything else than Dr. Thompson. He was no crude, careless writer, who took up a proposition in order merely to prove it by some simple rule of Whatelyan logic. He was a careful dealer with facts. A Tyndall could not be more careful. He laid the foundation of his argument as any Huxley or Tyndall might have done. And there is something touching in the story of Archdeacon Paley, when his health was enfeebled and he could do but little actively for the Church, setting himself to study the facts of human anatomy and science, in order that he might use this knowledge to illustrate the truth and wisdom of God whom he loved and served. There was something touching, I say, in the way he devoted himself to the late acquisition of the knowledge which he intended so to use. But who can read his book through, without feeling that it is true, painstaking, careful? And to this day it is read with great profit by the young men of the Universities, and, I would add, by old men too, like ourselves,—though it may be some forty years since I read very much of it. Paley has been used on this occasion, however, so as to point the excellent argument of Dr. Thompson, while Hume has happily been brought forward to receive a crushing rejoinder. We are grateful then to Dr. Thompson for having given us a noble paper. But while saying this, it would seem ungrateful if we were to pass over entirely all the special features of the paper. I will turn aside then for a moment just to take notice of one point which seems to require a little clearing up. The professor said that “forces in nature were qualities of the things themselves.”

Dr. THOMPSON.—What I said was that force was a property of cause, not of things themselves.

Dr. IRONS.—Yes, but I thought you said that though the facts led us at last to argue a cause; the phenomenon induced us to suppose force latent in the thing, and that after this we argued a cause beyond.

Dr. THOMPSON.—No, I did not say a force latent in itself.

Dr. IRONS.—But I have something to ask, even as you now put the matter.

Do you say the force is the cause? or, is it some property *in* the cause? Either is very difficult to understand. Science, I see, takes us up to the last edge of the dead phenomenal. What is it that then sets the phenomenon in motion? That is the question. It must either be something identified with the phenomenon—(which would make the “First Cause” part of the universe)—or it must be a *kinesis* linked to the phenomenon; or, thirdly, it must be something distinct from the phenomenon. I can conceive of no other than these three statements of what that must be which gives motion to phenomena. I apprehend that every Christian would say the last, viz. that the cause is essentially distinct from the phenomenon; or else we should deny the whole idea of Creation. We put it as the Christian position that God created all things out of nothing; in other words, He projected apart from Himself all things that now exist out of Himself—(for God Himself changes not). It follows that they are not God nor linked to Him. If we accept this conclusion, I think we should be in difficulty if we also adopted Dr. Thompson’s; for his would place God as immediately touching the several phenomena of the universe as the force, without any intermediate created force. I cannot believe that God moulds the leg of that table or each hair of my head, in such a sense as that each is done by the *immediate* touch of God. I rather believe Moses, when he said that a created life was given to the creature. In these instances—the “table,” and the “hair”—the force is *mechanical* immediately (and man beyond), in the first, and *vital* in the second. I believe that God projects, that is, puts various kinds of life apart from Himself, and that life is force,—a distinct creation (Gen. i. 12). It seems to me there would be something almost atheistical in the thought of putting God locally, in relation with each phenomenon as the immediate cause; because also it would make God capable of being extended. It would conceive of His Divine omnipresence as a local ubiquity. I protest then against any notion of placing God as force before every detail of phenomena, since it cannot be thought out, without materializing God. I must now leave this to Dr. Thompson. I really want instruction on the point.*

Mr. BUNTING.—I should like to hear what the author of the paper says to a very common modern objection to Paley’s argument—that you may carry it a step backwards: If the design imply the designer, what does the designer imply? Why cannot you carry back the argument one step further? Must not the designer itself be a kind of instrument implying some prior construction which implied a further design? I think that Dr. Thompson’s criticism of Paley’s statement is clear and just. His one phrase puts the axiom pithily without tautology.

Sir T. LUSHINGTON.—It appears to me that you will be only going back to a final designer.

* Modern Pantheism aims to make God a part of the universe,—under the plausible name of Force; the truth is, that force is a *creature* of God, though itself unperceived except in its results.—W. J. I.

Dr. IRONS.—Does this not point to the great need of an ontology—a great need of our knowing what we mean when we believe in God?

Rev. Professor Mc ALL.—Being engaged in the education of young men for the ministry, I can scarcely conceive of any composition more valuable than the lecture to which we have just listened, and should it form part of the *Transactions* of the Institute, I should think it would have merit enough to keep the volume afloat and hand it down to a late day. Perhaps it would be better, if there be any one present who is not convinced by the arguments advanced, any one who has any objection to state, that I should give place, for I am most anxious to hear if anything can be said against this lecture. I feel, for one, deeply obliged to the lecturer, and if, in a few minutes, when he may reply, he will meet the objection just raised, that the designer seems to require a designer, then his work will be final and complete, and nothing can be added to the obligation under which he has laid us. (Cheers.)

Sir W. R. LUSHINGTON TILSON, Bart.—I would desire simply to say one word and add my tribute of thanks to the lecturer for his able paper. I entirely went with him in his criticism on Hume's argument, which I think was powerful. With regard to the observations he made when speaking of the "unfinished" condition of things, I think he went to the point, in reference to those difficulties often arising in scientific minds, in saying that without revelation many things in nature and Providence cannot be explained. The existence of evil in our world would lead one away from the idea of a perfectly benevolent Being as having created it, although we see marks of wisdom distinct. But the existence of physical evil must be traced to the existence of moral evil, and then you will see the importance of that word "unfinished." There is a time to come when the whole work will be complete; there is a time to come when moral evil itself will be removed, when, therefore, the benevolence of the Supreme Being will be vindicated; and then, and not till then, can we adequately understand the whole design of the universe. Unless you look forward to that period you will find great difficulties in looking at creation as it is, and will not be able to assert the benevolence of the Creator, although there is clear proof of His intelligence and power.

Rev. Professor LIAS.—I had not intended to intrude myself on the meeting to-night, but I rise at the honorary Secretary's request, just to add one or two observations. I have not had access to either Paley or Hume since I knew I was to be present to-night, but I conceive that the real reason why Paley's popularity seems to be on the wane, is that he happened to be too clear in his language. We all know what it is to be rated for good advice. When one cannot contradict it, the only thing is to abuse the person who gave it. (Laughter.) Now it strikes me that a great deal of the unpopularity of Paley is due to the fact that he states his case too well and forces his arguments too far home.* You will find in the *Natural Theology* of

* Professor Lias wishes to add that in these remarks he was referring to Paley's *Natural Theology* only.

Paley an enormous mass of illustrations, all bearing on the one point of design, and I think the lecturer was a little severe upon Paley's expression, "You cannot have design without a designer." It seems no very great assumption to say that where you see the evidences of a master mind at work, you are entitled to infer the existence of that master mind. And the *Natural Theology* is simply an elaborate mass of such evidence. I may be allowed to add a word on another point. A great deal has been said about the processes of Nature. Now in these we never see the cause, but the effect; and I contend we are entitled to reason from effect to cause, or, in other words, from phenomena to the force which produces them. I have used the word *force*, and it has been frequently used to-night. But it strikes me that we might often avoid much discussion by a clearer definition of the terms we use. What, for instance, do we mean by force? Newton uses it in the sense of the power which constrains a body to move in a certain orbit. And force is surely correctly defined as the unseem power which produces certain visible results. This is just where Hume's argument is false. He assumes that we are unable to reason beyond the limits of our own experience. But all the great discoveries which have been made in the sciences have been brought about by generalizing on the effect of hidden causes and thus bringing about results unknown before. Science may, therefore, be said to be one vast procession beyond the limits of our own experience. (Hear, hear.) And therefore I ask on what ground can Hume or anybody else say that we cannot climb one step further, and from the force step one degree beyond to the Will that set that force in motion? Force is simply the expression of the Eternal Mind and Will. I have only one other remark to make. The ground of Hume's popularity is, that he has translated into beautiful language those lurking doubts which are known to the best of us. There are times when we do doubt, when we ask ourselves, "Can this all be true? Is there a future above—a heaven or a hell? Is there such a thing as redemption or salvation?" And in these moments of darkness and despair some seem inclined to welcome a doubt, and then we turn aside from faith. But in the experience of life we come to cast aside these doubts. We see that there is something deeper than nature, a great cause of force, and rest at last in the conviction that that cause "is our God, for ever and ever, and shall be our guide unto death."

The CHAIRMAN.—As no one seems to be inclined to make any further remarks, I think it would be very bad taste in me to intrude upon the meeting. It is sometimes desirable that the chairman should, as it were, gather up the threads of the various subjects which have been touched upon. I shall leave this in the hands of the lecturer, and I will ask him to charm us by the replies to the various questions which have been asked him, as he did by his paper.

Dr. THOMPSON.—I thank you for the courtesy so repeatedly expressed; but I feel it would be an imposition on the patience of my audience to reply in detail to the various criticisms and suggestions which have been made upon the argument of my paper. If Paley wrote for the common

mind, I have written rather for the scientific, questioning, controversial mind, not expecting to encounter that here, but thinking that, through the publicity that will be given to my paper, some good might be accomplished outside the circle of belief. Let me here say that I doubt very much the expediency of neglecting scientific precision, for a phraseology suited to the common people. In the end you work mischief in the common mind. When, later on, it encounters scepticism, the mind is thrown into doubt and confusion, for lack of a more careful and critical training in its first notions of science and faith. A popular style should be simple and clear, but by all means precise. My sole object in the criticism on Paley was to call attention to the rule, that in making definitions we should exclude from the definition the name of the thing defined; and my friend Mr. Bunting has explained the phrase I have substituted in the place of Paley's axiom. Combination, adjustment, compel the conviction of intelligent purpose. (Hear, hear.) I should disclaim most sincerely the compliments which have been heaped upon me by the speakers this evening, if it were not that this would disparage your courtesy. As I sat here I have wondered why in the world I ever brought my poor coals to this great Newcastle; and then it dawned upon me that the glimmering of my coal-gas had given occasion for the exhibition of the dazzling electric lights which have flashed upon us, and that therefore I have been the unconscious author of great benefit to the Institute. As to the question of "force," I am sure I never entertained but have always combated the notion of God's direct and immediate agency in every phenomenon of nature. My thought was simply that the thing which is called "force" by scientists, is not a thing they can put their finger on; it is a mere name, used as a substitute for ignorance; that it is only a quality of the "something." I do not say it is always a mark of the same intelligence, but of *an* intelligence, and therefore, am not led into what is a very different and absurd conclusion;—I mean the one which Dr. Irons combated. This brings me to what Mr. Bunting said: we must here bring in the principles of ontology, and also the principles of logic; that when you have found a sufficient cause for a thing, there you can stop. I beg to remind you of what I said in my paper, that it was not my purpose to make out proof of a God from the evidence of a final cause in nature, but, putting aside difficulties which had arisen in the past, to indicate the line of direction which our thoughts must take if we are to retain this argument at all. I am very firm in the conviction that we must recover from the purely physical assumption of scientists—men for whom I have profound respect—we must recover for metaphysics certain terms which they claim as exclusively their own. They are not the only men who *know*. (Hear, hear.) I know, and one thing I know is that *I am*. And this is not a matter of external observation. My eyes have been deceived very much oftener than my conceptions have been mistaken. I maintain that it is a fact that I exist; as positive a fact as that the earth existed before me. There is a proper *science* of mind;—a science of facts and of laws. In this sphere we are to seek for Cause, behind all observable

causes, whether "mechanical," "material," "efficient," or however defined within the sphere of physics. And what we call probable reasoning is not at all inferior either to mathematical or to scientific or inductive reasoning, in force of conviction. In the practical affairs of life, in seven cases out of ten, we act upon moral conviction, and not upon knowledge which comes through the senses. We must maintain that there is no contradiction between these two lines or courses of evidence. If it be not immodest, I will say that, having given some thought to this matter, I have brought out in the January number of the *British Quarterly Review*, an essay on this whole question as to what is knowledge and science, and what is the true method of harmonizing religion with science, and to avoid trespassing upon your time, I beg leave to refer you to that for an answer to other questions proposed to me this evening. With all my heart I thank you both for the attention and courtesy with which you have listened to me, and for the kindly reception with which you have honoured me, and will only add how much I am honoured in finding myself a member of a body devoted to such noble aims. (Cheers.)

The meeting was then adjourned.

REMARKS UPON PROFESSOR HUXLEY'S "HUME"; BY
DR. THOMPSON.

SINCE the foregoing Paper was read, Professor Huxley has published a Life of Hume, with an analysis of his works, which in its cheap and attractive form may give a fresh impulse to the popularity of the Scotch philosopher. A review of Hume's philosophical system, as a whole, would here be out of place. Supposing Huxley's synopsis of it to be now at hand, I must restrict myself to the points raised in my paper—Cause, Power, Intuition. It is a hopeful sign that such a master in physics as Professor Huxley should invoke such a master in metaphysics as Hume (just as Prof. Tyndall invokes Lucretius) in support of his own teachings; that Science, which we have been told was the only knowledge—the knowledge of *things* by observation of the senses—should have recourse to Philosophy to sift and classify phenomena under *ideas*, in order that they may have a place in the category of knowledge. The necessity for this I have endeavoured to show in the article, "What is Science?" in the "British Quarterly Review" for January, 1879; and the recognition of this dependence of science upon philosophy for its own expression would put an end to much of the controversy over physics and metaphysics. As to ideal speculation, Professor Huxley goes quite far enough. On page 55 he says, "All science starts with hypotheses—in other words, with assumptions that are unproved, while they may be, and often are, erroneous; but which are better than nothing to the seeker after order in the maze of phenomena. And the historical progress of every science depends on the criticism of hypotheses, on the gradual stripping off, that is, of their untrue or superfluous parts, until there remains only that exact verbal expression of as much as we know of the fact, and no more, which constitutes a perfect scientific theory."

This statement of the way of attaining a scientific knowledge of external phenomena raises two questions, which must be answered before we can have any confidence in such knowledge. Who or what is it which makes that "criticism of hypotheses" upon which "the progress of every science depends"? And how do we "know a fact," or who are the WE who know a fact, so as to reduce it to its "exact verbal expression"?

Professor Huxley is not quite satisfied with Hume's negation of mind; that "what we call a mind is nothing but a heap or collection of different perceptions, united together by certain relations, and supposed, though falsely, to be endowed with a perfect simplicity and identity." Of this view, Huxley says, "He [Hume] may be right or wrong; but the most he, or anybody else, can prove in favour of his conclusion is, that we know nothing more of the mind than that it is a series of perceptions." Here, again, I ask, Who or what are the *We*, who know this, or anything else?

Does a mere "series of perceptions," each of which gives place in turn to its successor, know itself as a series, and that this series is all that can be known of mind? Has a series of ever-changing, ever-vanishing impressions a continuity of consciousness, a power of retention as memory, and of discrimination as judgment? There can be no criticism without comparison, without remembrance, without selection, without discriminating judgment; and the question forces itself home to the school of Hume, If the mind "is nothing but a heap or collection of different perceptions," where or what is that faculty which examines and compares these impressions, and which reduces them to an "exact verbal expression" as fact or knowledge? The truth is that Mr. Hume and Professor Huxley necessarily assume a *something* within man which, though it cannot be known "by direct observation," yet knows itself, and knows other things. The existence of this something, which we call mind, is asserted by the consciousness of all mankind and in the language of every people. It is proved by the consciousness which every man has of personal identity and of individuality; by his exercise of memory and of will; and above all by his sense of right and wrong, and his spontaneous emotions in view of good or of evil. This something knows itself as a Cause, as a Power, and as possessing free will; that is, in all actions having a moral quality it has power to choose a course of action and also power to choose the contrary. Whatever the motive which finally determines its choice—say, if you please, the greatest *apparent* good—there is always the power of contrary choice. Every man knows these things to be true of himself. But it is absolutely impossible to predicate any of these things of a mere "series of perceptions." Though the existence and the properties of mind may "lie beyond the reach of observation,"—as the term observation is applied to the study of nature,—yet the existence of mind is known in consciousness with a certainty as absolute as that which pertains to the phenomena of nature observed and reported through the senses. In either case the conviction of certainty is given in the mind, or it could not exist at all. How can I know anything if I do not first know the I who knows, so far as to have full confidence in the observations which *I* make, and in the judgments which *I* form?

Now, there are also truths which the mind knows by intuition, of which it is as certain as of any fact ascertained by observation, and indeed as certain as of its own existence. Such truths do not depend upon experience but are assumed in all experience. They could not be made a whit more clear or certain by reasoning or observation than they are seen to be by direct cognition. Of this class of truths are the axioms of mathematics. Hume admits that there are "necessary truths," but he would not class with these the axiom of causation, "That whatever event has a beginning must have a cause." Professor Huxley is more inclined to class causation with necessary truths, and this upon scientific grounds. Thus, on p. 121, he says, "The scientific investigator who notes a new phenomenon may be utterly ignorant of its cause, but he will, without

hesitation, seek for that cause. If you ask him why he does so, he will probably say that it must have had a cause; and thereby imply that his belief in causation is a necessary belief." What is true of the man of science is equally true of the human mind under all possible conditions. It is an intuitive conviction of a necessary truth, that every event must have a cause. It is absolutely impossible for the mind to conceive the contrary. Let any one conceive of absolute universal Nothingness and he will find it impossible to conceive of anything as beginning to be! Either, then, we must have recourse to the unphilosophical conjecture of an infinite series, or we must believe in an eternal Creator of the universe.

In like manner, that adaptation points to a purposing intelligence is an intuitive cognition of the human mind. This does not arise from experience of adaptive power in other men; and though continually verified by experience, it does not rest in experience for its proof. Here too, as above, it is impossible for the mind to conceive the contrary.

Having already exposed the fallacy of Hume on this point, and having traced the notions of causation and of power to their seat in the mind itself, I trust I have opened anew the way for the evidence of God in Nature, which physics is more and more unveiling, for metaphysics to take note of and classify.

The reader who is interested in the preceding points of metaphysical inquiry, but who lacks facilities for studying German philosophy in the original, can put himself in communication with two of the greatest thinkers of Germany, by reading *A Critical Account of the Philosophy of Kant*, by Professor Edward Caird, of the University of Glasgow; and *The Logic of Hegel*, by William Wallace, M.A., Fellow of Merton College, Oxford. Kant was not satisfied with the argument from design, or as it is better called, the physico-theological argument for the being of God; and while controverting Hume on some points, he agreed with him that the existence of order in the universe could at most establish a *finite* cause. This point I have considered on page 142. But another form of reply presented by Professor Caird is so thoughtful and suggestive that I give the gist of it here, referring the reader to the full argument in his eighteenth chapter.

"Why do we seek in things, in the world, and in ourselves, a truth, a reality, which we do not find in their immediate aspect as phenomena of the sensible world? It is because the sensible world as such is inconsistent with itself, and thus points to a higher reality. We believe in the infinite, not because of what the finite is, but quite as much because of what the finite *is not*; and our first idea of the former is, therefore, simply that it is the negation of the latter. All religion springs out of the sense of the nothingness, unreality, transitoriness—in other words, of the essentially negative character of the finite world. Yet this negative relation of the

mind to the finite is at the same time its first positive relation to the infinite. 'We are near waking when we dream that we dream,' and the consciousness of a limit is already at least the germinal consciousness of that which is beyond it. The extreme of despair and doubt can only exist as the obverse of the highest certitude, and is in fact necessary to it."

Hegel, who was fond of reducing every conception to the last possible analysis, says, "We must decidedly reject the *mechanical* mode of inquiry when it comes forward and arrogates to itself the place of rational cognition in general, and when it seeks to get mechanism accepted as an absolute category." He then shows how even the argument from design has been vitiated by a mechanical tone.*

"Generally speaking, the final cause is taken to mean nothing more than external design. In accordance with this view of it, things are supposed not to carry their vocation in themselves, but merely to be means employed and spent in realizing a purpose which lies outside of them. That may be said to be the point of view taken by Utility, which once played a great part even in the sciences. Of late, however, utility has fallen into disrepute, now that people have begun to see that it failed to give a genuine insight into the nature of things. It is true that finite things as finite ought in justice to be viewed as non-ultimate, and as pointing beyond themselves. This negativity of finite things, however, is their own dialectic, and in order to ascertain it we must pay attention to their positive content.

"Teleological modes of investigation often proceed from a well-meant desire of displaying the wisdom of God, especially as it is revealed in Nature. Now in thus trying to discover final causes, for which the things serve as means, we must remember that we are stopping short at the finite, and are liable to fall into trifling reflections. An instance of such triviality is seen, when we first of all treat of the vine solely in reference to the well-known uses which it confers upon man, and then proceed to view the cork-tree in connection with the corks which are cut from its bark to put into the wine-bottles. Whole books used to be written in this spirit. It is easy to see that they promoted the genuine interest neither of religion nor of science. External design stands immediately in front of the idea: but what thus stands on the threshold often for that reason gives the least satisfaction."

The burden of my paper is to lead up through this external design to the idea that lies behind it. And here Hegel has given food for thought in his profound saying that "Objectivity contains the three forms of Mechanism, Chemism, and the *nexus* of Design." This *nexus* holds the world and the universe together in our intuitive conception.

* Pages 291 and 299.

ORDINARY MEETING, FEBRUARY 3, 1879.

ADMIRAL E. G. FISHBOURNE, C.B., R.N., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

ASSOCIATES :—Rev. J. Cohen, M.A., Heston ; Rev. H. W. Webb Peplow, B.A., London.

Also the presentation of the following Publications for the Library :—

“ Proceedings of the Royal Society.”		<i>From the same.</i>
“ Proceedings of the Royal United Service Institution.”		<i>Ditto.</i>
“ The Defence of Virginia.”	By Professor Daubeny.	<i>Ditto.</i>
“ Life of General (Stonewall) Jackson.”	By the same.	<i>Ditto.</i>
“ Church History.”	<i>Ditto.</i>	<i>Ditto.</i>
“ Theology.”	<i>Ditto.</i>	<i>Ditto.</i>
“ Sensualistic Philosophy of the XIX. Century.”	<i>Ditto.</i>	<i>Ditto.</i>

The following paper was then read by the Author :—

THE CAVES OF SOUTH DEVON AND THEIR TEACHINGS. By JOHN ELIOT HOWARD, F.R.S.

PART I.

THE pleasant shores of South Devon may almost be said to have given rise to a new line of scientific research—that of “the Antiquity of Man,” specially “in the West of England.” As the *Cambrian* and *Silurian* regions furnished our great geologists not only with materials for investigation but with appropriate designations under which to classify the strata of earth’s surface, so the discoveries at Brixham led to the belief “that the advent of Man in Devonshire was not only prior to the extinction of the cave-mammals, but occurred at a time so remote* that the valleys of the district were

* *The Ancient Cave Men of Devonshire*, p. 6.

at least 100 feet less deep than they are at present." These were the results of a systematic and careful examination of a virgin cave by a committee of scientific men, and they gave a stimulus to research which without abatement has lasted to the present time. The subsequent exploration of *Kent's Cavern*, Torquay, has even more imperishably associated the caves of South Devon with the new science.

This science is indeed the growth as of yesterday, though the discoveries on which it rests had been in some measure anticipated.* In 1833, the late Dr. Schmerling, of Liège, published the results of his labours in the numerous caverns in the basin of the Meuse, giving full proof of the co-existence of extinct animals with man.

About the same time † Mr. McENERY, "for many years chaplain at Tor Abbey, had found in a cave one mile east of Torquay, in red loam covered with stalagmite, not only bones of the mammoth, tichorhine rhinoceros, cave-bear, and other mammalia, but several remarkable flint tools, some of which he supposed to be of great antiquity and which are now known to be of a distinctly Palæolithic type, while there were also remains of man in the same cave, of later date."

These views of MacENERY, the result of five years' exploration, were withheld from publication, out of deference to Dr. Buckland, who, in his celebrated work entitled *Reliquiæ Diluvianæ*, published in 1823, declared that none of the human bones or stone implements met with by him in any of the caverns could be considered to be as old as the mammoth and other extinct quadrupeds.

About ten years afterwards Mr. Godwin Austen declared that he had obtained in the above cavern works of man from undisturbed loam or clay under stalagmite, mingled with the remains of extinct animals, and that all these must have been introduced before the stalagmite flooring had been formed.‡

Then followed, in 1858, the exploration of the Brixham Cavern by Dr. Falconer and others, which produced a revolution in public opinion; but Kent's Cave remained undisturbed from 1846 to 1864.

* In 1824 Cuvier exhibited his usual large-minded caution when asked whether human bones had yet been discovered and proved to be coeval with those of extinct mammalia. "*Pas encore*" was his simple reply.—Nott and Gliddon, *Types of Mankind*, p. 341.

† *Antiquity of Man*, Lyell, 4th ed. pp. 99 to 108. Trans. Devon Assoc., vol. iii. p. 321.

‡ *Paleontological Mems.*, vol. ii. p. 591.

After these events came Messrs. Lartet and Christy, whose combined labours seem to have established the fact of the co-existence of man with extinct mammalia.

As it is not my purpose to attempt to controvert unquestionable truth propounded as such (as we shall see by-and-by) some ages before the present era of enlightenment, I admit fully the reality of this spectre, which has scared so many minds from their propriety; but I do not at all admit the awful character and meaning attached to it. I have come sufficiently near to the apparition to discern that the materials of which it is constructed are of very commonplace character, and that the infernal light shining from those hollow sockets is but, after all, the glimmer of a miner's candle.

In plain words, whilst I give all credit to the great diligence exhibited by Mr. Pengelly, as also to his fellow-explorers, in the careful ascertainment of details, I wholly dissent from his deductions, briefly expressed thus in 1874 :—

“It is of no service to attempt a concealment of the fact that the real contention at present is not whether man has occupied *Devonshire* during 70,000 or 700,000 years, or any still greater number, but whether the old belief that he first appeared on *Earth* some 6,000 years ago, is to be retained or abandoned.”*

These words are calculated to rouse our attention; and as we do not know how far old beliefs on other points may be endangered, we shake off something of the languid softness inspired by the delightful air of this English Capua, and address ourselves to a combat which we find ultimately involves the truth itself.

The important question then which opens upon us is the lapse of time, of which we are supposed to possess a chronometer in the rate of deposit of stalagmite in Kent's Cavern. The Brixham Cavern having been pervaded by a rush of water and the stalagmite thus broken up, affords, as is admitted, † “only a complicated solution of the problem.”

To avoid prolixity in the description of Kent's Cavern, I adopt an authentic estimate in 1874.

“Taking the correct data (that of the report of 1869) ‡ we have twelve feet of stalagmite formed, let it be assumed from the dates on its upper surface, at the rate of .05 inch in 250

* *Notes on Recent Notices of the Geology and Paleontology of Devonshire*, Part i. p. 26. By W. Pengelly, F.R.S.

† Boyd Dawkins' *Cave-Hunting*, pp. 324 to 334.

‡ *Notes*, as above, Part i. p. 25.

years, and thereby arrive at the conclusion that the accumulation of the whole required 720,000 years."

This somewhat long date, examined by Mr. Pengelly's own standard, proves not nearly long enough. He has said (p. 24) that 250 years have failed to precipitate an amount of calcareous matter sufficient to obliterate incisions which at first were probably not more than an eighth of an inch in depth.

I have recently seen the cave under the courteous guidance of this gentleman, and was able to observe specially an incision to which he pointed our attention. It might seem to have argued too much intrusive curiosity and too little confidence in our guide for me alone, amongst a large party of ladies and gentlemen, to have attempted too near a view; but my belief is that the inscription is not nearly so deep nor the incrustation so great as above indicated. The example proves too much, and in all probability *there has been no appreciable growth in any of the formations*. In fact, the source of supply has from some cause failed almost entirely.*

All this matter might easily have been illustrated by sinking a shaft downwards through from thirty to fifty feet of earth and rock, so as to ascertain the composition of the superincumbent mass. This would have been a very easy and comparatively inexpensive operation. Why has it not been attempted? If twelve feet in thickness of stalagmite has been wasted by the rain, out of this thirty to fifty feet, it would be interesting to ascertain the state of the remaining limestone.†

The specimen which has been sent to me probably exhibits this, and shows that whilst the hard rock is entirely impervious to water, the clefts and fissures are, on the contrary, permeable, and the means of supplying the material for the stalagmite in the crystallized carbonate of lime visible in the specimen.

* See Appendix A.

† McEnery (p. 75) says, "On a late occasion, the wood which clothed the cliff was partially cleared away; the rock presented bare, bleached, and corroded surfaces. There was no large rent or external chasm observable on its summit. The only visible opening, except the two mouths, is through the cleft, which forms and extends inwardly from the southern mouth."

"The *physical impossibility* that the enormous mass of loam could have entered exclusively through the present mouths inclines us to think those canals open in the *concealed mouths* of the former entrances."—McEnery, p. 113.

"On further examination, I found that the rocky cover of the cavern is perforated with *numerous crevices or windows*, partly choked with mud and brambles, through which, at so many port-holes, the mud in a state of fluidity may have entered into the common reservoir of the interior."—McEnery, p. 281.

As these clefts were washed clean, this supply would naturally fail.*

This limestone is mineralogically identified with the rock at Oreston, which furnished the materials for the Plymouth breakwater.

Mr. Pengelly asserts that he "has always abstained from, and cautioned others against insisting that the thickness of the stalagmite is a perfectly trustworthy chronometer; nevertheless, it seems fair to ask those who deny that it is of any value, to state the basis of their denial."

This challenge I shall accept; but in the mean time must ask the reader to note that Mr. Pengelly passes on immediately to say that "such estimates, if sufficiently multiplied, are of great value."

Now it may be conceded that, under some circumstances, the growth of stalagmite may be shown to be so far continuous as presumably to indicate a certain lapse of time. The observations of Mr. Boyd Dawkins,† on the rate at which stalagmite is being accumulated in the Ingleborough Cave, are admitted to be of this character. "The author states, on what appears to be most satisfactory evidence, that the apex of a boss of stalagmite known as the Jockey's Cap, in that cave, rising from the crystalline pavement to a height of 2·50 feet, was found, by careful measurement, on March 13th, 1873, to be 87 inches from the roof; whilst when measured by James Farrar, on October 30th, 1845, it was 95·25 inches from it; so that the upward growth has been 8·25 inches in 27·37 years; giving an average vertical growth of ·3 inch per year."

"On the strength of this fact," the author remarks that, "all the stalagmites and stalactites in the Ingleborough Cave may not date further back than the time of Edward III., if the 'Jockey's Cap' be taken as a measure of the rate of deposition." "It is evident," he continues, "from this instance of rapid accumulation, that the value of a layer of stalagmite, in fixing the high antiquity of deposit below it, is comparatively little. The layers, for instance, in Kent's Hole, which are generally believed to have demanded a considerable lapse of time, may possibly have been formed at the rate of a *quarter of an inch per annum!*" At this rate "twenty feet of stalagmite might be formed in 1,000 years" (p. 41).

We have in the above carefully-recorded experiment an *approach* to the accuracy of a chronometer in a calculation derived from the increment of real stalagmite; but it will be

* McEnery, p. 259.

† *Cave-Hunting*, W. Boyd Dawkins, F.R.S., pp. 39, 40, and Appendix II.

seen by the specimens which I have had cut and polished (chosen out of a mass of broken-up stalagmite carried by the miners out of Kent's Cavern), that the increase marked by annular rings is by no means uniform. And yet uniformity of action, and the absence of all change in external surroundings, are indispensable to the value of a chronometer. So that we can only say of our estimate of years, *valeat quantum!* Let it pass for what it is worth, and no more!

When circumstances are favourable, as they must have been at some period or periods, in Kent's Cavern, this deposit accumulates with great rapidity; thus M. Reclus, in his work entitled "The Earth,"* relates that in the cave of Melidhoni the skeletons of three hundred Cretans smoked to death by the Turks in 1822, are gradually disappearing under the incrustation of stone, which has enveloped them with its cretaceous layers.

If we could accumulate a sufficient number of such observations, they might, by correcting each other's errors, lead to some useful results. But it is obvious that we have not any hope of thus bridging over the chasm between a reliable calculation of 0.3 inch increment per year, and an utterly unreliable estimate of 0.5 inch in two hundred and fifty years.

I have accepted Mr. Pengelly's challenge to show on what grounds I rest my opinion that his calculations are absolutely unreliable.

In the first place, then, it is to be noted that there is nowhere to be found in all the cavern two layers superimposed, twelve feet in thickness, of *homogeneous and uniform stalagmite*. The chronometer is *absent*.

The first and uppermost stratum met with was a band of black mould, over which no stalagmite had formed, the source of supply having apparently been exhausted.† The clock had stopped for an interval estimated by Mr. Pengelly at 2,000 years. Beneath this we meet with what is called "*the modern stalagmite floor*" of very variable thickness, concerning which I have this much to say, that if we are to judge by what is left, it could not properly be called stalagmite at all. It differs wholly in appearance from the true stalagmite, as I noticed in one place where the latter had formed upon the surface of the

* *Epoch of the Mammoth*, p. 91.

† The cave had served as a place of interment, as evidenced by the remains of a human skeleton, in the ordinary position of burial; also by cinerary urns (see McEnery, *Lit. of Kent's Cavern*, p. 34). This early explorer found human bones entombed in a pit *excavated* in the surface of the stalagmite (p. 145).

former.* It is more properly a *magma* (or tufa, as McEnery calls it) into which a stick may be thrust to a considerable depth; and consists of lime united with carbonic acid, and associated intimately with iron (peroxide) in such sense that it is apparently impossible at the usual atmospheric pressure to re-dissolve the mass in any quantity of water acidulated with carbonic acid; the oxide of iron being, of course, entirely insoluble, as will be seen by the analysis I present.†

How, then, should the immense mass of material forming this floor have been dissolved by rainwater, and infiltrated through the rocky roof of the cavern? ‡ This solvent could not have extracted the iron from the superincumbent earth unless it there exists at a lower state of oxidation, which I do not think probable, and had no means of examining (the hill above the cave is laid out as a garden, beneath which I am told the labourers can be heard at their work). I certainly was led to suspect the existence of a thermal spring, which containing as usual iron in solution at a lower stage of oxidation, as well as lime, might have gained entrance in some way into the cavern. It is not my business to find the explanation, but to insist on this, that a mass of so uncertain origin which (as we may see presently) need not to have been produced as stalagmite at all§ cannot be reckoned upon in any sense as a chronometer of time.

So much for the upper stalagmite floor, which was from sixteen to twenty inches thick, sometimes attaining five feet, and containing large fragments of limestone, a human jaw, and the remains of extinct animals. During the long period of years which this took in forming,|| it seems that only one human being left his remains in the cretaceous mass. If

* Mr. McEnery very appropriately observes that in some parts of the cavern the stalagmite and stalactite had been formed by the percolation of water "through the rents or pores of the rock." The rock itself, as seen by the specimen I exhibit, is impermeable to water; in other parts "the calcareous moisture entered laterally through the clefts and crevices, and spread slowly over the floor."—*Literature of Kent's Cavern*, pp. 41, 42.

† "After rains these infiltrations are copious, and in some places coloured with a solution of red marl or vegetable soil."—McEnery, p. 282.

‡ In their first report the Committee say, "Since the commencement of the work unusually heavy rains have fallen in the district, but water has entered through the roof at very few points only."

§ Mr. McEnery says in other places the drop from the roof acted concurrently with the oozings from the sides in forming the floor, which consequently partakes of both manners.—*Lit. of Cave*, p. 42.

|| In *Notes on Recent Notices of the Geology and Palæontology of Devonshire*, Part i. p. 37, read at Teignmouth, July 1874, I find that "the human jaw was near the base of the stalagmite." This was 20 inches in thickness, and reckoning "500 years for each inch of the stalagmites," we verge upon 100,000 years for the era of this human being.

he could have bequeathed to us his autobiography, it would have been highly interesting to learn what he thought of his position and of his companions.

Especially, should we desire information respecting one animal, the *Machairodus latidens* (Owen), a large lion-like animal, armed with double-edged teeth, in shape like the blade of a sabre and with two serrated edges. This formidable creature seems to belong rather to the *pleiocene* than to the *pleistocene* age, and its remains are exceedingly rare, but were found by McEnery in the cave, giving rise to considerable controversy.

It is probable that the expenditure of some thousand pounds by the British Association has produced no result so important as the confirmation of the accuracy of the previous discoveries of McEnery, this one among the rest, which tended greatly towards the clearing of the cavern. It is needful, if we would preserve the regular sequence of strata, to notice in the next place a local deposit called "*the black band*," which yielded 350 flint implements and flakes, charred wood in great quantity, bones partially charred, bone tools, including a well-formed *awl*, a harpoon or fish-spear, barbed on one side, and a *portion of a needle*, having a nicely-made eye, capable of carrying fine twine, and remains of bear, badger, fox, cave-hyena, rhinoceros, horse, ox, and deer.

All these objects may, if I mistake not, be seen in the Torquay Museum, and, if admitted to be more than one hundred thousand years old,* throw considerable light on the early development of the honourable pursuits of the tailor and sempstress. Pity that the art was lost before our first parents so much needed clothing!

The cave-earth (next in order) contained the great harvest of remains of the common cave mammals, including extinct species, such as the mammoth, cave-bear, &c. ; recent species no longer existing in Britain, such as the reindeer, wolf, &c. ; and recent species still inhabiting the district, such as the badger, fox, &c.

The remains of the horse and rhinoceros were extremely abundant, but were probably surpassed by those of the cave-hyena. "The bones lay together, without anything like order; remnants of different species were constantly commingled, and in no instance was there met with anything approaching a complete skeleton. Mixed with them, and at all depths to which the cave-earth was excavated, indications of man were everywhere found,"—harpoons, bone pins, and the inevitable flint flakes.

Now I wish to examine how all this mass of cave-earth entered the cavern? When I first visited the place in 1869, under the guidance of Mr. Pengelly, it was supposed that there were only two entrances to Kent's Hole on the eastern side of the cavern hill, fifty-four feet apart, and nearly on the same level, about two hundred feet from the level of mean tide, and from sixty to seventy feet above the bottom of the adjacent valley in the same vertical plane. Under these circumstances it seems to have been concluded "that at least the great bulk of it was washed in through the two external entrances, *because there is no other channel of ingress.*"* But it seems now uncertain whether these are the only two entrances, as in about the furthest point to which the excavations have been extended Mr. Pengelly pointed out to us, from the deflection of the flame of a candle, that a current of air was entering from some yet unexplored communication with the surface. This leads to some doubt about the whole explanation. Indeed, the admissions made by the committee in various places quite confirm the idea of violent disturbance of the contents of the cavern having at intervals taken place.

According to Mr. Pengelly, † "the hypothesis that best explains the facts is this, that at the time the cave-earth was carried into the cavern it was introduced in very small instalments or minute quantities at a time, and after some interval a further quantity; and so on. In the intervals the cave was inhabited by wild animals and by men, *not jointly but alternately.*" But I read in the Fourth Report (p. 3), "The older floor, of which the masses of old stalagmite are obviously remnants, appears to have been *broken up* by being fractured along planes at right and other high angles to its upper and lower surfaces." But if so, the remains of man and of animals must surely have been borne along likewise in heterogeneous confusion; and I must confess that, notwithstanding all the explanations of my guide, and statements such as are found in the numerous works on the subject, such was the impression left upon my mind. If the reader will study the above description of these entrances, and

* But it seems probable, according to McENERY, that the ancient apertures were not confined to the actual inlets. It has been already remarked that the sewer-like passages which traverse the body of the deposit, as well as the sallyports, *appear to have once opened in the sides (a strong current of air circulates through them), though we have not yet succeeded in discovering their exits*, owing to the accumulation of rubble or their being masked by the growth of copsewood.

[It has only been by long investigation that I have discovered these confirmations of my original impressions, which will account for the mode in which I present them.]

† *The Cave Men, &c.*, p. 143, Part ii. 1875.

much more if he could see the place, he would be satisfied that nothing short of the waters of a deluge could effect this result.*

As to the period of time which it took to effect all this, I find no attempt at accurate calculation. When once we begin to draw cheques on the Bank of Imagination and are quite sure they will not be dishonoured, it is well to be liberal in the amount.

Mr. McEnery, who was not acquainted with the views of modern scientists, calculates from the discovery of a boar's skull accompanied by the head of a badger and an *iron spear*, which were found in the middle of the stalagmite. He says,† “It is a curious inquiry to ascertain at what historic period the cavern was visited by the boar-hunter, armed with his iron spear. Could we arrive at an approximation to that period, by doubling it, we might have the age of the stalagmite. An intermediate period between the deposition of the mud and the present time is strongly indicated; which squares with that assigned by history for the occupation of this country by savage aborigines, who dwelt in native caverns and pits, which they dug underground, before they formed into societies and built themselves abodes on the surface, brought fields into cultivation, and assumed a civilized form.”‡

“If we may compute by this scale, taking the charcoal seam as a species of chronometer to measure the time elapsed before and since its deposition, we shall have pretty nearly the time which should elapse since the Deluge, viz. 4,000 or 5,000 years.”

According to Mr. Pengelly, who has a different theory to support, *some hundred thousand years* at least before Adam sinned (as Jews and as Christians believe) man was associated with a creature§ possessing the formidable weapons of offence characteristic of the sabre-toothed bear. (See the plate opposite, adapted from Figuier.)

Beneath all that I have described comes a second stalagmite floor from three to twelve feet thick, containing bones of bears *only*. I am not *quite* certain whether this is always so regular and subjacent as it ought to be in theory; but be that as it

* See Appendix B.

† McEnery, p. 73.

‡ Camden quotes from Hauvillan, an old British poet, as follows:—

“Titanibus illa,

Sed paucis fabulosa domus quibus nda ferarum

Terga dabant vestes, cruor haustus, pocula trunci,

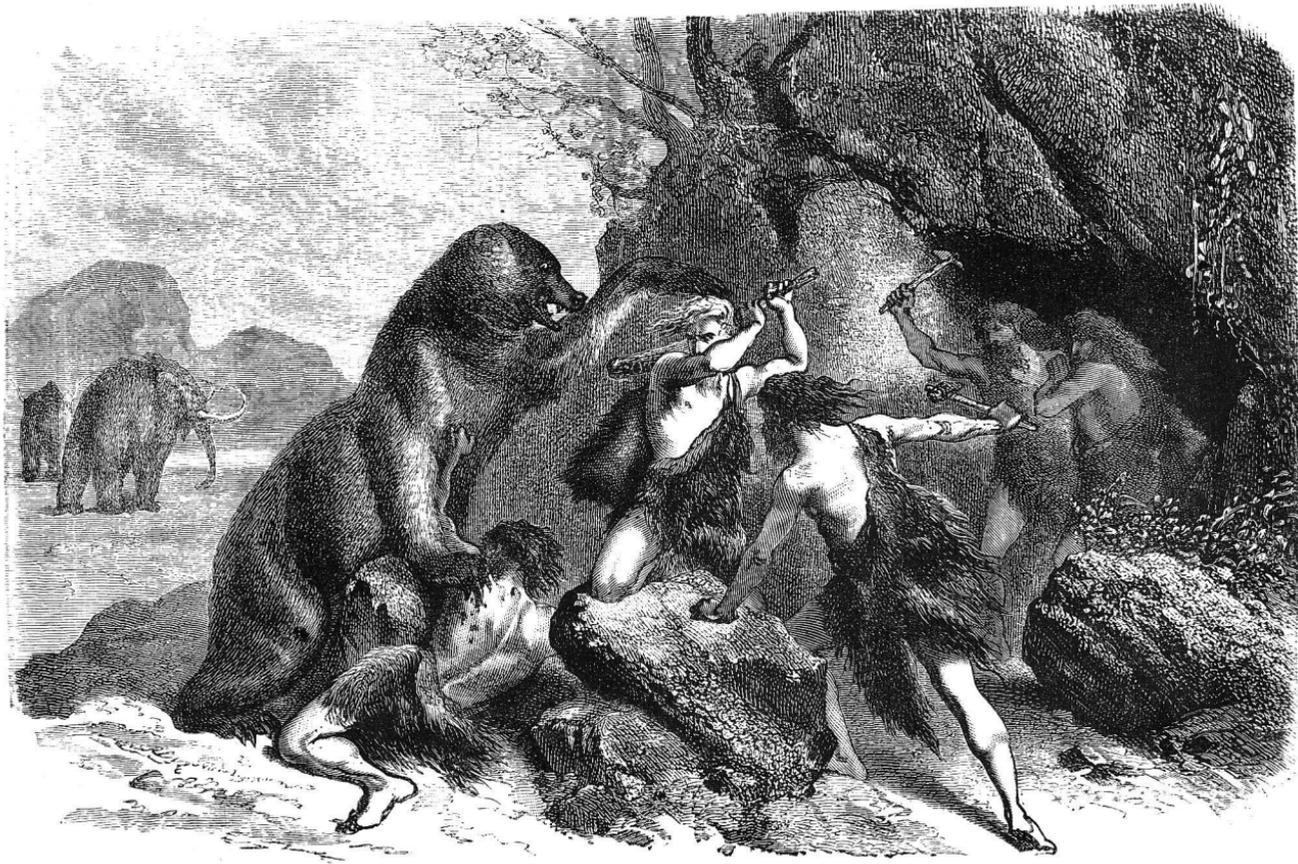
Antra lares, dumeta thoros, coenacula rupes,

* * * * * sed eorum plurima tractus,

Pars erat Occidui; terror majorque premebat,

Te furor, extremum Zephyri, Cornubia, limen.”

§ McEnery, p. 105.



may, it is at all events a very noteworthy and remarkable formation. It contains no inscriptions or marks by which we might calculate the lapse of time occupied in its deposit; but Mr. Pengelly tells us that it shows by its thin laminae that it was *formed slowly*,* and by its great thickness—sometimes fully twelve feet—that in all probability the time over which it extended vastly exceeded that of the *modern granular floor*. According to Mr. McEnery, it was in some places (in the bears' den) silicious, and struck fire with the pickaxe.†

Mr. Pengelly calls this the *old floor of crystalline stalagmite*, and relies upon it to make up a large portion of his 720,000 years. I cannot understand the argument, that the thinness of the laminae implies a long period of time. That which I do see is that it must have been formed under very different circumstances from the upper floor, which, as we have seen, is *granular*, whilst this is *crystalline*. The difference arises probably from the fact of its having crystallized under the influence of a great excess of carbonic acid, as an experiment which is easily tried seems to show. Mr. McEnery observes with great propriety that “*according to the variation in the chemical fluids at different points of the work, this substance was deposited in crystalline beds or granular spongy masses.*”‡

But what is the explanation of its deposit? I may be pardoned for withholding my assent to theories which seem to me insufficient. Mr. P. says, “the conformation of the hill containing Kent's Hole renders it certain that the only water entering the cavern is the rain which falls on the hill itself, and the only source of stalagmitic matter is the limestone shell of the cavern.”§ This may be the case *now*, but it was otherwise, he admits, when the red earth was washed in.

Mr. Pengelly says, “When the bottoms of the valleys were at least one hundred feet above their present levels, persistent streams or fitful land-floods carried the characteristic red loam into these caverns.”|| Very probably, but then what becomes of the *tranquil deposit theory*?¶

“Lastly, we reach the period of the *breccia*, when there was carried into the cavern (but how and from whence?) a loam of darker red and rock fragments, of more distant derivation than those which compose the cave-earth.”

Even here, I regret to say, “were indications of man; for a flint flake and a *perfectly angular* and sharp flint chip were found three feet deep in the *breccia*, mingled with the remains of

* Comp. p. 15.
§ *Geology*, p. 27.

† *Lit. K.C.*, p. 51. ‡ *Lit. K. C.*, p. 42.
|| *Antiquity of Man*, p. 32.

¶ *Ancient Cave Men*, p. 8.

the bear.”* “The flake is undoubtedly the most ancient human relic that up to this time the cavern has yielded.”

Sir Charles Lyell says, “*three* flint implements and one flint chip.” Mr. Boyd Dawkins says “*four* flint implements.”† I have no means now of reconciling this diversity, nor have I examined these ancient specimens. The fact is that I once asked Christy (who was my friend and schoolfellow) how many of the flint implements he thought genuine, and he replied “about eighty per cent.” Since then my belief in them generally has been conformed to the above proportion.

To assume from these flints the joint tenancy of the bears’ den, as divided between these interesting animals and man, would indicate a credulity beyond that of “the Jew Apella.” Nor is alternate tenancy much more probable. “In the very bed containing their bones [in another part of the cave?] a rude knife-shaped piece of *iron* was detected much corroded.” How did *this* come there? (McENERY, p. 286.) Was the smelting of iron also known 100,000 years ago?

I turn with inexpressible relief from the lowest floor of the cavern to the free light of heaven.

“E come quei che con lena affannata,
Uscito fuor del pelago al riva,
Si volge all’ acqua perigliosa è guata.” ‡

I feel like one delivered from a distressing dream, and I ask myself what is there *real* in these countless ages of miserable humanity?

To sum up briefly the points on which the investigation of the many scientific labourers after McENERY fails to satisfy me in reference to Kent’s Cavern:

1st. I do not believe that the two entrances on the east side of the hill have been the only entrances. The First Report of the committee informs us that there were formerly *four or five* entrances to the cavern, of which two only were generally known; the others being merely narrow apertures or slits, through which, until they were blocked up from within, the inmates were wont to enter clandestinely.

2nd. At one, two, or more intervals a powerful current must have swept through the cave, introducing at the earlier period the *breccia* “of unknown depth,” differing “from the cave-

* *The Ancient Cave Men of Devonshire*, p. 15.

† *Cave-Hunting*, p. 328.

‡ Dante. *Inferno*, Canto i. 122 :—

“And even as he who with distressful breath,
Forth issued from the sea upon the shore,
Turns to the water perilous and gazes.”

earth in the darker red of the loam, and the much greater prevalence of *stones* not derivable from the cavern hill. At a later period, or periods, the same cause must have operated in bringing in the "cave-earth," and sweeping before it an accumulation of bones, sometimes, I was told, a *barrow-load together*, and in all unimaginable confusion, not at all like the effect of a tranquil deposit. In addition to this must be noticed the blocks of stalagmite "*in every branch of the cavern,*" whose structure indicated that they were portions of an old floor, which in some way not easy of explanation had been broken up.*

3rd. That due allowance has not been made for other very obvious causes of disturbances of the contents of the cavern. It is quite possible that not only the teeth of the *Ursus cultridens* found by the committee, but many other things, may have got out of place in the *mêlée*.

4th. Including, perhaps, the *one* human jaw in the upper stalagmite floor, for who shall certify that all this *magma* of "granular stalagmite" *was stalagmite* at all, and not rather filtered in through chinks and passages, bringing with the carbonate of lime† also the iron in such a state of oxidation as it occurs in the superincumbent soil. I can at all events certify that the iron in *its present state* did not enter as solution filtering through the rock and forming real stalagmite or stalactite.

If *washed in* from the surface, we are at once delivered from the question, what became of the rest of the skeleton, and also from all the laboured calculations about the lapse of time, which simply *disappear*. The gravel of which Mr. Pengelly speaks as probably occupying the valley, and requiring an immense time to excavate, might have been *washed out* in a single night.

5th. As to the *lower or crystalline stalagmite floor* of laminated and granular structure, I object to any deductions being made from a *totally different formation*, that is, the upper floor, as to its rate of deposit, and the consequent lapse of time. One thing seems to me pretty clear, that it must have assumed its present crystalline structure under the influence of a considerable excess of carbonic acid. How this may have come about and what are the conclusions to be derived from it (if such be indeed the fact), I leave to be inferred from

* *Third Report*, p. vi.

† Mr. McEnery speaks of "the roof, the vestibule, as *pierced with spiral holes and clefts in all directions*, but [now] closed at the surface through which flowed copiously the calcareous matter."—*Lit. K. C.*, p. 59.

the following observations of Sir Charles Lyell* as to calcareous springs :—

“Many springs hold so much carbonic acid in solution that they are enabled to dissolve a much larger quantity of calcareous matter than rain-water.”

“Calcareous springs, although most abundant in limestone districts, are by no means confined to them, but flow out indiscriminately from all rock formations. In central France, a district where the primary rocks are usually destitute of limestone, springs copiously charged with carbonate of lime rise up through the granite and the gneiss. One of these springs at the northern base of the hill on which Clermont is built issues from volcanic peperino, which rests on granite. It has formed by its incrustations an elevated mound of travertin, or white concretionary limestone, 240 feet in length, and at its termination 16 feet high and 12 wide.”

I presume that this is the same spring which forms incrustations on birds' nests or similar natural objects, in a very short time, as I was told when there.

“The more loose and porous rock (like the upper floor) is called tufa, the more compact (like the lower floor) travertin.”

“If we pass from the volcanic district of France to that which skirts the Apennines, in the Italian peninsula we meet with innumerable springs, which have precipitated so much calcareous matter that the whole ground in some parts of Tuscany is coated over with tufa and travertin, and sounds hollow beneath the foot.”

“The water which supplies the baths of San Fillipo falls into a pond where it has been known to deposit a solid mass thirty feet thick in about twenty years. Near the hot baths called the Bulicame, a monticule is seen about 20 feet high and 500 yards in circumference, entirely composed of concretionary travertin. The laminae are very thin, and their minute undulations so arranged that the whole mass has at once a concentric and radiated structure.”†

The rest of Sir C. Lyell's observations may be read with advantage, but are too long for me to quote.

In reference to the probable flow of water through the cavern, I would adduce the following observations of Louis Figuier in his *Primitive Man*, which seem to me well-founded and applicable to Kent's Cavern as well as that of Brixham.

“It is supposed that the bones in question were deposited in these hollows by the rushing in of the currents of diluvial water which had drifted them along in their course. A fact

* *Principles of Geology*, 7th ed. 1847, pp. 238 to 244. † See p. 12.

which renders this likely is that *drift pebbles* are constantly found in close proximity to the bones. Now these pebbles come from localities at considerable distance from the cavern. There are evident indications that these bones had been carried along by rapid currents of water, which swept away everything in their course, or, in other words, *by the current of the waters of the deluge, which signalized the quaternary epoch.*"

It is specially to be noted that "*rolled stones, not derivable from the cavern-hill occur here and there in every part** [of Kent's Cavern] *which has been explored.*" These comprised "*pieces of granite from Dartmoor, crystalline schist from the Start and Bolt (15 miles off), and even of slate from the more immediate neighbourhood.*"

I read in the committee's First Report† that many of the bones "*appear to have been rolled, including most of those which had been gnawed; and in the case of the latter it is tolerably obvious that the rolling was subsequent to the gnawing.*"

In order to present this more clearly I shall refer to the evidence of Mr. McEnery, who seems to me to have read the riddle of the cave more perfectly than its other explorers.

Having described the obstacles which he had to remove before he could obtain entrance into a before unexplored part of the cavern, he says,† "*This obstacle removed, we burned with impatience to penetrate into the chambers beyond. As a grotto hung with curious concretions of dazzling brilliancy, it well repaid our search. The floor sloped upwards and conducted into two oven-shaped branches, which it threw off to the right and left, similar to those near the common entrance, and with which the one on the right seemed to communicate, though partly closed up at present with stalactites. That on the left seemed to pierce through the boundary wall of the cavern into the open air.*"

"We now returned to the excavation which produced the wolf's head. The stalagmite was about a foot and a half thick, and of excessive hardness, in which were embedded rocky fragments rolled down the slope; but as we advanced inwards, the stalagmite became altogether free from foreign admixture, and *moulded itself upon the mass of bones.* Of the quantity and condition of the remains here it is scarcely possible to give a just idea without appearing to exaggerate. They were so thickly packed together that, to avoid injuring them, we were obliged to lay aside the picks and grub them out with our fingers. They had suffered considerably from

* *Third Report of Committee*, p. 6.

† *First Report*, p. 8.

‡ McEnery, p. 55.

pressure, after *having first undergone violence from the force which impelled and congregated them in this narrow neck.* They were found driven into the interstices of the opposite wall, or piled in the greatest confusion against its side, with but a scanty covering of soil, and that of the finest and softest sand intermixed with greasy earth. To enumerate the amount of fossils collected from this spot would be to give the inventory of half my collection, comprising all the genera and their species, including the *cultridens*; there were hoards, but I must specify jaws and tusks of the elephant with the teeth in the sockets, and the bone of which was so bruised that it fell to powder in our endeavour to extract it, a rare instance of the teeth occurring in their jaws or gums. The same may be observed of the rhinoceros, one portion alone of which was saved, but the teeth of both were numerous and entire. The teeth of the elk, horse, and hyena were taken out whole. The teeth of the two last were gathered in thousands, and in the midst of all were myriads of rodentia. The earth, as may be expected, was saturated with animal matter. It was fat with the sinews and marrow of more wild beasts than would have peopled all the menageries of the world.

“The long bones abounded no less than the jaws, generally bruised and split longitudinally; but, without an exception, they had been broken and gnawed, that is, they had passed through the jaws of carnivorous animals *before they were subjected to the violence that crushed them.*”

“Intermixed with them at lower depths was sand and gravel, and marl, angular and rounded fragments, the former generally limestone, flat masses of which had fallen into the heap from the roof, where its under surface was coated with stalactite, cones and slabs of the latter scattered through schists and slates, and grauwacke, angular and sharp. The rounded substances consisted of small pebbles of limestone, chert, and quartz, green and sand stones.”

Whatever evidence may here exist of the long habitation of hyenas in this cave (and I do not deny its force), there is much more cogent evidence of a diluvial current of water having entered the cave, not through the eastern openings (for this is impossible), but having found its way from the land side, and apparently terminated their existence.

This was the opinion of Mr. McEnery, the first human being probably that ever entered this particular part, who says in connection with the heading *Diluvium* :—

“The floor was surprised by a body of mud which swept up and confounded promiscuously the materials lying upon it, and that this body of mud so covering the bottom of the

cavern was *derived from without*, and impelled inwards in a fluid state, and that it was composed of the adventitious transportable materials which it collected in its march, viz., sand, clay, and gravel. That there is evidence of only one such irruption, and that there is no evidence of its having been preceded or followed by another.

“From an inspection of the compound character of the deposit reposing on the substratum of rubble, and enveloping the bones, it is certain that it is merely the sediment of a fluid that held in suspension clay and gravel, which it swept up in passing over the surface of the adjacent country, and threw its waves into the cavern in a tumultuous manner, is manifest from the ruins of the ancient roof and floor buried in the sediment in the shape of loose cones and slabs of spar, and in the accumulation against the opposite walls of heaps of gravel and bones.”

“The land flood descended from the mountains to the level of the ocean; and if its direction may be inferred from its gravel, it came from Dartmoor. It can be conceived how the cavern and open fissures *may* have been filled with a muddy sediment derived from the surrounding surface, by supposing its vehicle to descend from above in the form of rain, and to have washed into the open cavities the movable substances which it met on its march. All this might have happened before the land flood had joined its waters to the ocean. The absence of marine exuviae supports this view.”

PART II.

THOSE who desire really to understand the true character of Kent's Cavern should take the trouble to read through some hundred pages of McEnery's MS., left by him in an imperfect state, but published by Mr. Pengelly, under the title of the "Literature of Kent's Cavern." The great beauty of the stalactite in some of the distant recesses of the vast series of caverns which he was the first to enter, the peril and difficulty of the exploration, the weird character of the unknown world revealed to view, and its first impression on the imagination, remind us of some of the descriptions of Dante. The almost incredible abundance of the relics of animal life leads to inquiries as to the surroundings of the cavern; since in the present configuration of the land, it does not appear possible that so large an amount of animal life could have found subsistence in the

neighbourhood. It seems clearly proven, that some of the deepest recesses were quietly tenanted by large bears of three or four distinct species, one of which was the sabre-toothed variety before alluded to—a bear with the teeth of a tiger. These held undisputed sway in what may be called the aristocratic portion of the cavern, whilst at the same time, as it would seem, the rest was held possession of by troops of hyenas, of a size about one-third larger than any now in existence, and furnished with teeth of even more than proportionate power. These were the commonalty of the cavern; no doubt, according to the habits of the tribe, ranging through all the surrounding country by night; their brightly-gleaming eyes discerning all objects in the faintest light, and hunting out all carrion, in which they especially delight, by their keen smell, dragging in piecemeal the remains of the huge beasts whose remains were met with. In addition to the mammoth, to which I shall devote further attention, the rhinoceros is one of the most remarkable of these. There are very abundant remains of a small thick-headed, large-teethed horse, which must have much resembled those figured in my paper on the “Early Dawn of Civilization.” Beside the dwellers in the cave which I have mentioned, an innumerable multitude of smaller *rodentia* must have found their subsistence on the remains of the feasts of the gaunt hyenas.

These, together with the bears and the hyenas, apparently perished together in that irruption of a flood which McEney calls the Diluvium, which left its traces everywhere, and with surprising violence drove the bones and the carcases together into vast cemeteries, still so fœtid with their remains, that the author of the above description nearly lost his life, and certainly impaired his health, in the research. It is probable that few persons will read the unfinished descriptions he has left; but multitudes have given the fullest credence to the abundant literature of the Cave, a large portion of which I myself perused before I was even aware of the existence of McEney’s MS., which antedates much since written.

I should recommend all who explore these caverns not to trust to the light provided by their guides, but to carry with them the bright guidance of their own common sense; or, if this be considered too fatiguing, to receive at my hands the torch of a salutary scepticism, which will disclose the unreality of the spectres that meet their view.

Doubt and uncertainty are perhaps all our acquisitions from these later researches; but these stimulate inquiry. For myself, I must say that I was thus led to study the surroundings of the cavern more carefully.

Notably, I was impressed by the fact, which may be new also to many who, like myself, are not adepts in geology, that these shores were at some time surrounded by low-lying forests, filled with the very same creatures, both predacious and otherwise, to whose remains our attention has been directed. This is shown to have been the case by relics that have been occasionally met with, as well as by appearances of the forests when unusual storms have laid bare the bottom of the sea. Mr. Parker, a member of the Torquay Natural History Society, obtained from some fishermen the tooth of an elephant, dredged up in the trawl on the southern side of Torbay. According to Dr. Falconer, it is "exceedingly fresh-looking, and free from any incrustation of marine *polyzoa*, with which it must have got covered if it had lain long at the bottom of the sea."

Dr. Falconer says, "This Torbay peat-bed in which the above tooth, it is supposed, rested, indicates a subsidence of the land in Devonshire, then peopled with elephants of a very modern date, and long subsequent to the period of the raised beach which is so boldly developed along that part of the coast." And according to Sir C. Lyell, "the specimen is interesting as serving to establish the fact, that the mammoth survived when the surface of the region *had already acquired its present configuration, so far as relates to the direction and depth of the valleys*, in the bottom of one of which the peat alluded to was found."

Again, in 1869, 1871, and 1872, Mr. Hutchinson laid before the Devonshire Association molars of mammoth cast up by the waves on Sidmouth beach. In 1872 he also produced an unusually large molar of the same species, found in the Sid by a young man wading up the river in search of lampreys; and in 1873 he read to the same body a paper on "Submerged Forests and Mammoth teeth at Sidmouth," when he described a series of carefully observed facts connected with a submerged forest laid bare on Sidmouth beach by the gales of the preceding winter. In this were found four mammoth molars.

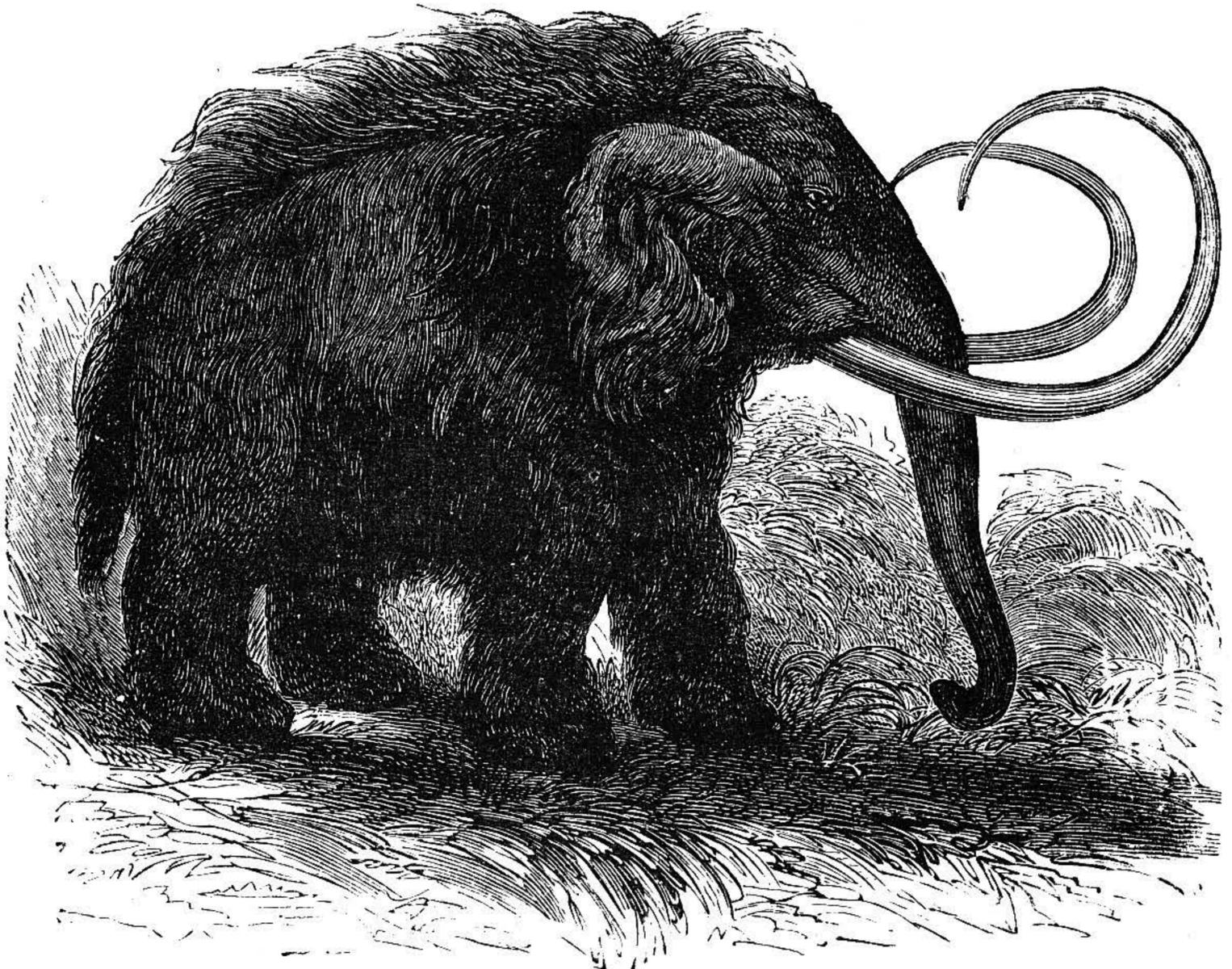
The Mammoth, *Elephas primigenius* (Blumenbach), was, as we have seen, contemporary with man. I have in a previous paper shown a very well-designed representation of this creature, sketched on ivory from a living specimen.

I shall now seek to show that the era of its co-existence with man is after all not so remote. The very name may lead us towards this conclusion, as men do not generally occupy themselves with finding out names for things with which they are unacquainted. (Compare Dr. Latham's Dic. *in loco*.)

I should derive the word originally from the Hebrew,

as it is given by Gesenius as the *pluralis excellentiæ* of *Behemah* ;* thus implying that the *Elephas primigenius* is the chief of the quadrupeds or mammals created on the sixth day ; the *Leviathan*, whatever it may be, evidently belongs to the *Tanninim*, or Saurian shapes of the fifth day, of which the crocodile and some other creatures seem to be survivals.

Now in the book of Job we have the description of Behe-



moth through the pen of a contemporary writer. It is evidently as much intended to represent a living animal as was the magnificent description of the war-horse which, although highly poetical, is immediately recognized as perfect in its kind. Of Behemoth, on the contrary, the commentators write nothing but absurdities. Indeed, the philosophic Renan observes, "*L'auteur laisse aller son imagination et semble faire le portrait d'un monstre fantastique.*" But apart from all questions of inspiration (in which Renan does not believe), it is surely a strange conceit to suppose that any author would

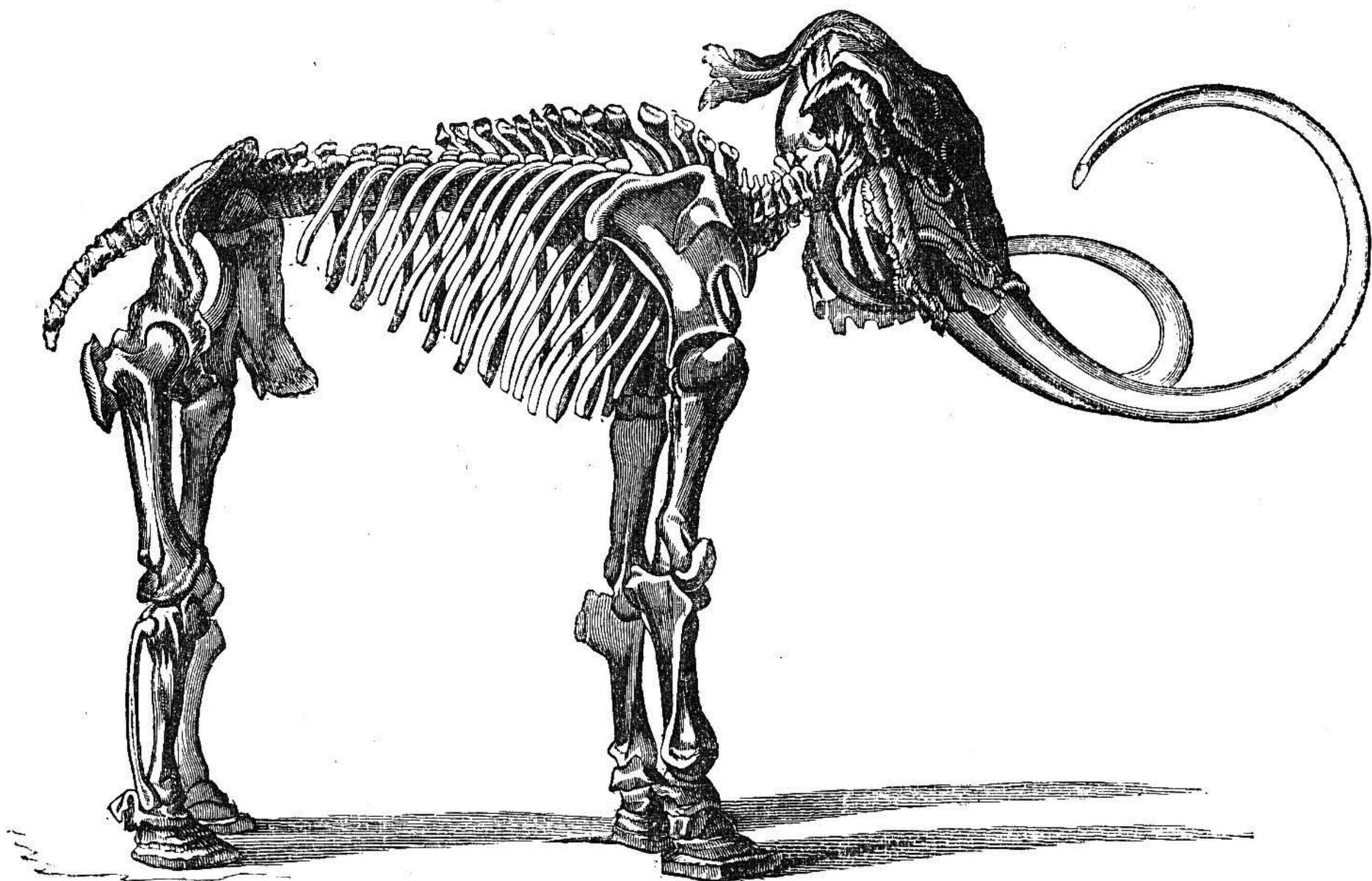
* The Seventy translators, not understanding this, have rendered *Behemoth* by *Σηπία* in ver. 10, followed by the singular *αὐτοῦ* in ver. 11.

** For the above, and other illustrations in this paper, the Institute is indebted to the kindness of Messrs. Cassell, Petter, & Galpin.

deduce the power of the Creator from the description of an animal never created at all, but the product of the man's own imagination!

I turn to the description itself, and find as exact a portrait as we can imagine of the *Elephas primigenius*, prefacing this for the sake of illustration by a sketch of the skeleton.

“Behold now *Behemoth*, which I made *with thee*,” part of the same creation, and of course contemporaneous, an herbivorous animal, but the chief of the ways of God. “Lo now his strength is in his loins, and his force is in the navel of his belly.” Could any characteristic be more true of an elephant?



Skeleton from 16 to 18 feet in height; tusks from 12 to 13 feet in length. The Belgian specimen in the British Museum has a much longer tail.

“He moveth (or setteth up) his tail like a cedar,”—true apparently of the mammoth. “The sinews of his thighs are wrapped together.” “His bones are as strong pieces of brass, his bones are like bars of iron” (look at the skeleton—what muscles these apophyses must have been designed to support). He is chief of the ways of God. He that made him has endowed him with his weapons of offence,* “*curved*

* יָגֵשׁ חֲרָבוֹ See *Ges. Lex. in loco*.

tusks." We have here the picture complete. Look at the curved tusks in the engraving.

Even the modern elephant can be a formidable antagonist. I extract from Dr. Falconer (p. 259) the account of the death of a "Goondah," or wild elephant, which for a long time was the terror of a district in India. "It was killed in the jungles on the banks of the Ganges, at no great distance from Meerut, in May, 1833, by a party of four experienced sportsmen, who went out for the express purpose of killing it. The savage animal made no fewer than twenty-three desperate and gallant charges against a battery of at least sixteen double-barrel guns to which it was exposed on each occasion, and fell after several hours with its skull literally riddled with bullets."*

The old commentators probably thought that the elephant was unknown in Arabia, but we now understand that the elephant abounded in the neighbouring district of Mesopotamia, in the days of Thothmes III., about 1500 years B.C., who, in a campaign against Nineveh, captured on a hunting expedition, one hundred and twenty wild elephants.† In the ninth century B.C. the same creature is represented on the Black Obelisk of Shalmanezar II. as part of the tribute brought by the tribe called Muzzi, from the headquarters of the Tigris to the Assyrian monarch. It had no doubt been exterminated in the interval from the plains of Mesopotamia, as at a preceding period it had been from the banks of the Jordan and the forests of Arabia.

There can be little doubt that at some period the elephant, or mammoth, extended from the head-waters of the Tigris to the forests of Siberia.

There is in fact scarcely any limit to be placed to the migrations of the elephant family in some one of their forms, of which we have now several but sadly degenerate representations.

I conclude that we have good ground for believing that the description of the Behemoth in the book of Job is that of a then existing form of the *Elephas primigenius*, symbolizing with the now extinct mammoth, in the curved tusks, the gigantic stature, the waving and bushy tail, and not improbably also in the character of its food, and of its teeth fitted for the mastication of a somewhat indiscriminate vegetable diet.

The now submerged forests of the shores of Britain seem to have furnished the sustenance exactly fitted to the wants of this huge creature, which appears to have abounded therein,

* The skull is now in the British Museum.

† See Appendix C.

for it is stated that on the coast of Norfolk alone the fishermen, in trawling for oysters, fished up, between 1820 and 1833, no less than two thousand molar teeth of elephants, and these, according to Sir Charles Lyell, of not less than three species. If we give credence to the view of geologists that in the Pleistocene period the whole of the shore until we pass the depth of one hundred fathoms was dry land, we should indeed recall magnificent plains of pasture for these noble creatures and appropriate hunting-ground for their enemies.

But this is as nothing compared to the plains of Siberia. "New Siberia and the isle of Lachou are for the most part only an agglomeration of sand, ice, and elephant teeth." "At every tempest, the sea casts ashore new quantities of mammoths' tusks, and the inhabitants of Siberia carry on a profitable commerce in this fossil ivory. Every year during the summer innumerable fishermen's barks direct their course towards this 'isle of bones'; and during winter immense caravans take the same route—all the convoys drawn by dogs—returning charged with the tusks of the mammoth, *each weighing from one hundred and fifty to two hundred pounds.*"

Think of the apparatus of bone and muscle requisite to wield this tremendous double "sword."

The fossil ivory thus withdrawn from the frozen north is imported into China and Europe, where it is employed for the same purposes as ordinary ivory.

The "isle of bones" has served as a quarry of this valuable material for export to China for *five hundred years*, and it has been exported to Europe for upwards of a hundred, but the supply from these strange mines remains undiminished.

All this wealth of animal life seems suddenly and violently to have come to an end by the waters of a deluge.*

Erman remarks that the alluvial deposits of Siberia, in which are found the bones of the mammoth and leaves and twigs of the birch and willow, consist *to the depth of one hundred feet* of strata of loam, fine sand, and magnetic sand, and that they have been deposited from waters which at one time, and it may be presumed suddenly, overflowed the whole country as far as the Polar Sea. It is only in the lower strata of the New Siberian wood-hills (composed largely of drift-wood) that the trunks have that position which they would assume in swimming or sinking undisturbed. *On the summit of the hills they lie flung upon one another in the wildest disorder, forced upright in spite of gravitation, and with their*

* *The Epoch of the Mammoth*, Southall, 1878.

tops broken off or crushed as if they had been thrown with great violence from the south on a bank, and then heaped up.

So it is clear that at the time when the elephants and trunks of trees were thrown up together, one flood,* extended from the centre of the Continent to the furthest barrier existing in the sea as it is now.

Mr. Howorth says, "We find the mammoth remains aggregated in hecatombs on the pieces of high grounds, and not scattered indiscriminately.† An immediate change of climate seems to have supervened, so as to allow the bodies of the mammoth to be at once frozen, and thus preserved intact. It seems that the animals fled to the higher eminences for safety when the waters spread around them,‡ reminding us of the deluge of Deucalion, as described by Horace—

"Omne cum Proteus pecus egit altos
Visere montes."

No human remains nor works of art are met with in these deposits. "The appearance of the *Tundra*," § or alluvial plain, "seems to point to a *not very distant* submergence of the whole of Siberia, as far south as the highlands which roughly mark the present northern limit of trees"; but the climate in the Mammoth epoch was milder, for, "remote from the present line of trees, among the steep banks of the lakes and rivers, are found *large birch-trees*, complete, with bark, branches, and roots. At first sight they appear well preserved, but on digging them up they are found in a *thorough state of decay*. The first living birch-trees are not now found nearer than three degrees to the south, and then only as shrubs."

I direct particular attention to this, for it is evident that the era in which these trees lived and flourished coincided with the (Pleistocene?) era of the mammoths, and of a much more genial temperature than now prevails. The period during which a birch-tree can be continually decaying until it turns *absolutely* to dust, marks out exactly the length of this space, and may be placed side by side with the accumulation of stalagmite in, at all events, the upper floor of Kent's Cavern. Are we to believe that 250,000 years have elapsed since these birch-trees lived, and that the bodies of the mammoths have been kept in ice all this long age so fresh that the Siberian wolves can now feed and fatten upon them?

* See Falconer's *Palæon. Mem.*, p. 243.

† *Proceedings of the British Assoc.* 1869, p. 90.

‡ Appendix D.

§ *Hedenstrom*, quoted by Southall, p. 327.

M. D'Orbigny,* whose grand work in nine quarto volumes is no doubt the best on all subjects connected with the geology of South America, is of opinion that the destruction of the great races of animals which inhabited the country before the present era was owing to a flood; which swept the soil and the animals from the surface, and deposited them together in an unstratified mass, covering not less than 23,750 square leagues. This formation of the Pampas deposit of the same red argillaceous earth with bones, which appears to cover almost all South America, and is found even at the elevation of 400 mètres above the level of the sea, coincided with the last elevation of the Cordilleras; the extrusion of the trachyte rocks, "sur une longueur de trente-six degrés," "mouvement l'un des plus grands qui ait lieu à la surface du globe;" and with a great line of dislocation, due, without doubt, to considerable sinkings towards the west in the bosom of the great ocean.

All this reminds one of the Scriptural expression, "In that day were broken up all the fountains of the deep;" † and is something startling, vast, gigantic; and since the same author finds traces of the same event in Auvergne, it would suggest some world-wide catastrophe.

I do not know how far it is conceded by geologists that the general disappearance of the mammoth was coincident with "the Palæolithic Flood," but "that there was such a flood, covering no inconsiderable area in Belgium, in France, in England, in the valley of the Tiber, in the valley of the Mississippi, and elsewhere, there is no doubt. It is what Dr. Andrews calls 'the flood of the Loess.'"

"With regard to the fact of this flood there is no question—the only question is as to the extent of it. There are some indications that it was even more serious than has been supposed." ‡

I refer to several able and recently published works for further information, especially the one just quoted, remarking only that the era at which this supposed flood occurred cannot reasonably be put back more than a few thousand years.

Was it in this deluge that the creatures perished whose remains are found in "los Gigantes," near Santa Fé, at an elevation of 7,800 feet; and again, by Humboldt, at the elevation of 7,200 feet, near Imbaburra, in Quito; and again in Central Asia, at 16,000 feet elevation? See Buckland, *Rel. Dil.*, p. 222.

* D'Orbigny, tome iii. pp. 80, 254, 273, &c.

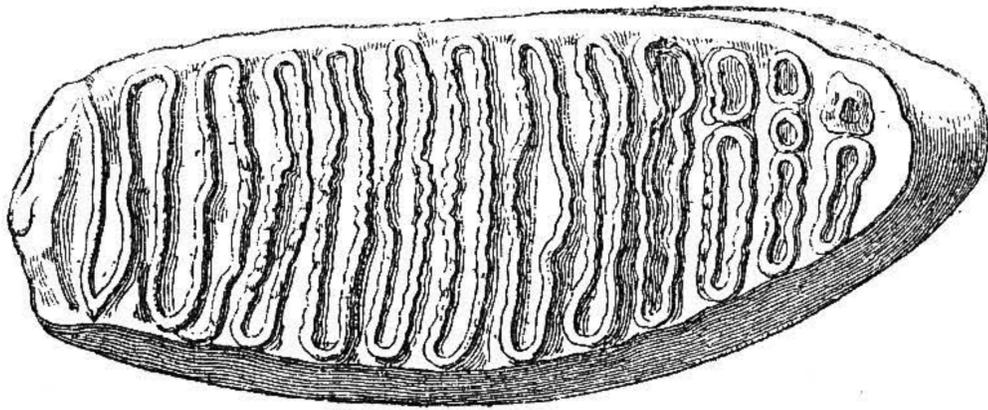
† See Hebrew.

‡ Page 128. *The Epoch of the Mammoth*, by J. C. Southall, A.M., LL.D. 1878; also Appendix D.

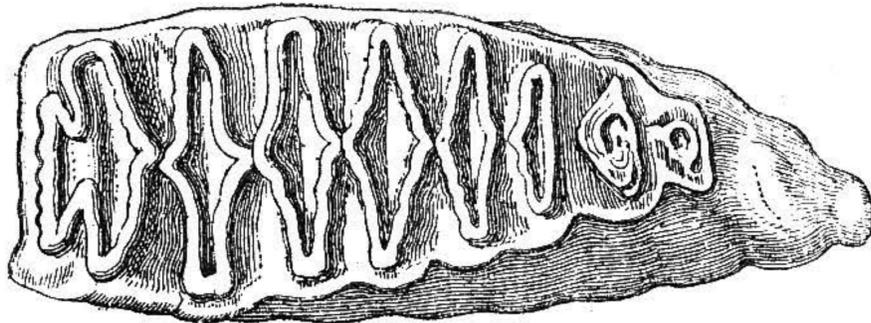
It may be inquired how it is possible that the term *Behemoth* could be applied to any creature that may seem to have perished from off the earth so many centuries before the book of Job can be supposed to have been written. My reply to this is, in the first place, that many of the associated animals, such as the bears, the great cat of the caverns, &c., left some survivors, enduring to historic times.*

The *Megaceros Hibernicus*, or Irish elk, and the reindeer † are not unknown even to tradition. The bears of Kent's Cavern, if we are to judge by *iron* found along with their bones, must have left some survivors even till Roman times.

“The † state of our exact knowledge at the present time



No. 1. *Elephas primigenius*, last true molar, lower jaw, right side. §



No. 2. *Elephas Africanus*, first true molar, lower jaw, left side.

regarding the duration, geographical range, climate, habits, and food of the mammoth appears to be thus:—The species existed before the Glacial period in Europe, and survived long after it in Europe and America. The *constitutional flexibility*, which is evident by its extending through two cycles' term in time, is equally evinced in its *vast geographical range of habitat*; extending from the valley of the Tiber to the Lena, and from Eschholtz Bay to the shores of the Gulf of Mexico. Making due allowance for the interference of the

* “In the Apennine valley of the Chiana, in Tuscany, *Elephas primigenius* existed so late as to have been a contemporary of the Irish elk (*Megaceros Hibernicus*), *Bos primigenius* and *Bison priscus*; bringing down the period to the very modern date of the superficial marly beds of the Isle of Man.”—*Memoirs*, Falconer, p. 240.

† Falconer, vol. ii. p. 289.

‡ See Appendix E.

§ Falconer, vol. ii. plate 6.

glacial phenomena, the extremes of north and south latitude, in which undoubted remains of this ancient elephant have been found, necessarily imply that his constitutional flexibility was *like that of man*, capable of adaptation to very great differences of climate." In Siberia he was enveloped in a shaggy thick covering of fur like the musk-ox, impenetrable to cold or rain. But we are not obliged to suppose that in his southern habitat he was thus clad. The fine silky fleece clothing the Cashmere goats, at 16,000 feet elevation, disappears in the valleys in the same animal.

The character of his teeth accords with a more promiscuous and more herbivorous alimentation than belongs at the present day to the Indian elephant. The surface is extremely like a well-dressed millstone.

The African elephant has teeth more adapted to bruising branches of trees, and its range is consequently more limited.

Dr. Falconer says, "If there is one fact which is impressed on the conviction of the observer with more force than any other, it is the *persistence and uniformity of the characters of the molar teeth in the earliest known mammoth and his most modern successor*" (p. 252).

Here, then, is a most valuable testimony to *stability in creation*, given as the result of life-long research by the greatest authority in this particular line.

"Assuming the observation to be correct, what strong proof does it not afford of the *persistence and constancy throughout vast intervals of time* of the distinctive character of those organs which are most concerned in the existence and habit of the species" (p. 252).

"The whole range of the mammalia, fossil and recent, cannot furnish a species which has a wider geographical distribution, and at the same time passed through a longer period of time and through more extreme changes of climatical conditions, than the mammoth. If species are so unstable, and so susceptible of mutation through such influences, *why does that extinct form stand out so signally* A MONUMENT OF STABILITY?" (p. 254).

I am delighted to find that he adds, though apparently unwillingly,—

"Another reflection is equally strong in my mind, that the means which have been adduced to *explain the origin of species by 'natural selection,' or a process of variation from external influences, are inadequate to account for the phenomena*" (p. 254).

I have, then, the following facts to present as the result of my researches, such as may be admitted as fairly proven, and we shall see to what deductions they lead.

First, that at a certain period of the world's history *man* and

the *mammoth* both appeared upon the scene. *Man* the head and chief of the whole creation, the *mammoth* the head and chief of the behemah or cattle. They are creations (in the language of Scripture) of the sixth day, and neither the one nor the other is found associated with the ferocious saurians of the fifth day's creation, with whom indeed they would have been incompatible.

I have the greatest objection to forcing a supposed agreement between Genesis and geology, when in truth we are as yet so far from having attained the complete knowledge either of one or the other, but it is absolutely necessary to define with some precision the terms we use. We may speak of æons or of Indian Kalpas, or, as it seems to me, with more advantage, in Scriptural phrase of *days* to indicate *periods*, whose duration passes our comprehension.

In the earliest *æons* then of which we have any records—in the rocks—*life*, whether vegetable or animal, was perfect in its kind, but apparently sparsely scattered in the midst of uncongenial circumstances. The world was not yet prepared for great creations.

From the early Silurian dawn, however, we find the same contrast between the mathematical forms of crystallization and the spiral and elegant forms of life, which I have endeavoured before to illustrate, and which our "scientists" choose to ignore.



Afterwards followed the *day* when the earth brought forth the tender grass, and herb yielding seed after his kind,

and the tree yielding fruit whose seed was in itself *after his kind*:—not by development of the earlier creations, with which it would be difficult to trace any connection, but the earth itself bringing forth these things according to divinely conceived and implanted ideas.

So, in his better days, Sir C. Lyell expressed it:—"It appears that species have a real existence in nature, and that each was endowed, *at the time of its creation*, with the attributes and organization by which it is now distinguished."

Next followed, according to Scripture, and, I think, according to the testimony of the rocks, the command to the waters to "swarm forth swarms" of creeping things having living souls, and fowls were to fly above the earth in the open firmament of heaven.

These would find their food ready prepared, both in the seas and in the abundant fruits and seeds with which the earth was already replenished, and their multitudinous increase was checked and kept down by appointed and most formidable destroyers.

But none of the animals suited especially to minister to the wants or to become the companions and friends of man had yet appeared upon the scene. It was needful to introduce the mammiferous animals, creatures of another origin and of blood entirely diverse; showing how impossible it is for the one to be derived from the other by "natural selection," for the effects produced by the injection of the blood of the one into the other are comparable to those which follow the introduction of the most energetic poison.

"Earth, air, and water have their mammiferous animals. This provision is a physical and even moral advance in animated nature, for amongst the animals thus furnished, man himself takes his place, and wherever the mother's breast is, there is there a strong parental affection for the offspring."

The creations of the sixth age were thus benevolently associated with man.

Between the head of the mammiferous cattle and the head of the whole creation there are these points of resemblance, that both appear upon the scene perfect, without, as far as geology can ascertain, any predecessors. They both "come," as it will be seen, at a late period of the world's history. One is destined to survive, the other, after long ages, to disappear; but both have this peculiarity, that they have been adapted to spread over a very wide extent of the earth's surface, the *mammoth* to multiply exceedingly, the *man* to replenish the earth and subdue it. Wherever the mammoth, a quiet herbivore, could exist, man could doubtless find means to live.

What, then, are we to say as to the period during which they lived together?

"It has been assumed that that epoch is removed by tens and hundreds of thousands of years from the present. Millions of years were the figures employed to describe the time which has elapsed since that great geological episode. In the tenth edition of his 'Principles,' Lyell estimated it to be about 800,000 years ago, which was moderate compared to the 1,280,000,000 years of some geologists. But in the eleventh and last edition of Lyell's great work, he substituted* 200,000 for 800,000! Dr. Andrews' calculations, drawn from very careful observations on the North American lakes, put 25,000 years as an extreme limit, and indicate in reality only some 7,000 years."†

M. Chabas, who has written some of the best books on the subject of the antiquity of the human race, ridicules the statement of a contemporary writer, who says that the horse had been hunted, killed, and eaten by man before being brought into a state of domesticity from the commencement of the Quaternary age until the epoch of the age of Bronze, or not less than 300,000 years. Also that the Aryans first bethought themselves that the said animal might be made useful for other purposes than being eaten before the year 19,337 B.C.

I wish to pay all respect to the calculations of Mr. Pengelly, which assign 17,000 years as the period which has elapsed since the subsidence of the wood-covered shores of the bay. Mr. Pengelly, at all events, gives reasonable calculations (whether dependable or not) for his opinion; nevertheless, they remind me of the above.

Only this calculation seems to me to prove too much, for nothing is more certain than that St. Michael's Mount, which is now surrounded by the sea at high water, used to be called in the Cornish language (*carreg luz en kuz*), "the hoary rock *in the wood*," and subsequently in Norman-English, "Le hore rock *in the wood*"; and notwithstanding the great opinion which I entertain of the antiquity of the Cornish and the allied Welsh and Breton languages, I hesitate to assign to them an unchanged duration of 17,000 years. If it be supposed that part of this interval may have been bridged over by tradition, I find that this supposition again fails to establish the theory, for distinct and unanimous tradition records great loss of land

* Based on the theory of Mr. Croll. To this theory I attach no importance, as I see no reason to believe that any change in the obliquity of the earth's orbit has any connection with the Glacial period.

† See Appendix F.

and incursions of the ocean even within the past few centuries. In fact, "*tradition tells us* that in former ages the mount was part of the insular continent in Britain, and disjoined from it by an inundation or encroachment of the sea,"* so that at whatever age the subsidence began, it was not complete till the era of tradition.

Mr. Pengelly's calculations seem quite modest and reasonable compared with those of many other palæontologists. The bone of a bear mistaken for the *fibula* of a human being gave rise to the *fabula* of the existence of man in Yorkshire during an immense period of years.†

"At the recent meeting in Dublin, it was stated that Professor Busk, who had brought his great experience to bear upon the subject, and who had provisionally admitted the human character of the bone, was now prepared to admit that it was more likely to be *ursine* than human."

The *os innominatum* of some luckless wanderer lost in the swamps of the delta of the Mississippi, and resuscitated by Dr. Dickeson, of Natchez, led Sir Charles Lyell to speak of the possibility of North America having been peopled more than a thousand centuries ago by the human race.

Such are the materials out of which Palæontological science blows these gigantic bubbles of history.

It never seems to occur to our "scientists" that it is needful to fill up these enormous lapses of time by some reasonable details; or to run the risk of their being rejected as utterly incredible.

For instance, it is the evident law of existence, both of mammoths and of men, that they should increase and multiply, though the latter at a much quicker rate than the former.

Suppose a single pair of each placed upon the earth a thousand centuries ago, and allowed to multiply at the lowest rate of increase; and instead of bones and tusks being found in abundance in some places only, they would fill the soil everywhere. As to man, we should not be able to find a rood of ground without a skeleton in it, and instead of the caves and ancient sepultures presenting a few‡ *doubtful* "Neanderthal" skulls, the *crania* of Palæolithic men would have supplied inexhaustible stores of material for our manufacturers of artificial manure.

Of still greater importance is the consideration that man is an improving creature, capable, at the very earliest age at

* *Antiquity of Man*, p. 24.

† *The Nineteenth Century*, October 1878, p. 772.

‡ See B. Dawkins, *Cave-hunting*, pp. 240-242.

which we can trace his relics, of fabricating pottery, and therefore acquainted with the use of fire.* We may well ask why we do not find more abundant remains of his works in this direction, and why he did not make greater improvement in all this time. The same may be said of his artistic drawings in ivory of the mammoth and other coeval beasts. He could also produce great changes in the earth's surface, as we see by the representation of the mammoth and the other mounds in Ohio. Why are these works so few and so much limited?

Did the Glacial period benumb his faculties, and did some diluvial catastrophe sweep him in great measure from the earth before he had time to subdue it? If science should discover this, it will present us with one more extraordinary point of resemblance to an ancient record, styled "The Oracles of God," which it is at so great pains to discredit.

The verification of knowledge, or real science, is a source of strength as well as of pleasure to the mind; † whilst the admission (on the authority of great names) of wild speculation has the exactly opposite effect. The latest theories of our century show as complete ignorance of the principles of chemistry as of theology; and I trust that I have succeeded in demonstrating that the teachings of the Devonshire Caves must be subjected to the rigorous control of *experimental science* before the conclusion to which they have been supposed to point can be admitted to have any weight in the instruction of the popular mind.

It is not real science that is opposed to real religion, but an impostor that has usurped her name, to whom the "Positivists" and prophets of the age would compel us to bow down and worship. We are to look upon the threefold image of the modern Buddha, representing to us the past, the present, and the future, and benignantly beholding its adorer with that imperturbable smile of ineffable self-conceit to which we are accustomed.

We are told to believe that it reflects the rising beams of the sun of truth; and what time the discordant voices of the great and small serals command, we are in like manner to do homage.

Would that some real iconoclast—some English *Virchow*—might arise to strip off all the false gilding, and so enable every one to see that the image is a block (*inutile lignum*) fashioned after the similitude of its fabricators, and nothing more!

* See "A fragment of pottery found by McEnery in the breccia;" also other authors—D'Orbigny, *passim*, Southall, p. 76, Sir C. Lyell, p. 133, and M. Chabas, p. 581. *La poterie ne fournit conséquemment aucun argument aux longs chronologistes.*

† Appendix G.

APPENDIX A.

IN 1846, a sub-committee of the Torquay Nat. Hist. Soc. commenced a search in the S.W. chamber, when they broke up the modern floor of stalagmite. Probably no part of the cavern is in wet weather more exposed to drop than this ; hence it might have been expected that here if anywhere twenty-two years would have produced a film of stalagmite of appreciable thickness, especially as it was known that the modern floor attains an average thickness *considerably surpassing* that in any other part of the cavern which the committee have explored. *Yet not a film was to be found* either at "the bottom of the pit, on the section made in digging it, or on the cave-earth thrown out of it. This remote part of the cavern was rarely entered by visitors, and the operations of nature went on without check or interference, but *everything was found precisely as it was left upwards of twenty years ago.*"

APPENDIX B.

From the Fourth Report of the Committee, page 4 :—

"In most cases the composition of the cave-earth was of the ordinary typical character, about equal parts of *red loam* or *clay*, and of comparatively small angular fragments of limestone. In this condition *it almost invariably contained bones*, but when there was any marked departure from it, by either loam or stones being greatly in excess, bones were extremely rare. In a few instances the deposit was a mixture of fine earth and sand, resembling ordinary road-washing, and contained no trace of bone."

Is it not evident that both the *red loam* and *clay* must have been *washed in* from the surface of the ground ?

If more proof is required, we have it in what follows :—

"The cave-earth contained a considerable number of fragments of Devonian grit, huge blocks of limestone, large masses of old stalagmite, and loose lumps of rock-like breccia."

"The grit fragments *could not have been derived from the cavern hill*, but were probably furnished by neighbouring loftier eminences. They have assumed sub-angular or well-rounded forms *indicative of the rolling* action of water ; but their transportation into the cavern by this agency would require that the district should have a surface configuration very unlike that which now obtains."

Compare the description of Victoria Cave in Yorkshire by Boyd Dawkins ; also the Paviland Cave (233), the Cavern of Bruniquel (247), of Cro-Magnon (252), the Grotta dei Colombi (259), the Gailenreuth Cave (274), the Kirkdale Cave (280), the Wirksworth Cave (284), Wookey Hole (296, 305, 312), Brixham Cave (320), Kent's Hole (326), "red clayey deposit" at Madras (426).

Why do the rivers, which, at the will of our scientists, convey the deposits

into these inaccessible places, *always* carry with them the same *clay*, generally of a reddish colour, described by Dr. Buckland as "diluvial detritus"? And why is this so like the deposit of the Pampas, of which D'Orbigny writes, vol. iii. p. 84, "Le dépôt des Pampas aurait dû s'opérer, pour ainsi dire, instantanément et dans un laps de tems très-limité. Il serait le résultat de courans violens, qui, entraînant à la fois les terres et les autres matériaux superficiels, enlevés aux continens par les eaux, en auraient fait un seul mélange. C'est en effet, ce qu'on remarque partout dans le bassin des Pampas, où à deux cent lieues de distance, l'argile a la même couleur rougeâtre, le même aspect, et loin de former des couches distinctes, diversement colorées, résultant partout des dépôts qui se font seulement dans les eaux, l'ensemble se compose, au contraire, d'une seule masse plus ou moins poreuse, mais n'offrant jamais de stratification bien distincte. Toutes les falaises qu'elles constituent sont aussi d'une seule teinte rougeâtre, absolument identique sur toute leur épaisseur, comme si les matériaux dont elles sont composées avaient été mélangés dans une seule eau bourbeuse, un peu teintée par les oxides de fer. D'un autre côté, j'ai remarqué que les ossemens ne sont, pour ainsi dire, qu'isolés dans les couches inférieures, tandis que les animaux entiers ne se trouvent qu'au pourtour ou dans les parties les plus supérieures du bassin. Un second argument de beaucoup de valeur est l'identité de couleur et d'aspect qui présente le limon qui dans les cavernes et dans les fentes de rochers de la province de Minas Geraes enveloppait les ossemens des mammifères et l'argile pampéenne. En effet, des fragmens rapportés par M. Clausen m'ont prouvé leur analogie complète de couleur et de contexture.

APPENDIX C.

The text as translated by M. Chabas.

Nous sommes redevables déjà aux inscriptions hiéroglyphiques d'un renseignement des plus précieux, concernant l'éléphant d'Asie au XVII. siècle avant notre ère. Dans la biographie d'un officier nommé Amonemheb, qui avait été au service de Thothmes III., on lit, entre autres faits intéressants pour l'histoire, que ce Pharaon prit à la chasse 120 éléphants à Ninève.

Voici le texte de ce curieux passage :—

" Une seconde fois je fus témoin d'un autre acte glorieux fait par le seigneur des deux mondes à Ninève. Il prit à la chasse 120 éléphants pour leurs défenses, pour l'ivoire. Je pris le plus extraordinaire d'entre eux, l'attaquant devant S. M. Moi, je fus celui qui lui coupa le pied de devant, il était vivant."

M. Brugsch Bey reads Ni (in *Northern Syria*) for Nineveh, vol. i. p. 358.

APPENDIX D.

The *fluvial theory* will have to be abandoned, as inconsistent with common sense and observation. I find it thus advocated by a writer in the *Athenæum* under the head "Theory of Geological Phenomena."* He says, "Now these alluviums, like all other alluviums in the wide, wide world, are formed by rain and rivers, not by *débâcles*. And the same floods which form these land alluviums stock them with the remains of land life. Have the Irtish, Obi, Yensei, Lena, and one hundred smaller rivers of Siberia ceased to flow and to overflow * * * * These rivers flooded by rain have formed these alluviums and have been storing them for thousands of years with dead elephants, which lived *thousands of miles from where they were buried.*"

I need scarcely point out the inconsistency of all this with common sense and with the facts of the case in Siberia. The transport of the bodies of animals for thousands of miles, in rivers of course above the freezing point, makes their subsequent preservation inexplicable. But there is much more than this, for in South America we should have to imagine this river as one of salt water, as is shown by the saline incrustations on the bones, and then to extend its deposit in such a way as never was conceived or thought of; and, after all, this saline river carries the carcasses of *land* animals, and deposits them whole and entire in the mud. What is this, then, but a sudden irruption of the sea? See D'Orbigny, *Géologie*, p. 83.

The same author, in p. 85 (note), remarks on this subject :—

"Un seul observateur a vu, depuis moi, le sol argileux des Pampas, et les considérations géologiques qu'il tire de leur examen sont bien différentes des miennes. M. Darwin (narr. p. 52) regarde la formation de l'argile rouge des Pampas comme tirant son origine de l'estuaire même de la Plata, qui étendait au loin ses limites, et couvrait de ses eaux *sauvâtres* les contrées basses environnantes. Il croit même rencontrer sur les bords de la rivière des signes fréquens de l'élévation graduelle du sol. *Ailleurs* (p. 96), le voyageur dit que la même argile rougeâtre s'est déposée dans une mer voisine de la côte. Pour répondre à la première hypothèse, il suffira, je pense, de jeter les yeux sur l'ensemble de l'argile des Pampas, qui, dans certains endroits, a *jusqu'à sept degrés et demi de largeur*, fait qui éloigne toute idée d'un dépôt amené par les eaux de la Plata. De plus, si d'un côté l'argile est déposée dans la mer, et de l'autre, par les eaux fluviales à de très-grandes distances, pourquoï, dans l'un et dans l'autre cas, ainsi que sur les points intermédiaires, *l'argile présente-elle les mêmes caractères, la même couleur, et contient-elle les mêmes êtres?* Je dois dire en passant, qu'on a beaucoup abusé des affluens pour y voir la cause du transport des grands animaux. Cette idée ne peut vraiment s'appliquer qu'aux fleuves de notre Europe bordées des villes, et dans lesquels les hommes jettent continuellement des animaux qui sont ensuite transportés par les courans. J'ai vu dans mes voyages, d'immenses cours d'eau, tels que la Parana, le Paraguay, l'Uruguay, la Plata, et tous les affluens boliviens de l'Amazone; et je puis assurer, que, pendant huit années, je n'ai jamais rencontré un seul animal flottant au sein des vastes solitudes du nouveau monde. Je crois qu'il faut renoncer en partie à cette supposition, *puisque les faits viennent la détruire.* Il est certain que jamais les animaux

* By G. Greenwood, Colonel, Brookwood Park, Alresford, March 31st, 1866.

sauvages ne se jettent dans les fleuves et que les inondations ne les entraînent que très rarement."

But if this *fluvial theory* is doomed to perish by force of facts, so must perish also the calculations of our scientists, who invent rivers where there are none ; and in order to make them flow at a level with the mouths of the caverns, as in Kent's Hole, raise the bottom of the valley 70 feet,* or 300 feet,† or any other number up to 7,000 or 8,000 feet ; as we have seen in the previous pages would be needful in South America ; and then set themselves to calculate the time the rivers have been employed in excavating the valleys — a task which there is no appearance that they ever have been competent to perform ; seeing that ordinarily tranquil-flowing rivers notoriously *raise* the bottom of the valleys (in my neighbourhood to the extent of many feet since the time of the Romans), and it must be remembered that all these streams, starting at first with so little fall, *must* have been tranquil-flowing streams.

Mr. Boyd-Dawkins remarks that "the general surface of the valleys has undergone but little change since history began, and the excavation by the rivers has been so small as to have *escaped accurate measurement*" (p. 271).

"J'ai fait remarquer que le terrain pampéen se trouve dans les Pampas, et jusqu'au sommet des Cordillères dans les vastes dépressions du plateau bolivien et du plateau de Cochabamba, jusqu'à la hauteur de 4,000 mètres au-dessus du niveau de la mer. Si, *comme l'a cru M. Darwin*, le dépôt des Pampas n'était que le *produit des affluens fluviaux dans un estuaire*, comment s'explique la présence de ce même dépôt dans les plaines et sur les plateaux les plus élevés du monde ? *Je crois qu'il faut entièrement renoncer à cette explication*, puisque des dépôts identiques avec leurs ossemens se trouvent à toutes les hauteurs. Ils ne seraient point dû à des causes partielles, mais bien à des causes générales purement terrestres, et l'on ne peut s'en rendre compte d'une manière satisfaisante, qu'en admettant comme résultats de tous les faits géologiques observés sur le sol Américain, la coïncidence d'effets d'un des reliefs de la Cordillère, avec la destruction complète des grandes races d'animaux qui le peuplaient avant l'époque actuelle et la formation du dépôt pampéen à ossemens, qui paraît recouvrir presque toute l'Amérique méridionale."—*D'Orbigny*, vol. iii. pp. 254, 255.

The Pampas Deposit.

"Cette couche, qui remplit le fond du bassin des Pampas, et compose exclusivement toutes les Pampas proprement dites, occupe une très-large surface arrondie vers le sud ; surface qui n'aurait pas, à elle seule, moins de 38 degrés carrés ou 23·750 lieues carrées de superficie—on dirait, en examinant l'argile pampéenne, qu'elle s'est, en quelque sorte, déposée dans un laps de tems très-court comme le résultat d'une grande commotion terrestre."—*D'Orbigny*, vol. iii. p. 73, also p. 52.

Diluvium.

As only one side of the question has hitherto been presented to the public by the advocates of the fluvial theory, I subjoin McEnery's remarks, under the head *Diluvium* (page 68, *Lit. Kent's Cave*):—

"From an inspection of the compound character of the deposit reposing on the substratum of rubble and enveloping the bones, it is certain

* "The Cave Men of Devonshire," lecture by Mr. Pengelly, Manchester, 1875.—"If there is anything that is clearly established in the minds of those who have studied the phenomena of Kent's Cavern, it is that the cave-earth was washed in through the present entrances of the cavern, which it will be remembered are some 70 feet above the bottom of the valley," &c.

† Boyd-Dawkins, p. 275.

that it is merely the sediment of a fluid that held in suspension clay and gravel which it swept up in passing over the surface of the adjacent country, and threw its waves into the cavern in a tumultuous manner, is manifest from the ruins of the ancient roof and floor, buried in its sediment in the shape of loose cones and slabs of spar, and in the accumulation against the opposite walls of heaps of gravel and bones.

"In the upper gallery they are so thinly dispersed that their existence is only traced by a straggling bone.

"At the foot of the slope splinters of bone and of stones were driven into the crevices of the rock, and the remains of rodentia, accompanied by fine gravel, injected into the chambers of the skulls and long bones, places into which it was impossible for them to have penetrated without the agency of a fluid in violent commotion.

"Fragments of jaws and bones perfectly corresponding, that had been divided, not by the teeth of animals, but by mechanical force, were picked up in the upper and lower gallery at the distance of 70 feet from each other.

"But that it was as transient as it was violent appears from the unrolled condition of the bones, and still further from the state of the *album vetus*. The great majority of it was detained in the narrow strait, where it was deposited between upright walls in heaps, while scattered balls entangled in the mud and perhaps carried down by eddies arising from cavities in the floor, were scattered through all depths; more of it, from its buoyancy, was floated upwards to the surface. The whole must have been reduced to powder, the teeth dislodged from their sockets, and the processes of the bones struck off in the supposition of a long-continued agitation of the mass. It further appears that it subsided by degrees, in proportion as the liquid in which the clay and gravel were suspended escaped through the bottom of the cavern. The large masses of rock and heavier bones sank undermost, just as they are found. Marks of its gradual subsidence before the stalagmite had yet acquired consistence may be traced on the sides of the cavern like tide-marks."

APPENDIX E.

"One such man used to live at Bradford, in the Isle of Skye, who told wondrous tales of the Elan na Fermor (Island of the Big Men), that is, the opposite Isle of Raasay, where huge bones of some extinct race of giants are still shown in the kirk. He told also of the Picts, or little men, whose curious 'beehive houses' built under ground, chamber within chamber, still puzzle the antiquarians in Lewis and Uist; unless, indeed, they have been content to accept Campbell of Islay's suggestion, of the strange likeness between these old houses and those in common use among the little Lapps of the present day. Both are alike sunk in the ground, so that to the passer-by they appear but a grassy conical hillock, with a hole at the top to act as a chimney for the fire, which burns in the centre of the hut, a chimney through which a man standing upright might suddenly thrust his head, greatly to the amazement of the passers-by. Round these huts, say the old Gaelic fairy tales, the little men drove their herds of wild deer, and the little women came forth to milk the hinds, just as at the present day the little Lapps still drive the wild deer down from the mountains, and the little Lapp women milk the hinds and give the traveller reindeer cream in bowls of

birch-wood. And in case any foolish unbeliever should doubt, as some have doubted, the existence of reindeer on Scottish hills, and should venture to suggest that our wild red deer never would submit tamely to be thus herded and driven about, we refer him to the old Orkney saga, which tells how, in the eleventh century, when Harald and Ronald, Earls of Orkney, made peace after their deadly feuds, they came over to Caithness to hunt the reindeer, and they and their merry men feasted abundantly on their venison, and left a great store of bones, both of red deer and reindeer, as a special legacy to Professor Owen, and for the discomfiture of the incredulous, for there the bones remain to this day."—*From the Hebrides to the Himalayas*, vol. i. p. 183, by C. F. Gordon-Cumming.

APPENDIX F.

M. Chabas well observes :—

"Longtemps comprimé dans un cercle trop étroit l'esprit humain a franchi toutes les barrières qu'on lui opposait, et semblable au torrent qui a rompu ses digues, il est répandu sans frein dans toutes les directions. La réflexion et l'étude le ramèneront peu à peu dans la voie normale."—*Etudes sur l'Antiquité Historique, Int.*, p. 2.

APPENDIX G.

In order to complete my library of Cave books, I have, since writing this paper, procured the "Antiquités Celtiques" of M. Boucher de Perthes, and the "Reliquiæ Aquitanicæ" of Messrs. Lartet and Christy. To my surprise I find in the former the works of a man of real genius, who spared neither labour nor expense in the verification of knowledge. He published, in 1838, a work at Paris entitled *De la Création*, and in which he insisted that traces of antediluvian man would sooner or later be found. He rested "this opinion (1) on the tradition of a race of men destroyed by the Deluge; (2) on the geological proofs of this Deluge; (3) on the existence at this epoch of the mammiferous animals (*mammifères*), the nearest to man, and unable to exist except under the same atmospherical conditions; (4) on the certainty thus acquired that the earth was habitable for man; (5) that in all regions, islands or continents, where these great *mammifères* have been found man lived, or had lived . . . and that at the era of the Deluge the race was already sufficiently numerous to leave signs of its passage; (6) these remains of human beings may have escaped the attention of geologists . . . universal belief comes to the assistance of tradition, that evidently a race of men anterior to the last cataclysm, which has changed the surface of the earth, lived at the same time, and apparently in the same places as the great quadrupeds of which the bones have been found."*

Proceeding on this supposition, Mr. Perthes never rested till he had found in what was then called the *Diluvium*, and in that alone (vol. ii. pp. 9, 11, 52), the traces which he sought of human workmanship.

Will our geologists tell us why this fruitful theory has been abandoned for the sake of impossible fluviatile theories and tranquil alluvial deposits?—

* *Ant. Celt.*, p. 3.

LIST OF WORKS CONSULTED.

- "Reliquiæ Diluvianæ." By Rev. W. Buckland, B.D., F.R.S. 1823.
 "Cave-Hunting." W. Boyd Dawkins, F.R.S. 1874.
 "Rude Stone Monuments." J. Fergusson, D.C.L., F.R.S. 1872.
 "Epoch of the Mammoth." J. C. Southall, A.M., LL.D. 1878.
 "Les Premières Civilisations." Par F. Lenormant. 1874.
 "Études sur l'Antiquité Historique." Par F. Chabas. 1873.
 "The World before the Deluge." By L. Figuier. 1867.
 "Primitive Man." By L. Figuier. 1876.
 "Palæontological Memoirs and Notes." By Hugh Falconer, A.M.,
 M.D. 1868.
 "The Antiquity of Man." By Sir C. Lyell. Fourth edition. 1873.
 "Voyage dans l'Amérique Méridionale." Par A. D'Orbigny. 1855.
 "Camden's Britannia." 1695.
 "Géologie et Volcans éteints du Centre de la France." E. Vincent. 1866.
 "Lyell's Principles of Geology." Lyell. 1847.
 "The Literature of Kent's Cavern." Part II. (McEnery's MS.)
 "Kent's Cavern." A Lecture delivered in Glasgow by W. Pengelly,
 F.R.S. 1876.
 "Antiquity of the Cave-Men." By do. do. 1877.
 "The Ancient Cave-Men of Devonshire." Torquay.
 "Notes on Recent Notices of the Geology and Palæontology of Devon-
 shire." By W. Pengelly, F.R.S. Teignmouth, 1874.
 "The Antiquity of Man in the South-west of England." By W. Pen-
 gelly, F.R.S. 1867.
 "The Time which has elapsed since the Era of Kent's Cavern and the
 Cave-Men of Devonshire." By W. Pengelly, F.R.S. Two Lectures at
 Manchester. 1872 and 1875.
 "First Report of the Committee for Exploring Kent's Cavern, Devon-
 shire," presented to the British Association.
 "Second Report." Ditto.
 "Third Report." Ditto.
 "Fourth Report." Ditto.
 "The Time that has elapsed since the Era of the Cave-Men of Devon-
 shire." W. Pengelly, F.R.S. 1873.
 "The Romance of Kent's Cavern." E. Vivian, Teign Naturalists' Field
 Club.
 "Palæolithic Man: a Reality of the Past, or a Myth of the Present."
 By N. Whitley, C.E.
 "The Lapse of Time since the Glacial Epoch." By J. C. Southall
 Vic. Ins.

* * * The italics in quotations are my insertion.

The CHAIRMAN.—I think we must all thank Mr. Howard for his interesting and important paper. It is the more interesting to us when we consider the purpose which, in his own mind, the writer has evidently set before him. He has very well dealt with the conclusions of certain scientific men, who seem to be desirous of calling in question the whole doctrines of religion. They write with what is manifestly a foregone conclusion, and all their observations are tainted with this fact. They are searching for something which they have already condemned in their own mind without sufficient examination, and it is very important that when men are found going forth and calling in question the truths of religion there should be such men as Mr. Howard to show the wholesale manner in which they contradict each other; for, although these men have really no ground to stand upon, they are at the same time very industrious in going about the country and practising upon the credulity of those to whom they lecture, and if their teachings were not called in question, people would be inclined to say they would have been called in question if they were not true, and that these men are great men and true. Consequently, it is, as I have already said, important that men like Mr. Howard should have the opportunity of dealing with these people, as he has just done in the interesting paper we have listened to.

The HON. SECRETARY said—Before the discussion commences I have to read the following communications.* The first is from Professor Challis, F.R.S. :—

“I have read Mr. Howard’s paper with much interest, as it confirms by appeal to facts views which I entertain respecting the date and effects of the Deluge from theoretic considerations.”

* The following letter was received from Mr. Pengelly, to whom an early proof of the paper had been sent. The paper when read did not contain the term “crypt of dates,” and the peculiar nature of the error, the only one alluded to in Mr. Pengelly’s letter, prevented the possibility of its affecting the argument. His letter was read, and is inserted in accordance with an assurance which was given to him. Replies from those whose arguments may be disputed are always encouraged.—ED.

“LAMORNA, TORQUAY, 1st February, 1879. SIR,—Be so good as to convey my thanks to your Council for so kindly inviting me to be present at the discussion on Mr. J. E. Howard’s paper on 3rd inst., and to express my regret that, owing to the very short notice, and a pressure of engagements, it will not be in my power to attend.

“I am sorry that Mr. Howard did not send me his MS., for, though I have not had time to glance at more than a page here and there of the proof you were so good as to forward, I perceive that he has fallen into the error of supposing that he visited the Crypt of Dates in Kent’s Cavern (see page 166), he having confounded that recess with the Cave of Inscriptions, which is in a distant part of the Cavern.

Professor Boyd Dawkins writes as follows :—

“ 11, NORMAN ROAD, RUSHOLME, MANCHESTER,
“ 2nd February, 1879.

“ SIR,—Allow me to thank the Council through you for the interesting paper which you were kind enough to send. I am sorry that my engagements here prevent my being present at the discussion to-morrow. Had it been possible I should have liked to have said that to me the limits of chronology as fixed by years entirely depend upon the written record, and that therefore any speculations as to the number of years which have elapsed outside the reach of history are worthless. But, while holding this, the evidence seems to me satisfactory that man has been in Europe for an enormous period, which bears no relation to the 6,000 years of chronology, because it cannot be measured in terms of years.—I am, my dear sir, yours truly,
“ W. BOYD DAWKINS.”

The last letter is from Mr. S. R. Pattison :—

“ Mr. Howard will not have any difficulty in maintaining his positions so far as their chronological bearing is concerned. The evidence of the caves is no longer quoted in support of indefinite antiquity. The concurrence of testimony brings down the mammalian epoch within the limits of the Ussherian chronology, and the occurrence of proofs of violent action since the commencement of man's dwelling here, altering the levels, and bringing them into their present condition, enables geologists to discard altogether the argument derived formerly from infinitesimally small progressive changes. The Lyellian hypothesis being reduced to its proper dimensions and the fact of a period of disturbance appear to me to take the supposed antagonism between Scripture and geology entirely away.—Yours faithfully,
“ S. R. PATTISON.”

The CHAIRMAN.—I should like to ask Mr. Howard a question which I think has some bearing upon the subject he has dealt with, namely, whether there are not in the caverns referred to a large number of stalactites ?

Mr. HOWARD.—I can find no difference in Kent's Cavern as compared with others that I have visited in Derbyshire and Somersetshire, and many more of which I have read descriptions as found in Germany and elsewhere. It is a cavern filled with stalactites, but there are no grounds on which to

“ The Crypt of Dates was discovered on 7th December, 1868. It was always a difficult spot to reach, and, in consequence of the excavations, it has become impossible for any one to get there without ladders and an amount of risk which few people would care to incur.

“ I am safe in stating that since its discovery in 1868 not so many as a dozen persons have ever entered it, and that Mr. Howard was certainly not one of them.

“ A stalagmitic floor 12 feet thick was found in the Crypt of Dates, but nowhere else in the cavern.

“ I have not had time to ascertain how far Mr. Howard's error may affect his arguments, or whether he has made any other mistakes. I shall hope to take an early opportunity to attend carefully to the paper, and shall take such course respecting it as may seem called for ; but in the meantime I trust to your sense of justice to give the same publicity to this note as to the paper which has called it forth.—I am, truly yours,
“ WM. PENGELLY.”

estimate the lapse of time in any other cavern different from what is seen here.

The CHAIRMAN.—I have asked the question for this reason. The first action of the soluble matter percolating through the roofs of these caverns is clearly to form the stalactite, and this process goes on until what may be called the overflow, which is not crystallized in forming the stalactite, drops to the floor and forms the stalagmite, this formation is rapid in proportion to the quantity of matter held in solution.

Mr. HOWARD.—That which is peculiar or remarkable in Kent's Cavern is the great mass of tufa, which, as shown by Sir Charles Lyell's description, can be formed in a very short time and, as you may see at Clermont Ferrand or in Italy, abundantly. The suggestion is that the tufa varies in its mode of formation from pure stalagmite.

Rev. J. FISHER, D.D.—I consider the paper read this evening a valuable one, abounding in common sense. We can all admit what are shown to be the facts of science, and we delight in the discoveries of scientific men; but we say that there is not a single fact of science which clashes with a single statement of the Word of God, rightly expounded. Moreover, it cannot do so. This paper consists of two parts, one dealing with the Devonshire Caves directly, and the other with the Mammoth. If we admit the idea of uniformity in the natural deposits which have taken place in these caves, then, of course, we have a sort of chronometer; but I suppose that no one now holds this doctrine of uniformity fully and completely.* Therefore, as we are driven from this mode of testing the lapse of time, we have in reality no standard whatever, and those who attempt to measure by the method I have indicated do so by a false standard. The first step to be taken by men of science who wish to prove that they are right in their conclusions, as to the intervals occupied by geological processes, is to show that their standard is correct. It is of no use for one man to say that an inch is deposited in a certain time, and for another man to say the deposit which takes place in that time is seven yards. There is no agreement in these measurements. Let them first agree upon their principle. They may talk as long as they please about the periods that have elapsed, and Sir Charles Lyell may descend from 800,000 to 200,000 years, and someone else may guess 1,000,000, while another estimates 10,000 or 12,000 years. There is no standard to guide us as to who is in the right and who is in the wrong. We are told that there are two openings in one of these caverns, the matter forming the stalagmite coming through these two openings. Who can say that there may not have been ten openings, or any other number? (Hear, hear.) Then, with regard to animals coming into the cave, there is a good deal of room for difference of opinion on this also. Then, again, the rolling of the stones and bones found in the cave

* As a rule, it will be found that many leading geologists, notably Mr. J. Evans, have recently given up the thickness of stalagmite as a measure of time.—Ed.

seems to point to the existence of some very strong current of water, something that you may call diluvial. You need not call it the Noachian deluge, but it is diluvial after all. And with regard to the head of the behemoth, it comes out very clearly that man and the mammoth were co-existent on the earth, and that the mammoth has been upon the earth at a comparatively late period. We find the teeth of this animal in large quantities, some of them not covered by anything of marine formation. Then, again, there are those birch-trees which have been referred to, and which have not yet been fully blotted out, but have been preserved for a long time in the water. You would not suppose them to have been millions of years where they are found with the leaves upon them. Then we find that the animals whose remains have been discovered have been travelling about almost everywhere in great numbers, nor do we see any improvements in the mammal. There he is, and there he was, and the same may be said with regard to man. Man has been exactly the same as far as history or science can trace him, always the same animal, whether cultivated or uncultivated. There is no improvement with respect to him. The species is still the same. In conclusion, I have only to say that I have been very much pleased with Mr. Howard's paper, and I hope Mr. Pengelly will write an answer to it.

Rev. H. BRASS, F.G.S.—I beg to thank Mr. Howard for his able paper. I have long felt it to be a reproach to the scientific world that the extraordinary conclusions as to the immense antiquity of Man arrived at by some of the explorers of Kent's Cavern, have been so long allowed to pass unchallenged. I visited the cavern a few years ago, and though one was somewhat hurried through it, and not allowed much time for examination, I saw enough to make me doubt many of the assertions of the guide, who, by the way, seemed somewhat intolerant of any one who presumed to question the correctness of his conclusions. I could not help feeling that the deposit of stalagmite over a boss bearing (what was assumed to be) the date "1688," was a very precarious and unsatisfactory measure of the rate of its formation in the rest of the cavern; for in one part stalagmite was forming at a rapid rate, in another very slowly, and in some parts it had altogether ceased; and the thickness of the stalagmite floors varies in different parts of the cavern. Moreover, there is every probability that the average rate is continually decreasing, and that a much smaller quantity of water, and much less charged with lime, finds its way into the cavern than in former times. The lower stalagmite floor had been evidently broken through in places, probably by some of the later dwellers in the cave, in their search for suitable bones, and this may possibly account for a few flint implements being found in the lowest breccia. Sir Charles Lyell is not always to be relied on in his calculations. For instance, he gives 35,000 years as the time the river Niagara has taken to excavate its channel; but he actually bases this calculation on the rate of recession of the Falls at their *present width*, about three-quarters of a mile, although he states that the channel of the river for the seven miles of its course below the Falls is only "from 200 to 400 yards in

width" ! (*Principles*, 8th ed. p. 204.) The world has been ransacked of late for proofs of the great antiquity of Man, and the immense lapse of years since any great change took place ; but a number of facts which point to an opposite conclusion have been strangely overlooked ; e.g. the Delta of the Rhone, in the Lake of Geneva, has gained $1\frac{1}{2}$ mile since the tenth century (*Principles*, p. 183), and so has probably taken not more than 3,000 to 4,000 years to form ; and even, allowing time for the filling up of smaller lakes in the upper part of its course, it seems to point to some great and remarkable changes in the configuration of the Alps at no very distant date. We are all very apt to notice only those things that we are looking for. I think, if geologists would only look for traces of the Deluge, and of the comparatively recent introduction of Man upon the Earth, they would find a great many more than they imagine or expect.

Mr. D. HOWARD.—I have read this paper with particular interest because it strikes me as being one of those cases in which this Society has done good service in hitting the uniformitarian theory very hard. I do not think we have any more untrustworthy measure of the lapse of time than the thickness of stalagmite or the length of stalactite, and all the remarks that have been made on this subject in this paper will be fully borne out by a scientific study of the question, which is a very curious study, and deserving of a much more accurate examination than it has yet received. The very condition of the springs which produce the stalactite is often a very important element in the matter. There must be neither too much nor too little of what is held in solution. What is required is the exact quantity of the solvent—carbonic acid—to keep the lime and magnesia in solution till it rests on the floor, and the latter is then given up. You will therefore see that such a close balance as this may be effected by a very minute cause. Allusion has been already made to the quantity of vegetation on the surface above the cavern. Not only will this enable the soil to hold the water longer, but it will provide the carbonic acid required to dissolve the stone underneath ; and even under these circumstances it is difficult to see how this tufa could have formed ; the conditions are so widely different from what are generally met with. It is more usual that tufa forms under water than on the surface of a wet floor. It is most usually formed in a lake or some confined piece of water into which this solution of lime flows, and where it can be deposited. This, as far as it goes, would tend to show that at some time the cave actually was full of confined water into which the carbonic acid solution of lime flowed. All these points require a most careful scientific examination, but there is one thing which is made out most clearly, that this stalagmite is shown to partake of the character of a watch that does not go regularly, thus taking away the value which has been assigned to it as a chronometer. This tends to destroy one's confidence in these kinds of estimates. At Ingleborough you have a cave which was apparently never touched by man or beast since a very remote period, at any rate since the beginning of the formation of this wonderful stalactite and stalagmite. When the cavern was broken into, this very "Jockey's Cap" which is referred to in the paper was

found, and its rapid growth in height from its original dimensions is here noticed. Why should this have begun to form so recently, and have progressed so rapidly, while we are asked to believe in the slow and uniform growth of all the rest of the stalagmite? If we wanted a chronometer this Jockey's Cap would be a very tempting one; but why did it begin at so recent a period? When you have a case in point such as this, a well-known case as to the measurement of stalagmite which began to grow without the smallest reason that can be alleged, it throws the very gravest doubt upon the whole question. The whole subject wants a great deal more examination than it has yet received before the science of the geologist can be regarded as certain. There is one thing that is certain in this controversy, and that is that we cannot calculate dates by any method which is at present in our possession. (Applause.)

Mr. T. K. CALLARD.—I should like to give a case in point. Mr. Clark, writing to *Nature*, in December 1873, calls attention to some stalagmite forming on a gas-pipe. The fact he mentions is worth something because we know how long the gas-pipe has been there. This gas-pipe had been put down in Pool's Cavern, near Buxton, about twelve years before Mr. Clark wrote his letter, and he says that on this pipe there was formed one-eighth of an inch of stalagmite six months after the gas-pipe had been placed there. This, I think, is a good point. Now at this rate of formation the 12 feet of stalagmite for the deposit of which Mr. Pengelly has allowed 720,000 years could have been formed in 576 years. (Laughter.) There is another point in connection with the gas-pipe that goes to confirm the conclusions reached by Mr. Howard, and that is, that the accretion is not uniform. I have brought with me a boss which I had permission to take from the gas-pipe. This boss, I presume, is the same as was referred to by Mr. Clark, for no doubt he would have measured the largest, and this was the largest in the autumn of last year. That would make the period of formation seventeen years, as it was in 1873 that Mr. Clark wrote to *Nature*. When the boss was taken off the gas-pipe it measured one inch and three-sixteenths. What I wish to call attention to is the different rate of formation; as at first, it was forming at such a rate that four years would have given an inch; but subsequently the formation so decreased that it would have taken more than fourteen years to form an inch. Consequently, this boss bears upon points that have been touched upon by Mr. Pengelly, and shows both the rapidity and the want of uniformity in the formation of stalagmitic matter. At the rate at which the formation commenced, when it was first noticed by Mr. Clark, it would, as I have stated, have taken 576 years to form a thickness of 12 feet, but at the rate at which it has been forming subsequently, it would take 2,061 years to make the same thickness, and both these figures are immensely different from those given by Mr. Pengelly, while they are sufficiently at variance with each other to prove the correctness of Mr. Howard's position as to the non-uniformity of the accretion of stalagmite.

The CHAIRMAN.—I think that those scientific men who are attempting to establish a law from what they assume to be a time rate, must be brought

face to face, in the first instance, with the necessity of establishing a law of uniformity. If you put it to them, and venture to say that for a hundred thousand years there has been the same order of things, the same sequence of events, the same operations, the same springs leaving the same deposits, they will say, "No." Of course, then the whole theory breaks down. Look at the deposition of mud for instance. The theory of the Nile mud is broken down because they find modern pottery there. We know that in the case of mud, where it is almost fluid because of much water with it, anything heavy or of greater specific gravity than the mud will sink down, and in this case they found pottery, from 60 to 70 feet deep, at a very recent date. Going up the Hooghly I observed the whole of the bottom of the river in a state of quicksand. If a vessel takes the ground there, she goes down. I have seen a vessel that has sunk in that river until only its upper masts have been visible, and that took place in a few hours. What, then, is the use of talking about ascertaining the chronology of the earth from the deposition of mud when this state of things is going on? Then, with regard to the forests that have been alluded to. I remember starting from Berne for Paris, no rain had then commenced; before we got to Paris, whither we went, the rains had descended from Switzerland, sweeping away houses and bridges. When we arrived at the French capital we found that there had been a 12 feet rise in the Seine, and on the following day one of 18 feet. I remember once, when in the tropics, in charge of a water-party, we had our water-casks rolled to a stream to get water. It was a beautiful day, with the sun shining brightly, but rain had fallen the day before, and it came down with such force that it swept us all out to seaward, casks and all; we were swept off our legs, and our tent was carried away with its contents to seaward. That is only an instance showing how easily great changes may be made by natural causes. Is it not possible that the rate of deposits like the formation of stalagmite may be influenced by the interference of currents, or the drawing-off of the water of springs? We all know how the water of springs in a particular district disappears and re-appears again; how at one moment the springs are saturated with one kind of mineral, and at another time with another. Before they can establish a claim for uniformity my opponents are bound at the beginning to prove that during the deposit of this stalagmite there has been no change in the circumstances. It is in this way that one must fight with those philosophers who claim to have all the facts on their side, and say that we have none on ours. It should be recollected that it is some of these very men who are arguing from geological deductions who are their own greatest opponents, and who entirely overthrow one peculiar system in endeavouring to establish their own. I hope the meeting will permit me on its behalf to thank Mr. Howard for this very important paper, which will no doubt be published together with the discussion upon it; and I trust that our friends will furnish themselves with copies, so that it may be circulated amongst the middle classes and those who are being led away by the fallacies with which it deals. (Hear, hear.)

Mr. HOWARD.—I have to thank you very much for the kind and flattering way in which you have received my paper. I do not think I have any explanations to make, but it may be well to say that I have endeavoured in my paper to trace out the progress of *bonâ fide* research. It has been a very interesting subject to me, and I trust that I have made my position sufficiently clear.

The meeting was then adjourned.

INTERMEDIATE MEETING, MARCH 17, 1879.

THE REV. R. THORNTON, D.D., VICE-PRESIDENT, IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

ASSOCIATES :—The Ven. Archdeacon Williams, New Zealand ; Rev. W. D. Ground, London.

Also the presentation of the following Works for the Library :—

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| “ Proceedings of the American Geographical Society.” | <i>From the same.</i> |
| “ Supernatural Revelation.” By Professor Birks. | <i>Ditto.</i> |
| “ Pauliciens Bolgares.” By M. A. Lombard. | <i>Ditto.</i> |

A paper “ On the Genesaic Theory of Creation,” by the Rev. A. Stewart, M.D., was then read by the Rev. T. M. Gorman, the author being unavoidably absent. A discussion ensued, in which the following took part :— J. E. Howard, Esq., F.R.S. ; Rev. J. Fisher, D.D. ; R. and L. Dibdin, Esqrs. ; Rev. T. M. Gorman, M.A. ; D. Howard, Esq., F.C.S. ; T. K. Callard, Esq., F.G.S. ; Rev. J. W. Buckley, M.A., and the Chairman.

The meeting was then adjourned.

ORDINARY MEETING, APRIL 7, 1879.

THE REV. R. THORNTON, D.D., VICE-PRESIDENT, IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

ASSOCIATES :—Rev. D. Fotheringham, London ; Rev. R. Lamplough, South Africa ; Rev. P. Tearle, South Africa ; J. C. Pinkerton, Esq., South Africa.

Also the presentation of the following Works for the Library :—

“Proceedings of the Royal Society.”	<i>From the same.</i>
“Proceedings of the Royal Geographical Society.”	<i>Ditto.</i>
“Warwickshire Natural History Society Report, 1878.”	<i>Ditto.</i>
“Genesis and Migration of Plants.” By Dr. Dawson, F.R.S.	<i>Ditto.</i>
“Everlasting Punishment.” By Mrs. McLaughlin.	<i>Ditto.</i>

The following paper was then read by the author, who, owing to indisposition, was assisted by the Rev. T. M. GORMAN :—

*THE CONTEMPORANEITY OF MAN WITH THE
EXTINCT MAMMALIA, AS TAUGHT BY RECENT
CAVERN-EXPLORATION, AND ITS BEARING
UPON THE QUESTION OF MAN'S ANTIQUITY.*

By THOS. KARR CALLARD, F.G.S.

IN the paper that I am about to read to you to-night I will confine my attention exclusively to British caverns, because they have had the advantage of more careful and scientific exploration than any others.

The senior members of the Victoria Institute may remember the interest that was excited in 1821 by the accidental discovery of a cavern in Kirkdale, Yorkshire, containing unusual animal remains; but especially those of the hyæna. The exploration was conducted by Dr. Buckland, afterwards Dean of Westminster, a geologist of much celebrity. In one cavern he found remains of as many as seventy-five hyænas. How was this to be accounted for? Had the explorer come across an ancient

menagerie, or were these the animals which in former days roamed over the wolds of Yorkshire?

The interest belonging to this discovery had not died out, when it was announced that at Torquay, in Devonshire, similar remains had been found in Kent's Cavern beneath a stalagmite flooring. This Devonshire cavern had been frequented by picnic parties for some centuries past, but it was not till 1825 that any one knew what was beneath the stalagmite. From that time until 1840 the Devonshire naturalists were every now and then surprised by having some strange bone or unusual tooth brought under their notice. These relics were dug up by Mr. McEney, a Roman Catholic priest, to whom this cavern had become a favourite place of research.

In 1840 the cave was explored with more system by Mr. Godwin Austen, who identified the remains of the hyæna, the bear, the woolly rhinoceros, and the mammoth. These remarkable remains, now well authenticated, made the naturalist still more eager for fresh exploration, an opportunity for which again presented itself by the discovery, in 1858, of another cavern in the face of a limestone hill overhanging the little harbour of Brixham.

Cavern-research had now become of sufficient importance to be taken up by the Royal and the Geological Societies. These societies appointed a committee from amongst their number to systematically explore this cavern at Brixham, and to determine the species of animal to which each bone belonged that should be found therein. The same arrangement was also come to for the exploration of Kent's Cavern.

The committee numbered amongst them some of the leading geologists and palæontologists of the day. And the superintendent appointed was Mr. William Pengelly, F.R.S., now so well known for his untiring labours in cavern-research. The work was no sinecure, for when Professor Dawkins went to Kent's Cavern to determine the bones, there were no less than 50,000 labelled and set aside for examination, with a complete record of the exact spot where each bone was found.

Not only did the explorers find the bones and teeth of animals that had not lived in this country within the memory of man, but also those of animals supposed to have been extinct long before man's creation. They also met with the remains of animals now found only amongst the snows of the North, mingled with those whose habitat is the sunny South.

Whilst these cavern revelations were being made in England, at Abbeville and Amiens, in Piccardy, bones of some of the same extinct mammalia, notably those of the mammoth and the Siberian rhinoceros, were being dug out of the gravel-beds of

Moulin Quinon and St. Acheul, and with them chipped flints, so chipped that M. Boucher de Perthes, the antiquarian, of Abbeville, and Dr. Rigollot, of Amiens, were convinced that they were the work of man, and if so, pointed to the contemporaneity of man with these extinct mammals. Whether these chipped flints are, indeed, the work of man, or whether the chipping is to be attributed to accidental fracture of the flint in the *mêlée* which brought them where they are found, is a question which it will not be necessary to enter upon now, as in Kent's Cavern the more palpable works of man, such as bone implements, are found associated with these extinct mammals.

But all questions respecting both the contemporaneity of man with the extinct mammalia, and also the age of man, appeared for a time as if they were going to be set at rest by the discovery of a cavern near Settle, in the West Riding of Yorkshire, nine hundred feet above the Ribble, in the limestone hill known as King's Scar. The cavern was discovered as far back as the day of her Majesty's coronation, from which circumstance it was named Victoria Cavern.

The early finds were those which more deeply interested the antiquarian. They consisted of fragments of pottery; of Roman coins of the reign of Trajan and Constantine; of spindle whorls and beads; of bronze ornaments and ladies' brooches, the latter beautifully enamelled in red, blue, yellow, and green; they were delicate in workmanship, and of graceful design. The treasures pointed to the explanation that this cavern, away up on the bleak hills, had been a place of refuge to some Romano-Celtic families of the first few centuries of the Christian era.

More recent excavations in Victoria Cavern have shown that it had had in times still more remote, other occupants than Romano-Celts, for the workmen on digging below the first floor came upon another, thickly strewn with bones of a different character to those with which they had been familiar.

Amongst the bones, the osteologist found those of the hyæna, grisly bear, hippopotamus, *Bos primigenius*, woolly rhinoceros, and the mammoth. And following this bone-bed beneath the clay to the outside of the cavern, a portion of a bone was discovered which presented some difficulty in its determination. It was therefore sent to London to Professor Busk, who at first considered it to be the fibula of a small elephant, with which decision the late Mr. James Flower (articulator of the College of Surgeons) agreed; but after some months Professor Busk gave it as his altered opinion that it was *human*, and read a paper upon the bone before the Anthropological Institute, and on another occasion referred to it as representing "one of the earliest extant specimens of humanity."

At the same time the clay under which the bone was discovered was decided by the explorer to be glacial clay.

If these two decisions had proved correct, the contemporaneity of man with the extinct mammals was put beyond question, and equally so the antiquity of the man to whom the bone belonged. It was not a flint implement this time, which might admit of some doubt, nor even a bone needle, but a supposed part of the man himself, that was now found with woolly rhinoceros and mammoth.

A report was read upon the subject by Mr. Tiddeman, at the British Association meeting at Belfast, in 1874; and from that time it was generally accepted as a settled truth that man had lived before the great Ice age in association with the extinct mammals whose remains were found in this bone-bed.

In the autumn of 1876 I visited the cavern in company with Mr. Jackson and a gentleman connected with the Leeds press. Mr. Jackson it was who commenced the exploration when the entrance to the cave was first discovered; he was also thoroughly acquainted with its subsequent working. We were indebted to his kindness for much valuable information.

One thing led me to doubt the glacier having deposited the clay after the bone in question had been left there,—it was the laminated condition of the clay. The model on the table shows a section of the deposits at the entrance of the cavern. The bone was at this spot (*pointing to the model*) with laminated clay both below and above it; and next you will observe two strata of stalagmite. The lamination appeared to me to imply an intermittent deposit, the result of a succession of wet and dry seasons, whilst the stalagmite gave evidence of other and greater dividing periods,—a condition of things which I should not expect to find with glacial clay *in situ*.

At my suggestion our party of three climbed to the top of the limestone rock that overhung the entrance to the cavern, from which spot we saw that the hill sloped up full 300 feet more, and on this sloping plateau we found several stranded boulders that had travelled on the ice from other elevations. Where the boulders were, there, doubtless, the boulder clay had been; and I thought that I now saw the explanation of the laminated clay below.

If, instead of the glacier having left the boulder clay at the mouth of the cavern, the glacier had come up higher (which the boulders at the top proved that it did) and had deposited the clay upon the sloping plateau above, the winter rains disturbing the clay would carry in suspension portions of it from time to time over the precipice, which drying after the water subsided, would produce the laminæ observed, and this would

have taken place exactly where the bone was found, which was not really in the cavern, but just at its entrance.

If this explanation is admitted, then the boulder clay is but *remanié*, and may have been deposited long after the glacier had ceased to move in the Ribble Valley. My firm conviction is that neither the bone in question, nor any of the other bones in this deposit are pre-glacial.

So much for the age of the bone, but now a word or two more about the bone itself. Prof. Boyd Dawkins, in his interesting book on Cave-hunting, p. 121, says "that the comparison of the bone with a specimen in the possession of Prof. Busk removed all doubt from his mind as to its having belonged to a man who was contemporary with the Cave Hyæna, and the other Pleistocene animals found in the cave." And again, referring to the bone, he says, p. 411, "The man to whom it belonged was probably devoured by the hyænas who dragged into the den the Woolly Rhinoceros, Reindeer, and other creatures whose gnawed bones were strewn on the floor."

But Prof. Rupert Jones gave us a more minute description of the bone and of the relations of the man to whom it belonged. In a lecture on the Antiquity of Man, delivered April 26th, 1876, he says that the bone "is platycnemic in character, that is, it belonged to some sharp-shinned race, such as are found in the old deposits at Gibraltar, Central France, and North Wales."

And so the evidence appeared to stand until 11th April, 1877, when Prof. Dawkins, in concluding a paper before the Geological Society, with a candour quite characteristic, expressed his growing doubt about the human origin of the bone, and at a conference convened by the Anthropological Institute in the following month, to consider "the present state of the question of the Antiquity of Man," Prof. Dawkins then gave his reasons for believing that instead of the bone being human it was a portion of the fibula of a bear. The reasons were judged conclusive, for almost without exception the palæontologists then present were prepared to give it up. Prof. Busk rose to say, respecting the bone, which he facetiously designated the bone of contention, that he "was perfectly open to be convinced that it might be ursine." And at the late meeting of the British Association at Dublin, a communication from Prof. Busk was read, in which he says, "I have received from Toulouse two ursine fibulæ of abnormal size, which in the part corresponding to the fragment of contention so closely resemble it as to leave little room for doubt that the latter is, or may be, in reality ursine, and not human; I am disposed, therefore, to acknowledge

that my diagnosis of the Victoria Cave bone was in all probability erroneous.”*

The Committee with equal candour gave publicity to their decision that any argument based upon the bone's supposed character must be unreservedly given up.

I hold in my hand a human fibula, and have coloured that portion which corresponds to the fragment which has given rise to so much discussion. It is but six inches in length and without any articulation.

And here is another human fibula marked in a similar way. This one belonged to a man of large stature. You will observe how different the two are in form. Such a fragment of a bone so variable will leave it less a wonder that a mistake should have been made, than that there should have been the venture to determine a species from such a fragment.

We are left, then, where we were before, to argue the contemporaneity of man with the extinct mammalia from his handiwork, and not from the presence of any portion of his frame.

But the next and latest case of cavern exploration introduces a new feature into the argument.

On the estate of the Duke of Portland, at the north-east of Derbyshire, there is a beautiful dale known as Creswell Crags, where the shadows of the adjacent rocks, with their rich foliage, are reflected in the clear waters of an artificial lake that separates certain natural caverns in the limestone. Three of these caverns have lately been explored by the Rev. J. M. Mello, F.G.S.,—the Pin-hole and Robin Hood's Cave on the left side of the lake, and Church Hole on the right.

Within these caverns and on the surface were found ornaments of the same age and character as those in the Victoria Cavern, and on digging beneath the surface into the cave-earth Mr. Mello met with the bones of lion, bison, hyæna, tooth of machairodus, and also with the presence of woolly rhinoceros and mammoth; and associated with these remains were two or three fine bone implements, a perfect bone needle, some awls, a kind of gouge,† and an oval ironstone implement; and lastly, to the great joy of the finder, he extracted from this cave-earth, in the presence of Prof. Dawkins and Mr. Tiddeman, a bone which had scratched upon it the outline of a horse's head.

We have now, then, got overwhelming evidence of man's existence in Derbyshire at the same time as the woolly rhinoceros and mammoth. But now comes the question, what order of man? To what period did he belong? Most assuredly it was

* *Daily Express*, Dublin, August 17, 1878.

† *Quarterly Journal Geological Society*, vol. xxiii. p. 586.

not Palæolithic man. Palæolithic man, if such a being ever existed, was a low savage, incapable of anything higher than simply chipping a flint for his weapon; when he reached the capacity of smoothing that weapon we had then arrived at the Neolithic age. Mr. Sydney Skertchley, F.G.S., who is now writing upon the subject of "The Antiquity of Man," says of the Palæoliths that they "were more degraded than any known savage tribe."* But these men of Creswell Caves were workers in bone, artificers who used awls and gouges. They knew the use of the needle, and also wrought in iron,† for they left behind them one oval ironstone implement, and two more leaf-shaped, all worked to approved forms.‡ There were also artists amongst them, for one of them had left his artistic product in the cavern, and Professor Boyd Dawkins, as an art critic, describes the work as follows:—"The most important discovery of the handiwork of man is the head and fore-quarters of a horse incised on a smoothed and rounded fragment of a rib, cut *short off* at one end, and broken at the other. On the flat side the head is represented with the nostrils, and mouth, and neck carefully drawn. A series of fine oblique lines show that the animal was hog-maned. Indeed, the whole is very well done, and is evidently a sketch from the life."§

Is this, Mr. President, the kind of product that you would expect from a Palæolithic savage?

Observe the artist's care in preparing his tablet. The bone is first "smoothed and rounded." It is "cut short off at one end." I particularly noticed in the bone the clean cut, and will ask the members of this Institute, could you cut a bone clean through with a Palæolithic implement? It looks much more like having been done with a saw. I don't say a metal saw—saws have been made of flint; but there has been no proof of saws in Palæolithic times; and, then, observe that "the engraving is evidently a sketch from the life," and that the living model was a *hog-maned* horse.

Horses are not hog-maned in a state of nature, hog-manes are cut manes. The artist, then, that drew this horse lived at a time when horses' manes were cut to fashion; but Palæolithic times were by no means fashionable times either for men or horses.

It is also evident that you could not cut horses' manes with

* *English Mechanic and World of Science*, March 28, 1879, p. 49.

† I accept the correction of the Rev. J. Mello made at the meeting. I ought to have said wrought on *ironstone*, instead of wrought in *iron*.

‡ *Journal of the Anthropological Institute*, November, 1877, p. 153, *Quarterly Journal Geological Society*, 1877, pp. 582, 586.

§ *Quarterly Journal Geological Society*, 1877, p. 592.

Palæolithic implements. To make a hog-maned horse you must *clip* the mane, and this suggests a pair of shears, which, as far as I know, are always made of metal; and until Mr. Mello or Prof. Dawkins find some stone shears I shall certainly believe that these hog-maned horses lived not in the Palæolithic, but in the metal age. I quite agree with what Professor Dawkins says about the careful drawing of the nostrils, and mouth and neck, and that the whole is well done, so well done that its very excellence is an *à priori* argument that Palæolithic man did not do it.

I am then quite prepared to accept the proof afforded by Creswell Caves of the contemporaneity of man with the extinct Mammalia—but not of palæolithic man.

I know that it has always been assumed that *Rhinoceros tichorinus* and mammoth became extinct at so remote a period that any remains of man found with them are at once pronounced palæolithic. Mr. Mello and Prof. Dawkins always speak of the Creswell Cave men as palæolithic on that account. And Mr. Pengelly says, “Whilst a geologist would hesitate to pronounce a deposit of palæolithic age, merely because he had found in it a solitary unpolished flint implement, his hesitation would vanish in a moment if he also detected a relic of the cave-bear or woolly rhinoceros, or any other extinct mammal.* Mr. Skertchley places the Palæolithic fauna prior to the formation of the English Channel, and at the time when the German Ocean was a fertile plain.

When, therefore, the remains of man are found with these extinct mammals, the antiquity of man is accepted as a matter of course.

Now the remote date at which *Rhinoceros tichorinus*, mammoth, and the cave-bear became extinct is one of those supposed facts that it would be more in accordance with science to prove rather than to assume.

It must also be remembered, that when the geologist speaks of the antiquity of man he does not mean what would be meant by the Egyptologist by that term. Chevalier Bunsen claimed for the human period 20,000 years, but the geologist is thought very moderate who asks for 200,000.

There is a tooth of *Rhinoceros tichorinus* on the table, and also one of mammoth; they both came from the caves under consideration.

I do not know how long such teeth will last, but certainly there is nothing in their appearance that would lead me to say that they are 200,000 years old, or older than the English Channel or the German Ocean.

* *The Flint and Chert Implements in Kent Cavern*, p. 31.

I think the time has now fairly come to ask calmly the question, whether finding the works of man in association with *Rhinoceros tichorinus* and mammoth, instead of proving man's great antiquity, does not rather prove the more recent extinction of these mammals, seeing that it is now found that they lived when men made polished bone needles, hammered out iron implements, drew horses' heads, and with metal shears cut their flowing manes.

We will now take a backward glance, and see how the previous evidence stands respecting the place in history of some of the best known of the extinct mammalia.

From the evidence afforded by the Victoria Cavern, Mr. Tiddeman thought he had proof of the presence of man, independently of the bone now handed back to the ursine family.

Mr. Tiddeman called attention to two bones with marks upon them, which indicated, to his mind, the work of man. These bones were found with the extinct mammalia; but on their examination at the Anthropological conference, it was suggested that the marks, if indeed cut by man, had been cut with a metal instrument; if so, the evidence would not be worth much in sustaining the doctrine of man's antiquity. But whatever were the doubts about the marking on the bones, of this, about one of them there appeared to be no doubt in the minds of competent authorities,—namely, that it was the rib-bone of a goat; and Mr. Tiddeman says of the goat, that it certainly had appeared in Victoria Cave in association with the remains of hyæna, *Elephas antiquus*, and *Rhinoceros leptorhinus*, showing that these extinct animals had not died out in Yorkshire when the goat lived amongst its crags and scars. Now the modern origin of the goat is distinctly recognized by osteologists, and was unknown in Europe before the Neolithic age.*

The goat, then, gives us the clue to the age of his associates.

If we now go back to Kent's Cavern, Devonshire, where Mr. Pengelly has constructed a chronology from the cave deposits, we find a granular stalagmite that divides a layer designated the Black mould, from another denominated the Black band. The black mould represents the modern period, whilst the black band, together with the cave-earth, are the storehouse of antiquity. The granular stalagmite is then the supposed dividing-line between the far past and the present.

Whilst satisfied with such division in the main, I must yet remember that the hyæna, rhinoceros, elephant, and bear, were found in the same foot of *cave-earth* with the bat and rabbit in the excavation of Smeedon Passage. Rabbit was also found in

* Prof. Dawkins, *Macmillan's Magazine*, December, 1870.

association with rhinoceros and bear in that part of the sallyport named the Islands.—*British Association Report*, Edinburgh, 1871.

And in the cave of *Rodentia* in the second foot of cave-earth was found a tooth of *sheep*, with the teeth of *hyæna*, rhinoceros, bear, elephant, and lion.

Also, in the charcoal cave tooth of *sheep* was again found with *hyæna*, rhinoceros, and bear.

And in Long Arcade remains of *pig* were found, with rhinoceros, *hyæna*, and mammoth, in the undisturbed *cave-earth*.*

If, then, these extinct mammals lived on till the time of the bat, rabbit, pig, and sheep, we must not attempt to draw the line too sharply between the palæolithic fauna and the present.

I would now direct your attention to the sixth report of Kent's Cavern, read by Mr. Pengelly at the British Association Meeting in Liverpool, 1870. He says, that "in exploring the North Sallyport, the overlying black mould yielded potsherds, marine shells, and bones (chiefly modern, but a few of *extinct* animals), the astragalus of the rhinoceros being the most important of the latter." You will observe, then, that bones of *extinct* animals, and notably the knuckle-bone of the extinct rhinoceros, was found, not only above the granular stalagmite but in the black mould, mingled with the bones of modern animals and with potsherds.

Now if we turn to Dr. John Evans' account of the cavern, we shall learn something more about these potsherds. He says in his valuable work upon "Stone Implements in Great Britain," that above the stalagmite, and principally in the black mould, have been found a "number of relics belonging to different periods," amongst which relics he mentions pottery; and then describes the pottery, some of it as "distinctly Roman in character," whilst some of it belonged to pre-Roman times. † *Rhinoceros tichorinus* lived, then, in Roman or pre-Roman times, and left his knuckle-bone amongst the pottery of that period. How is it, then, that we are asked to believe in man's great antiquity on the ground of man's remains being sometimes associated with those of this extinct animal? Clearly, in the case before us, the contemporaneity only proves that man lived some 2,000 or 2,500 years back, which no one doubts.

And this evidence is not unlike that of Creswell Caves, for Mr. Mello in his first paper upon their exploration read before the Geological Society, June 23, 1875, tells us that in the *surface* layer of Robin Hood's Cave he found several molars of

* *British Association Report*, Belfast, 1874.

† *Stone Implements in Great Britain*, pp. 445, 446.

Rhinoceros tichorinus and some hyæna teeth; and continues to say the upper part of the floor of this cavern also contains a small piece of Samian ware, showing an ornamental rim, and with this two or three pieces of a coarse earthenware vessel; a few recent bones of sheep were also found here.*

As in Devonshire, so in Derbyshire, *Rhinoceros tichorinus* is found amongst the pottery; the legitimate inference is that he was contemporaneous with the potters, Roman or pre-Roman, or Samian; also that he lived when the modern sheep browsed in Creswell dale.

Again, in the second report upon the caves, read before the same society, April 5th, 1876, reference is made to blasting the stalagmitic breccia which covered the cave-earth containing the bones and implements. In this breccia were found teeth of both rhinoceros and hyæna.†

And Professor Dawkins in his table of contents of Robin Hood Cave, under the head of Upper Breccia, enumerates the jaws and teeth as follows:—1 specimen of Irish elk; 1 of wild boar; 3 of horse; 2 of *Rhinoceros tichorinus*, and 6 of cave hyæna.‡

And in Mr. Mello's third report, read April 11th, 1877, he says, "The few remains found in the breccia consisted, as before, of bones of the hare, a few teeth of the larger pleistocene mammalia, *Rhinoceros tichorinus*, hyæna, bear, horse, &c.§

Prof. Dawkins in his paper, read the same evening, says "that the breccia of the previous exploration turned out to be a mere local deposit, which was represented in other parts of the cave by the upper strata of cave-earth."|| And in his paper at the conference, May 22, 1877, after describing the bone awls, needles, sketch of horse's head, and associated mammalian remains of the cave-earth, he says that "above the strata containing these remains was a layer of stalagmite ranging from one foot to a few inches in thickness."¶

Wherever the stalagmite, or stalagmitic breccia existed, it was always above the cave-earth; and where they did not exist, the upper stratum of cave-earth was their equivalent. Whatever, therefore, was found in this superincumbent layer of stalagmite, or in the stalagmitic breccia, or their equivalent, the upper stratum of cave-earth, must of necessity be more recent than the contents of the cave-earth below them, the upper deposits having been the last formed.

* *Quarterly Journal of Geological Society*, vol. xxxi. p. 683.

† *Ibid.* vol. xxxii. p. 242.

‡ *Ibid.* p. 247.

§ *Ibid.* vol. xxxiii. p. 581.

|| *Ibid.* 590.

¶ *Journal of Anthropological Institute*, vol. vii. p. 154.

The evidence then clearly afforded by the Creswell Caves is, that *Rhinoceros tichorinus*, cave hyæna, and bear lived on to a more recent date than the men who made the bone awls, bone needles, and the engraver who incised the horse's head, for they are found above them, whilst the two species rhinoceros and hyæna had not ceased to exist at the time when ornamental Samian pottery was either made in Derbyshire or imported from Samos. How then can the contemporaneity of man with the extinct mammalia prove man's antiquity?

Let us now return to the Devonshire rhinoceros, which in Kent's Cavern left a portion of his frame amongst the Roman and pre-Roman remains.

I think we shall find that he did not so far outlive his congeners as to be a curiosity in his day, for not only his brother rhinoceros but also the cave-bear, cave-hyæna, and the mammoth, not content with the period of the cave-earth and black band, they had splashed their way into the cavern, or had been dragged in by some of their companions after a foot or more of the upper stalagmite had been formed, for their remains were found nearly on the surface, covered only by an inch and a half of this stalagmitic substance. Mr. Pengelly produces the case to prove the very slow formation of the stalagmite, but he must forgive me for drawing another lesson from the fact, and that is, the more recent existence of the mammals referred to.

I will give the passage in Mr. Pengelly's own words, as I shall have to refer to it again. Mr. Pengelly then says, in an address to the Devonshire Association for the Advancement of Science, July, 1874:—"I have found teeth of the cave-bear, cave-hyæna, the mammoth, and the tichorine rhinoceros so very little below the surface of the stalagmite in Kent's Cavern that more than an inch and a half at most of calcareous matter had not accumulated there since they were lodged where they were met with, whilst below them was a floor of the same material a foot, and sometimes much more, in thickness; and the situation was such as to place it beyond all doubt and question that they had not been dislodged from an older deposit and re-inhured."*

This is a good case for our investigation. An inch and a half of stalagmite, we learn, divides the remains of four of the most important species of extinct mammalia from the astragalus of rhinoceros found in the black mould containing Roman and pre-Roman pottery. We have, then, but to learn how long that inch and half took to form to enable us to determine how far removed in time were these mammals from the Roman or pre-Roman period. We have not much data from which to

* *Notes on Palæontology of Devonshire*, W. Pengelly, p. 21.

calculate the rate of stalagmitic formation; it is a subject that has only lately engaged much attention, but we will make use of what we have.

Mr. John Curry had observed $\frac{3}{4}$ of an inch which had formed on the edge of some deal boards used in connection with the working of a lead-mine at Boltsburn, near Durham. These boards, he knew, had only been there fifteen years. The particulars will be found in *Nature*, December 18th, 1873. Mr. W. Bruce Clarke called attention to one-eighth of an inch of stalagmite having formed on a gaspipe in Poole's Hole, near Buxton, six months after the pipe was placed there. It was so placed in March, 1861, eighteen years back. Since then the stalagmite boss has increased to $1\frac{3}{16}$ inch; and on the 24th of October, 1878, I obtained permission from the proprietor of the cavern, Mr. Redfern, to remove the boss, which I place before you to-night.

I have also an iron nail which had been left by the workmen in a forsaken lead-mine, called Rackets, on the road from Buxton to Castleton. The nail projected from a plank, and intercepted the drip from a stalactite. It has a delicate casing of stalagmite, a quarter of an inch in thickness. The branch of the mine in which this nail was found February, 1877, was worked in 1805; consequently the stalagmite must have formed in 72 years.

There were also careful measurements made by Mr. James Farrer in Ingleborough cavern in Yorkshire, in 1845, which, compared with those afterwards made by Prof. Boyd Dawkins on the same spot in 1873, showed an increase at the rate of more than a quarter of an inch in the year.

If the above-named cases were to be made the data for calculating the $1\frac{1}{2}$ inch of stalagmite which divides the mammalia in question from the pre-Roman period, the Boltsburn case would fix the time at 30 years. The first observation in Poole's Cavern would lead us to accept six years for the time employed. But the accretion has not been uniform, for since then it has only increased at a rate that would require about 22 years to form the $1\frac{1}{2}$ inch under consideration. Whilst, in the case of the nail before us, 432 years would be employed in producing the same amount of deposit; but that of Ingleborough would only indicate five years.

Of course I do not say that any of these cases are to decide the time required for stalagmitic formation, but they show that it is not necessarily so slow a process as we had been led to think. Mr. Pengelly very justly asks, "Why must the rate of accretion in Ingleborough Cave be taken as the measure of other caves?" And he says that "it is unsafe to use the rate

at which stalagmite accumulates in one branch of a cavern to measure the time required by the stalagmite in any other branch of the *same* cavern, and that consequently, even if it had been uniform, the rate of the growth of the jockey-cap of Ingleborough Cave cannot be applied as a chronometer in the case of any other cave.* Very true, and we will bear this truth in mind.

Mr. Pengelly's estimate of the rate of stalagmitic deposit in Kent's Cavern is $\frac{1}{20}$ of an inch in 250 years.† This computation is made from the deposit upon an inscription on a boss of stalagmite at the entrance to the "Cave of Inscriptions," which inscription bears date about that number of years back. And Mr. Pengelly says, as the result, that "I am content with the modest hypothesis of 5,000 years for each inch of stalagmite."‡ If so, although the estimate for time is 250 times greater than that for the stalagmite at Boltsburn, more than 300 times greater than for the boss before you from Poole's Cavern, and 1,250 times greater than that at Ingleborough Cavern, yet this estimate of $\frac{1}{20}$ of an inch in 250 years would only make the four species of extinct mammalia in question 7,750 years older than the pre-Roman pottery in the black mould, for $\frac{1}{20}$ of an inch in 250 years is equal to $1\frac{1}{2}$ inches in 7,750 years.

For the black mould Mr. Pengelly only claims about 2,000 years. He says, in a lecture delivered in the City Hall, Glasgow, upon "Kent Cavern and its testimony to the Antiquity of Man," "They found in the first deposit, or black mould, many artificial objects . . . that go back to the Roman and pre-Roman times; hence we come to the conclusion that the black mould, or uppermost deposit, is worth 2,000 years at least."§

If, then, I were to admit (which I do not) that the stalagmite has been uniform in its accretion, and that Mr. Pengelly's estimate of 1 inch for 5,000 years is the correct one, it would only bring us to this conclusion, that 9,750 years from the present time cave-bear, cave-hyæna, *Rhinoceros tichorinus*, and mammoth lived in the neighbourhood of the present Torquay.

* *Note on Recent Notices of the Geology and Palæontology of Devonshire*, part i. p. 21.

† *Ibid.* pp. 24, 25.

‡ Mr. Pengelly ought to be satisfied with 3,680 years, for it was as far back as 1872 when the estimate was made, and the inscription from which it was made was that of "Robt. Hedges of Ireland Feb. 20: 1688" which would be but 184 years for the accretion of $\frac{1}{20}$ of an inch; or 3,680 years for an inch. See Mr. Pengelly's lecture at Manchester on Kent's Cavern, December 18, 1872.

§ *Kent Cavern, its Testimony to the Antiquity of Man*, December 22nd, 1875, p. 17.

The contemporaneity of man, and the extinct mammalia as an argument for man's antiquity is virtually given up, if it is admitted that these mammals were not extinct 9,750 years ago, and yet I can reach no other conclusion from Mr. Pengelly's own estimate of stalagmitic rate of accretion applied to Mr. Pengelly's own statement of facts.

We must now ask a question about the uniformity of stalagmitic accretion,* and we shall be helped in that inquiry by Mr. Pengelly's own description. It is as follows:—"The roof of the cavern is of limestone, and through it in rainy weather the water percolates slowly in most cases, but sometimes more rapidly. That water contains carbonic acid. It is by that carbonic acid that the water dissolves the limestone which constitutes the roof. It reaches the inner surface of the roof, and hangs there as a drop. You come into the cavern and hear a drop here and a drop there, and you know what process is going on. The limestone has been dissolved overhead, and as the water falls it brings a particle of the limestone to the floor, where it is precipitated. It sooner or later forms a little boss, more or less conical; thence it flows away, and meeting that flowing from other such bosses, a sheet is ultimately formed, which covers the entire floor. This is stalagmite. The stalagmitic sheet cannot be formed more rapidly than the limestone is dissolved, which again is the function of the amount of carbonic acid in the water."† Could any description be better; at the same time it points to a probable cause of non-uniformity; for anything which could cause an increase or decrease in the amount of carbonic acid in the water would hasten or retard the accretion of the stalagmite. I suggested in *Nature*, January 1st, 1874, "that when the thick forest (the habitat of the animals whose bones were found in the cave) left an accumulation of decayed vegetation on the soil, we had the natural laboratory where the rain would find the carbonic acid to act as a solvent upon the calcareous earth; but as by the axe of man the forest decreased, in that proportion the chemicals lessened, and, as a consequence, the deposit diminished."

Mr. Pengelly in an address at Teignmouth, July, 1874, replied to the above by producing Liebig's chemical analysis of various kinds of vegetation, showing that equal surfaces of cultivated land of an average fertility are capable of producing equal quantities of carbon, whether it consists of trees, corn,

* Mr. Howard has some valuable remarks upon this subject in his paper read before this Institute on the Torquay caverns.

† *Kent Cavern, its Testimony to the Antiquity of Man*, December, 1875, pp. 8, 9.

hay, or straw; but he has left out the element of *decay*. The laboratory that I mentioned was the accumulated *decayed* vegetation which would naturally belong to an undisturbed forest.

Since I made that suggestion in *Nature* I have again visited the cave, and not satisfied this time with seeing its interior, I obtained permission to examine the summit of the cavern. It is now a gentleman's private grounds. The gardener pointed out to me certain spots where could be distinctly heard the workman's hammer when he struck the top; the thickness was not great. But what I want to direct attention to is this, that instead of the decayed vegetation that appertains to an unfrequented forest, it is now a gentleman's lawn, from which the gardener's broom removes every seared leaf. The conditions are altered; the laboratory is removed, less of the limestone is dissolved, and as a consequence the formation of stalagmite must be slower.

In the report read before the British Association at Exeter* Mr. Pengelly says, that "it may not be out of place to state here as a fact of at least large generality, and to which there is no known exception, that in those branches of the cavern where the drip is at present very copious the stalagmitic floor is of great thickness, and where the drip is but little there is no floor, or an extremely thin one; that, in short, the present amount of drip in any locality affords a good index of the thickness of the floor there."

Is it probable that for 7,750 years there has been a uniformity of drip in any one spot, seeing that any accidental accumulation of vegetable matter that retained the surface water at one time more than at another, would alter that drip; and without uniformity of drip it is shown by the above quotation that there would not be uniformity of accretion.

The non-uniformity of stalagmitic accretion is observable in Poole's Cavern; for this boss, taken from the gaspipe, commenced forming at the rate of an inch in four years; but it did not long continue to form at that rate, for the present measurement of the boss proves that it fell to a formation of an inch in 16½ years.

Now uniformity of accretion is necessary to the correct action of Mr. Pengelly's chronometer.

It is no venture to say that neither in this nor any other country has any cave had more careful and scientific exploration than has this of Kent's Cavern; and no explorer could be more explicit than Mr. Pengelly in telling us all the facts of the case.

* *British Association*, 1869, pp. 16, 17.

But the thirteen or fourteen years that Mr. Pengelly has had the cave under his careful inspection does not enable him to say at what rate the stalagmite formed 2000 years ago. His data for computation cannot possibly extend back farther than the year 1604, for that is the earliest date yet found in the cave.* And there is no evidence whatever to show that since 1604 the deposit has been uniform. The date only shows that $\frac{1}{20}$ inch of stalagmite has deposited since that time; it does not show that its equivalent, *i.e.* $\frac{1}{5000}$ part of an inch, has formed annually. There is in reality no evidence to show that stalagmite has formed at all since Mr. Pengelly first visited the cave in 1834. The $\frac{1}{20}$ inch may have formed in a comparatively short time, and then the work may have ceased. The drip from a limestone roof is not always depositing stalagmite; the quantity of carbonate of lime in the drip may be variable, or the deposit may entirely cease. In my judgment, the approach of stalactite and stalagmite in Cheddar Cavern is a case of this kind. A single drop of water suspended from the point of one touches the point of the other, and this has been watched for the last forty years, but they have not united, nor can the least increase of either stalactite or stalagmite be detected.

If, then, there is no evidence of *uniform* accretion for the past 250 years, it is something tremendous to base any conclusion upon a supposed uniformity for a period of 7,750 years, especially after Mr. Pengelly's own caution, "that it is unsafe to use the rate at which stalagmite accumulates in one branch of a cavern to measure the time represented by the stalagmite in any other branch of the same cavern."

I therefore object to applying the scale of $\frac{1}{20}$ of an inch in 250 years (if even the uniformity of the accretion could be proven) to the $1\frac{1}{2}$ inch of stalagmite covering the extinct mammalia, because it would be applying the scale belonging to the "Cave of Inscriptions" to the stalagmite of the vestibule, which Mr. Pengelly says that it is unsafe to do.

It would be unsatisfactory to all parties, but especially to the Palæontologist and to the Anthropologist, for, in the first place, it would put man in the wrong position with regard to the extinct mammalia; for if this scale be applied to the vestibule stalagmite it would go to prove that the antiquity of the men who made the bone awl and the harpoon is above eleven times greater than the extinct cave-bear, cave-hyæna, mammoth, and *Rhinoceros tichorinus*, for their works of skill were from 12 to 20 inches (average 16) beneath these mammalian

* *Notes of Geology and Palæontology of Devonshire*, part i. (July, 1874), p. 23.

remains, whilst there was but $1\frac{1}{2}$ inch of stalagmite above them.

This would be quite a new lesson in Palæontology, and would lead us to ask the question whether it is the antiquity of man or the antiquity of mammoth we expect to prove by their contemporaneity.

And, secondly, it would reverse all our ideas about progression; for in the black mould above the stalagmite was found a bone needle, and the man who made that needle must, according to the evidence, have lived about 2,000 years back; but in the black band beneath the stalagmite there was found another bone needle; and if we allow the scale of $\frac{1}{20}$ of an inch in 250 years to be applied, it would place the artisan who made the latter needle 87,000 years before the one who made the former,—long enough, one would say, to perfect the art of needle-making; but it is very disappointing to have to quote Mr. Pengelly's words, for he says of the modern needle, that it is "by no means so elegantly designed or so highly finished as that just described,"*—that is, the ancient needle. Eighty-seven thousand years, then, show no progress in needle-making, but the opposite.

But what say the advanced anthropologists to the 9,750 years for the age of the extinct mammalia? Whilst I have given my reasons for not accepting so long a period, there is no observed case of stalagmitic accretion that will make it longer. We have not to enter upon the question of how long cave-bear, cave-hyæna, mammoth, and *Rhinoceros tichorinus* have existed, the question that we have to answer is, At what period did they become *extinct*? Was it 200,000 years back? The British caverns answer emphatically, No, nor 10,000 years back. The extreme basis of calculation, stretched beyond all probability, refuses to reach beyond 9,750 years, whilst all the other cavern evidence points to less than half that time; and, as a consequence, the conclusion is inevitable, that the contemporaneity of man with the extinct mammalia, as evidenced by British cavern-exploration, lends no countenance to the doctrine of Man's Antiquity.

The CHAIRMAN.—I have now to return the thanks of this meeting to Mr. Callard for his extremely interesting, logical and well-expressed paper; and in so doing, I am sure all will desire that I should include Mr. Gorman, who, on account of the author's indisposition, has read the latter portion of the paper. I think Mr. Callard will acknowledge that Mr.

* *Fifth Report*, read at Section C, British Association, Exeter, August 20, 1869, p. 4.

Gorman has done him perfect justice. (Hear, hear, from Mr. Callard.) It is now open for those present to offer remarks upon the paper.

The HONORARY SECRETARY.—Before the discussion commences, I have to read a communication* from Professor Boyd Dawkins :—

“Sir,—May I ask you to be kind enough to read the following note to the Victoria Institute, as, unfortunately, I am compelled by my engagements in

* The following communication was also received from T. L. Strange, Esq., lately a Judge of the High Court of Madras :—

“The question raised by Mr. Callard is assuredly indissolubly linked with a circumstance of great influencing importance, to which he has given no consideration in his paper. The osseous remains, the antiquity of which is to be judged of, belong to all climes, assembled together in the same region, raising the inevitable inference that the locality where the several species of animals they belong to have flourished, must have had transitions of climate of a nature to correspond with the necessities of their existence. The lion, tiger, hippopotamus, rhinoceros, and hyena could not have occupied Britain but with the condition of tropical heat indispensable to their being; nor could the hairy mammoth and the reindeer have lived there without arctic cold. The animals of the temperate zone were also in the land, as now possessed by them. Other very apparent indications of these climatic changes exist, where coal, the product of plants of tropical growth, and ice, to a thickness of 3,000 feet, as shown by Mr. Geikie, have predominated in one and the same portion of the globe, as in Scotland.

“It would be natural to infer that such changes must be the result of fixed law, and not arising merely from the combination of adventitious circumstances, and that they must consequently be recurrent, the temperature, through invariable operating causes, gradually altering between the extremes of heat and cold. Mr. Geikie’s observation that the glacial visitation has occurred several times, supports the idea of regular recurrent law.

“It should also be the case that the supposed law should be of universal prevalence, and not confined to any one portion of the globe,—that every part of the earth passes from a torrid to a frigid climate, incurring also every intermediate grade of temperature. Accordingly, coal, requiring tropical heat for its production, is found within eight degrees of the North Pole, or as far as our explorers have been able to force their way in that direction, and traces of the prevalence of ice have been discovered in tropical regions. Professor Agassiz found at the embouchure of the Amazon, or in the latitude of the equator, proofs of the deposition of some vast glacier, which he presumed had stretched from the Andes to the Atlantic, and concluded that that sea, in the said quarter, had at one time been as much blocked with ice as is the Polar Sea. Mons. Du Chaillu, to his intense astonishment, observed what appeared to him indubitable erratic boulders in equatorial Africa; and I and others have seen similar boulders scattered over the elevated table-lands of Mysore and Bellary, borne thither, apparently, from the great chain of mountains that runs from above Bombay to Cape Comorin, along the western coast of India. One such well-known boulder has been arrested at St. Thomas’s Mount, the artillery station, within eight or nine miles of Madras.

“To convert such a climate as exists at the poles into one such as there is at the equator, and *vice versa*, it is obvious that the direction of the sun’s rays has so to be altered towards the parts to be thus affected, as would create the great heat to be introduced at one time, and the intense cold to be substituted at another. In other words, there must be that change in the

Manchester to refuse your invitation to the discussion on Mr. Callard's paper ?

"The author of the paper has directed the attention of the Society more particularly to two explorations of caves with which my name is connected,

polar axis of the earth relatively to the sun which would alone produce the effects in question that have to be accounted for. The sun, our great governor, it is fair to conclude, regulates all the important movements of the earth, and, among others, its diurnal rotation on its axis. Mr. Crooke's discovery of the motive power of light presents us with just the agency to effect such a movement. The sun itself rotates on its axis, and is believed, with all other heavenly orbs, to be in progress round some very distant and common centre. The sun is thus not a fixed body, but is subject to those external influences and consequent divergences which we see prevail among the planetary bodies, including the earth, from the associations with one another in which they are involved. Thus, it is easy to suppose that there may be such a constant alteration in the line of the sun's action upon the earth as would effect the continuous change in our polar axis now in view. That astronomers, in the course of their observations, maintained persistently and with suitable instruments only in comparatively modern times, have failed hitherto to detect such a movement, is no proof of its non-occurrence. The movement would be a very gradual one, to be ascertained only at long intervals of observation, and difficult of detection among other complicated operations influencing the sun's position relatively to the earth, such as the precessional rotation of the poles with its nutatory divergences, the alteration in the angle of the ecliptic, and that in the ellipticity of the orbit.

"To pass now to the testimony of the cavernous deposits, it appears to be a law that the stalagmite floorings repeat themselves, and are not restricted in the instance of each cave to one such coating. There are two such floorings in the Windmill Cave at Brixham, in Poole's Cavern at Buxton, in the caves of the Wye, and in the Trou de la Naulette, near Dinant, in Belgium. Kent's Cave, near Torquay, has had three such floorings, its capacity in depth and its antiquity having apparently permitted of the additional coating, and should the limits of depth and antiquity allow thereof, more, it may be presumed, would appear here or elsewhere. Now, what, it may be asked, can be more reasonable to suppose than that the stoppage and renewal of the drip, necessary to allow of the occurrence of these distinctly divided floorings, has been occasioned by these caverns passing into a glacial temperature which has frozen up the drip, and afterwards into a warmer one, which has thawed and renewed it ?

"In Kent's Cave, on the upper floor of stalagmite, are inscriptions reaching back beyond 250 years, the deposition on which is estimated to have been at the rate of but one inch in 5,000 years. The floor here measures several feet in thickness, so that the formation of a floor occupies a very lengthened term of years, as the necessities of the case suggested by me require. This floor, as I must presume from its advanced stage towards attaining the proportions of the one below it, was commenced long ago, or when the cavern was set free of the domination of ice in the vicinity of the South Pole, and will be maintained until it reaches a corresponding propinquity to the North Pole. The floor, it will thus appear, must have passed, in the process of its deposition, through the equatorial or tropical region. A portion of a human jaw with some teeth has been met with in this floor, where it had attained a thickness of 20 inches ; and below the floor, at a spot called the black band, have been found abundance of charred wood and some artificially formed bone implements, giving indubitable evidence of the existence of man at the

and on which I would make a few remarks. With regard to the Victoria Cave, the author very naturally assumes that the account of the exploration was the formal decision of the Committee, after weighing the evidence. It was, however, merely the private opinion of the Secretary, who, as a matter of fact, is solely responsible for the conduct of the exploration, and for the reports. My name, among others, was on the Committee, but since my retirement from the office of secretary, up to the last British Association Meeting at Dublin, I was unfortunately out of England when the reports were read. At that meeting I took the first opportunity open to me of expressing my non-acceptance of the Report, and of the evidence as to man in that cavern. The Report was not approved by the section, and the British Association grant was no longer made. The supposed human fibula found when I conducted the exploration was so equivocal that I put it aside without any remark. Subsequently, however, on the authority of one of the best osteologists in Europe, I accepted it as human; but ultimately, on fresh evidence which I immediately brought before the Geological Society and the Anthropological Institute, I held it to be ursine. The cut bones of the goat, and the small fragments of bone and teeth either of sheep or goat, which have been assumed to belong to the lower strata in the cavern, are obviously recent, and have dropped from

very remote period which the locality indicates. The remains of extinct mammals also here appear. At the Trou de la Naulette human osseous remains have been discovered below its second stalagmite floor.

“These, then, are the conditions to be accepted if fair inferences have been drawn from the facts apparent. At some very remote distance of time, beyond all bounds of history or tradition, the lion, the tiger, and the elephant, have roamed about in Britain, possessing there a tropical climate as necessary for them; at a still more remote period this region has been covered with a coating of, say, 3,000 feet of ice, placing it within arctic limits; and still further back, at some inconceivable distance of time, the human race have been found, by the traces left, to have had existence on the earth.—I am, Sir, yours truly, T. L. STRANGE.”

[The foregoing, not having been read at the meeting, is inserted as a note. Many of the points alluded to herein were taken up in the discussion. It would require much time to consider the whole of the questions raised, upon some of which leading scientific men are still at issue; in regard to these we shall do well to follow the suggestion in the last paragraph of Mr. Mello's remarks (p. 237). The following are Mr. Callard's comments:—

Mr. Strange, in his letter, raises a very interesting question of the possibility or otherwise of a change in the polar axis being the cause of great climatic changes. To this question, as Mr. Strange observes, I have given no attention in my paper, and for this reason, that the woolly mammoth, which we relegate to the cold regions, is not divided by any geological stratum from the hyæna, which is supposed to belong to a warm climate, but they are found side by side in the same stratum of cave-earth, and in the same foot of stalagmite, in which case there could have been no change of climate between the existence of the one and the other of these mammalia to have arrested the flow of stalactite by the frost, and again to have released it by a thaw,—and no evidence of the immense periods that would be required for the astronomical changes supposed. It is a very common assumption, but I believe an erroneous one,—that the present habitat of an animal is its necessary habitat.—T. K. C.]

the upper stratum of Romano-British age, in which they are very numerous. Unfortunately this faulty evidence has been taken by eager scientific imaginations to stamp the Preglacial age of man, and it presents a fair mark for criticism, such as that of Mr. Callard. It has, however, no more weight on the general question of man in caves, than the evidence of a witness would have in a court of law about things which he never saw or never heard of. It is simply out of court.

"The discoveries in caverns, from the Pyrenees as far to the north as Derbyshire, and as far to the east as the Danube, prove beyond reasonable doubt, that man lived in Europe at the same time as extinct animals such as the cave-bear and the woolly rhinoceros; and works of art, of the same kind as the sketch of the horse in the Robin Hood Cave at Cresswell, have been met with in Belgium, France, and Switzerland, under conditions which prove that the Palæolithic hunter delineated on bones and antlers, with remarkable fidelity, the animals which he hunted. With regard to the hog-mane in the sketch of the horse, supposed by Mr. Callard to have been cut, it does not seem to me to show any sign of cutting. Were it cut it would imply that the horse was domestic. No domestic animals have yet been found in any of the undisturbed older deposits in caverns.

"When the author concludes that the hyæna and woolly rhinoceros were living in Britain as late as the Roman times, because they were found in the Cresswell Caves in which Roman pottery and other remains were also found, he ignores that the articles of Roman age were always met with either in the surface soil above the stalagmite, overlying the older deposit with those animals, or in places which had been disturbed by digging, and by the burrows of rabbits and foxes.

"Other and minor points relating to other caves raised in the paper may safely be left to the consideration of those more particularly interested in them. It merely remains for me to repeat, that in dealing with the question of the antiquity of man, it seems idle to attempt to build up a chronology in terms of years, beyond the written record. Out of the reach of history there are no natural chronometers. The rate of the erosion of a valley, of the deposition of silt in the bottom of it, or of the accumulation of stalagmite in a cave, are equally uncertain, since they depend upon variable and intermittent causes. The rainfall may vary, or the silt-laden waters of the stream take a different direction, or the flow of water containing carbonate of lime may cease. They are, therefore, blind guides to the lapse of time. The antiquity of man is to be measured, not by years, but by the series of events which have taken place since he hunted the mammoth and woolly rhinoceros, reindeer and horse, and fought with cave-bears and lions in France and Britain, in the Pleistocene period. Measured by the geographical and biological changes which have taken place since that time, it seems to me so vast, that all the events recorded in history,—Egyptian, Assyrian, Greek, Roman,—are in comparison things of yesterday.

"Yours truly,

"W. BOYD DAWKINS.

"Captain F. Petrie, *Hon. Sec.*"

Rev. J. M. MELLO.—I have to express my thanks to the President and Council of this Society for having kindly given me the opportunity of being present this evening, and taking part in the discussion on the interesting subject which has just been brought before us.

The question for our consideration is one of great difficulty ; indeed, I doubt very much whether, in our present state of knowledge, we have anything like sufficient facts to enable us to form any decided opinion, whether we ever shall have a sufficiency, is perhaps doubtful ; any way, I think that our work at present should be rather to accumulate facts without being too careful to form theories upon the few we have ; as to the result, I have no doubt whatever that as it has ever been in the past, the more we know of the works of the Great Creator the more reason we shall have to see one and the same Divine Hand in the Word inscribed on the face of Nature, and that written in the sacred documents of our religion.

I must now ask your indulgence whilst calling attention to several points in the paper we have heard read, in which the author has, I am sorry to say, greatly misapprehended some of the facts derived from the exploration of the Cresswell Caves. In a question such as that before us, it is, I conceive, of the utmost importance that every fact on which we take our stand should be incontrovertible, otherwise the argument, however strong it may be in some respects, will serve but to confirm its opponents in their own views ; and agreeing as I do with Mr. Callard that we have no evidence at present which forces us to assign a practically unlimited antiquity to our race, and also believing that there is much which disproves it, it will yet be a very dangerous thing if we base any of our arguments on fallacies. The inference Mr. Callard appears to draw from the Cresswell explorations is that our Derbyshire men were not those commonly known as Palæolithic, and that the rhinoceros and hyæna and other Pleistocene animals, which he allows to have been their contemporaries, were themselves living in this country with the Roman and Samian potters ; and that, it may be observed, if there is any truth in the generally received views as to the date of the articles of Roman art found in British caves, would give us a date somewhere about the fifth or sixth centuries of our own era ! This conclusion is arrived at through a misunderstanding of the results of our digging, and you will perhaps allow me to lay those results before you as briefly as I can.

If the Cresswell Caves are remarkable for one thing more than another it is that in them we have the clearest proof that has ever been afforded of a chronological progress in civilization amongst the earliest occupants of this country. Mr. Callard says of this Derbyshire man that he was "most assuredly not Palæolithic man" ; if he was not, then Palæolithic man has no existence anywhere. A section of the floor of the Cresswell caves presents to our view a perfect and well-defined succession of beds of different lithological character : at the bottom we have red argillaceous sand ; over this comes the cave earth, in various stages ; then the breccia ; and, above all, the thin surface soil. Palæolithic man in his earliest condition was undoubtedly

“a low savage,” his art did not extend, as far as we know, beyond the skill to fashion the rudest implements; this is borne out by the Cresswell Caves: the red sand contains no trace of a higher civilization than that represented by those rude quartzite implements which you see before you,—mere pebbles fractured in the roughest possible manner,—implements, the nearest approach to which elsewhere is found in those of the old river gravels of the Somme or the Ouse, or in the rough tools of the Moustier cavern, or of the lower stratum of Kent's Hole, or of the Trou de l'Église at Excideuil, which latter cave has yielded evidence very similar in character to that of Cresswell. The bed containing these implements has yielded no trace of higher art than this; it is not till we reach the overlying cave earth that we get evidence of the use of flint, and then at first the chipped flints are as rude in form as the quartzites; higher up we meet with the more elaborate forms such as those lance-heads of well-known Solutré type, and with these, and at no lower level, we obtain the worked bones and the engraved figure of the horse of Madeleine character. Similar flints occurred in the breccia in conjunction with the Pleistocene mammalia. As yet there is no evidence of the existence of Neolithic man, nor of the modern fauna of Europe, far less of the Roman occupation. We have no evidence whatever in these caves of the presence of the men of the Neolithic race, who used such highly-finished or polished implements as these exhibited, which are recognised types of their class. As to the Roman remains, the pottery and the bronze fibulæ in the surface soil, these, as far as one can judge, belong to a period as late as that of the withdrawal of the Roman legions, when the more or less civilized Britons were driven to the caves by the invading hordes which then overran the country.

Just as there is no trace of this late art, or of the recent domestic fauna, in the lower beds of the caves, neither is there any real proof of the existence of the Pleistocene fauna in conjunction with Roman or even Neolithic remains of man. Mr. Callard has alluded to a passage in my first paper, in which it is true that I have said that in the surface layer of the Robin Hood Cave some teeth of rhinoceros and of hyæna were found, as well as some flints; and a little lower down I have stated that Roman pottery was also found in the upper part of the floor of this cavern. These Roman remains were found in a small inner chamber in the surface-soil, together with recent bones, but without any trace of Pleistocene animals. As to the teeth, these were found near the entrance of the cave, and the search made at that time consisted merely of a small test-hole rapidly and not very carefully made. My first paper must be checked by the more careful work recorded in the subsequent ones. The red sand was found capped by cave-earth, and there is little doubt that the teeth really belonged to that; but, any way, it is utterly impossible to obtain any chronological data of even the slightest value from things found in the few inches of surface-soil in a cavern that has been frequented for years by innumerable visitors. Roman and other remains prove the existence of their former owners, but under circumstances totally precluding the possibility of saying whether or no they were contemporaries unless we have independent proof; and to say that because a rhinoceros

tooth is found in disturbed surface-soil with Roman ware the two were of the same date, is as fallacious as it would be to say that, because we have found, as we have found, in another part of the cave, Roman, Mediæval, and modern pottery, and even fragments of tobacco-pipes, mingled in the surface-soil, the Roman and the Mediæval potter, and the user of the clay-pipes, must all have lived together in the same age. There is another point which must not be passed over. Mr. Callard says, as I gather from p. 218, that the men of Cresswell wrought in iron ; on the next page he says they hammered out iron implements, and with metal shears cut their horses' manes. The proof he gives is, that they left behind them some ironstone implements. But surely there is an enormous difference between chipping a rude tool out of a bit of the Derbyshire clay ironstone (this is one of the implements in question) and forging a tool out of metallic iron ! The use of metals, as far as we have evidence, was utterly unknown to the Palæolithic hunters. As to the hog-maned horses, if their manes were artificially produced,—which I am not prepared, however, to grant,—why might they not have been singed ? We know that these men were acquainted with the use of fire. But it is not at all unlikely that the cave horse, with its large asinine head and small limbs, like the ass or the zebra of to-day, had a short erect mane, as represented in all the old Palæolithic drawings ; we have no reason to suppose that the men of that period had succeeded in domesticating the horse, although they would frequently kill it for food.

The evidence of Cresswell then, as I read it, tells us nothing as to the antiquity of the earliest men in England, only that they lived in conjunction with animals long since extinct, or to be found only in distant countries,—animals concerning which history is absolutely silent ; and we can scarcely think that had the Romans met with or heard of the mammoth, the rhinoceros, or the formidable machairodus, or hyæna in North-Western Europe, such a remarkable fact would have escaped the notice of such observant writers as Cæsar or Tacitus ; and, besides this, all the negative evidence we have tends to show that the Pleistocene mammalia, with but few exceptions, were unknown to the Neolithic men, who were separated from their predecessors by an unbridged gap.

There are other points in the paper we have heard read which will, perhaps, be noticed by others ; but I fear that I have already taken up far too much of your time : my excuse must be the great importance of obtaining exact evidence. I think the question of the antiquity of man, as far as geology has anything to say about it, rests now pretty much where it did years ago. We have no proof that will stand the test of close examination that man was pre-glacial ; nor, on the other hand, have we any as to the date of his first appearance in North-Western Europe. It was certainly pre-historic as far as these countries are concerned, and the changes that have taken place in climate and in physical geography, as well as some other considerations, seem to show that a lengthened period must have elapsed since Palæolithic man disappeared ; any computation as to the exact time cannot be anything but mere guesswork, as far as I can read the evidence of British caverns. I

see no possibility at present of getting any clear answer from geology as to the antiquity of man ; but that that antiquity was so great as we are asked by so many nowadays to concede as beyond question, may well be doubted, on grounds which I cannot now enter upon, and so far I agree with Mr. Callard.

But there is no conflict between any clearly ascertained scientific fact and religion, the only conflict is between science and erroneous interpretation of Scripture, or between unstable scientific theories thrust into opposition to the Bible. We are far too apt to interpret the work of the Semitic writers as we should a modern book, and to apply to it the same canons of interpretation that we should to some work of English genius, even occasionally building arguments on the uncertainties of our own version of the Bible, and thus discrepancies are often made to appear where there are none, through over hasty and unsound interpretations.

As earnest students let us accumulate facts, and be very slow to form theories ; let us wait and be patient, and in time, though it be beneath the crossed swords of the controversialists, as through a triumphal arch the divine form of truth will be seen advancing ever nearer and nearer into the perfect light.

Rev. W. B. GALLOWAY.—I think we must all join in thanking Mr. Callard for his interesting and well-reasoned paper. (Hear, hear.) With regard to the contemporaneity of the mammoth and other extinct mammalia with any of the Roman remains, I must confess to feeling very doubtful on that point, and I think the objections made to such contemporaneity will probably be found valid ; but as my first acquaintance with geology was formed soon after Buckland published his “*Reliquiæ Diluvianæ*,” and during the time that Cuvier was hailed as a high authority on these subjects, I may be permitted to say that I think their theory has not been well superseded by the present glacial theory. It was made a subject of ridicule by unbelievers in a former age, that men should be so credulous as to believe in a universal deluge,—a deluge in which the world was covered by water ; but we now find substituted for that a deluge of solid ice, in which Scotland is affirmed to have been buried under a depth of 3,000 feet of ice, and Switzerland to have had its valley between the Jura and the Alps filled up by an entire glacier, so that rocks slid down from the Alps upon the Jura. We are further informed by these theorists, that America was covered by glaciers varying in depth from 7,000 to 8,000 feet, Scandinavia by glaciers varying in depth from 7,000 to upwards of 8,000 feet, and that all Europe bears evidence of this enormous depth of ice—solid ice—having covered the world. I think if Voltaire were again in life, and still disposed to ridicule the theory of a universal depth of water having covered the hills, surely he might find some ground for ridiculing the credulity of those who accept the latter hypothesis. (Hear, hear.) For my part, I feel that it is worthy the consideration of geologists whether Cuvier's and Buckland's theory was not the truer of the two. (Hear, hear.) I find in “*Lyell*” that he supposes the contents found in the caves that have been mentioned, ascribable to the caves having been

the channels of subterranean rivers, such as are found in the Morea and other parts of Greece ; but there is no proof of there having been any outlets for such rivers, and nothing to disprove the theory of Buckland and Cuvier that the deposits are diluvial. We have also found,—at least, there have been found,—remains of the mammoth in icebergs and vast formations of ice at the mouth of the Lena ; but it is affirmed by Croll and others, whose theory has been well noticed by Professor Birks in a recent contribution to this Society, that the Glacial age is to be attributed to an alteration of the eccentricity of the earth's orbit and a change in the relations of the pole to the line of the apsides,—two of the slowest processes in nature, in which 10,000 years would make probably very little difference in the degree of cold. Now, the mammoth that was frozen up in the mouth of the Lena must have stood waiting a long time for his being frozen up in the ice in which he was afterwards found, if the freezing was attributable to either of these causes, or to both combined. It seems to me that Cuvier's affirmation—that the catastrophe by which the animals were frozen up in the ice, or their remains deposited in the caverns in which they are found, must have been sudden—is the more reasonable, and that no change requiring the lapse of ages, would account for the phenomena at present exhibited in the things we are discussing. In the remarks I am making I earnestly desire to draw the attention of those who are strictly engaged in geological studies, to the question,—Whether they have done wisely in accepting this theory of one enormous glacier spread over the world, in preference to the Scriptural doctrine of a universal deluge ? (Hear, hear.) If we revert to that, then the contemporaneity of man with these fossil animals is beyond a doubt. The event by which these animals were swept from the face of the earth is then attributable only to the period of the Deluge. With regard to the Palæolithic implements, I must say, referring to an exhibition of them which was made by the Royal Society of Antiquaries in Somerset House a few years ago, it struck me that if evidence as weak as that furnished by these implements were produced for the purpose of shaking the oath of any man in a court of justice it would be treated as a subject for laughter. (Hear, hear.) How, then, should we consider such evidence as these implements afford, where we find that men of equal judgment with those who regard them as the work of man have concluded that they were the work of accidental fracture, simulating the work of man ? How are we to say that these implements should be accepted as of sufficient weight to reverse the statements of those who wrote in the fear of God, even if they should not be admitted to have written by divine inspiration ? (Hear, hear.) They, at least, wrote with all the solemnity attaching to an oath, and I think it is unfair that the records of Scripture should be considered as in the least degree liable to be shaken by any of the Palæolithic evidence that has been produced. The occasional forms of the roots of trees may simulate the shape and appearance of the head of an animal, and there are many occurrences in nature, in which the similitudes are such that we may be liable to make mistakes about them. In one of the best shaped of the Palæolithic imple-

ments that I remember having seen, it would have required an enormous hand to have wielded it, and in other cases it has seemed to me that the hand which used the implement was likely to have suffered fully as much as the enemy against which it was directed. With these few remarks I must apologize for having so imperfectly stated what I deem to be the difference between the Glacial and the Diluvial theory; indeed, the latter can scarcely be regarded as a theory, since it rests upon Scriptural testimony; but my wish is most earnestly to suggest that the points I have ventured to put before you are worthy of examination, and that the names of Cuvier and Buckland are deserving of the respect of the geologists of the present day. (Applause.)

Mr. D. HOWARD.—Mr. Mello has asked very fairly whether, if the extinct animals lived up to the date of the Romans, we should not have heard something about them; and this is certainly a strong argument against finally accepting the suggestion that the extinct animals were to be found in England at the time when Cæsar wrote. At the same time, I would ask,—are we quite sure that we have not the records of the existence of those extinct animals at a somewhat older date, in the traditions that are to be found among almost all nations of strange and monstrous beasts? It is a curious fact that we find some remarkable coincidences between some of these old traditions and some of the discoveries that have been made in modern times. Take, for instance, the gorilla, it is evident that this animal answers the descriptions given of the “wild man” by certain of the early writers,—although we denied the existence of anything but imagination in those early writers until we found the animal itself. Is it not curious also that the early hunters are invariably said to have chased monstrous beasts, and that the descriptions given of these creatures do most nearly approach the forms of the extinct animals? It seems surprising how the evidence of immense antiquity disappears in the comparatively high position in which the remains of these animals were found in the stalagmite of Kent’s Cavern, as well as the animals found in the flesh at the mouth of the Lena. (Hear, hear.) The traditions of monstrous beasts, which might very well have been these creatures themselves, all seem to point to the idea that these animals have been, if not actually contemporaneous with the Romans, at least contemporaneous with our not very remote ancestors; and it is not merely a question of whether they existed 9,000 years ago, but of whether they were in existence 2,000 or 3,000 years ago. It is certainly easier to believe that the frozen beast on which the dogs actually fed lived 2,000 years than 10,000 years ago. (Hear, hear.) It is likewise easier to believe that an inch of stalagmite which preserved some of the bones found in Kent’s Cavern took 2,000 years for its formation than that it took 10,000 years. Certainly the more recent discussions on this subject have brought out very clearly that stalagmite does form very fast. I think the testimony of our old traditions, and even of our nursery tales is not below the notice of scientific men,—there must have been some reason for them. Some have even gone so far as to say that the universal

belief in a dragon is actually the survival of the memory of some stray plesiosaurus which had remained to a comparatively recent age. There is one thing that I would ask, and it is this : if we had no evidence of the recent existence of the *Dodo*, should we not be tempted to say that it is a very long time since it existed? (Hear, hear.) The fact that an animal may become so absolutely extinct that even a small portion of it is very difficult to find within not thousands of years, but barely hundreds, is one of the most curious pieces of natural history that I am acquainted with. I do not know that we shall ever see a mammoth walking about this earth in the present day ; but still more surprising things might happen. (Applause.)

Rev. J. JAMES.—I think the canons of caution laid down by Mr. Mello are quite as valuable in regard to our method of ascertaining facts, as in regard to our method of forming theories. This I would illustrate by a circumstance which I lately found recorded in print ; and as the record is not very long, I should like to be allowed to read it. It is a statement made before a public society concerning a case in which Professor Owen was saved from imagining that he had made a great discovery in the North of England some twenty years ago, when the great dock in the Tyne was made. It says,—“ Many trees and horns of ancient animals were found embedded in the silt of Jarrow Slake. One of these was standing upright, but without its head. Its top had evidently been cut off ; there could not be any mistake about the fact. Sir William Armstrong, the late Robert Stephenson, and Mr. Harrison, the North-Eastern Company’s engineer, were greatly interested. It was concluded that some woodman of very ancient times had cut the tree, and that it was a most striking evidence of the extreme antiquity of the human race. In haste, Professor Owen, the renowned palaeontologist of the British Museum, was sent for from London. One Sunday morning was spent by all these gentlemen wading in the slush and mud inspecting this wondrous relic. Their conclusion was unanimous. The next morning a friend of mine to whom Professor Owen had sent his card, with the expression of a wish to see some horns he had from the same site, was present also. He asked Professor Owen to what conclusion they had come ? The Professor replied that they were all unanimous, and that the evidence was most satisfactory. My friend said,—‘ You have not been inspecting an old cut, at any rate, for I had some pieces cut off from that tree a few days ago, and have them now at home.’ The assembled company declared it was impossible. My friend assured them of the fact, and said ‘ Have you seen the man who first uncovered this tree ? ’ They said they had not, and Professor Owen was at once struck with the importance of having that man’s evidence. The man was sent for. My friend told him what the man would tell him, for my friend knew all about it, and besides that, would never have been so deceived, for reasons I could give even if he had not known the true history. But I will let Professor Owen tell the rest in his own words. He told the story himself at Leeds some few years afterwards, and this is what he said :—After giving his account of the portion of the story I have already related, and saying he had been told that the navy who first uncovered the tree had

himself cut the head of it off to lay down a sleeper for the tramway, he said,—‘The man was sent for, and on his arrival he declared that the tree pointed out was the one he had cut.’ Professor Owen goes on to say—and we should mark this,—‘It was endeavoured to be explained that that was impossible, as the place had not been excavated before’ (it had got covered up again since its first excavation), ‘but looking,’ said Professor Owen, ‘with supreme contempt upon the assembly of geologists and engineers, the man persisted in the identification of his own work, and exclaimed, “The top of the tree must be somewhere ;” upon which,’ says Professor Owen, ‘I offered half-a-crown to the first navy who would produce it. Away ran half a dozen of them, and in a few moments they returned with the top. Never,’ said Professor Owen, ‘had I so narrow an escape from introducing “a new discovery” into science, and never had I a more fortunate escape.’”

The CHAIRMAN.—Perhaps Mr. Mello would not mind pointing out what he wishes us to remark in the specimens he has brought here.

Mr. MELLO.—These rude implements of quartzite [showing them] are from the very lowest deposits. They are quartzite pebbles that were taken into the cave by the men who resorted to it, and were used, some as scrapers, very similar to those now used by the Esquimaux for cleaning skins, while others were used as hammers, probably for crushing bones, in order that the marrow might be extracted, there are a few flakes struck off the pebbles, and other marks of bruising on the face of them produced either by fracturing bones or breaking other stones—probably the latter. The marks are very fresh in appearance; this one [holding it up] bears marks as fresh as if they were done yesterday. This [showing another] is one of the stone implements of a material similar to the iron ores that are now being smelted in Derbyshire. These [showing others] are the higher type of the flint implements. All these high-class implements, together with the bone implements, are from the breccia, or the upper cave-earth; in fact, the breccia and upper cave-earth are one and the same: where the cave-earth is thin the breccia is thick, and *vice versâ*. While the breccia was accumulating there can be little doubt that the thick part of the cave-earth was forming, and above that we get the Roman remains. This [producing it] is a solitary bit of Samian ware that I got, and then there were fragments of ruder Roman pottery of a very rough character. This [showing it] is the jaw of one of the devourers of the other animals,—the lower jaw of a young hyæna,—and I have proof that it was not imported from a great distance, but must have actually lived in the neighbourhood of the cave, for I have the jaw of a young hyæna showing the canine teeth coming through the jaw. Here [showing the jaw] you have the permanent teeth coming through, and the deciduous teeth on the point of being pushed out, while in the old grandfathers of the hyænas visiting the cave we have the teeth worn down to mere stumps. We have the same evidence of other extinct animals breeding in this country, for in the same cave we find the teeth of the baby mammoth not bigger than the top of my thumb, with other teeth 20 inches long [exhibiting them]. The Neolithic

age is not represented in our caves at all ; but it is represented by this typical spear-head and these axes of Denmark, and the polished implements from the lake dwellings of Switzerland.* Mr. Callard has a very fine specimen here from the Robenhause district ; also a fine Neolithic Danish spear head. We have nothing Neolithic at Cresswell : as to the bone implements, I have only drawings of them.

Rev. J. FISHER, D.D.—I must express the great satisfaction with which I have listened to the paper of Mr. Callard, with whose views I sympathize to a great extent, as I do also with those expressed by Mr. Mello, who has been very candid in his remarks ; but, personally, I fail to understand the distinction that has been set up between the Neolithic and the Palæolithic. I think that some of the specimens which have been introduced are not of artificial origin. I have often, when a boy, found flints in my father's fields that I thought must have been made for our old Brown Bess musket, but, when I have shown them to my father, he has at once said, "No ; they are the works of nature" ; and I think that some of those before us have a similar origin. I am one of those who do not believe in the Palæolithic period being of the date that some geologists would assert. Of course, as one man is older than another so must one period be older than another, and thus we hear of the Palæolithic and the Neolithic ; but may it not be that when we have had what is called the Palæolithic in one part of the world, we have had the Neolithic in the other ; that is to say, there have been in two quarters of the globe at the same time two races, one tolerably far advanced, and another much less advanced, in the making of implements and so forth ? I believe that if we go to the centre from which men have been supposed to diverge to different quarters of the globe, we find in Egypt and Assyria and Babylon, the Neolithic men, and I think it will be some time before you can point to a period that shall be so far distant as to justify the distinction that has been drawn between that and the Palæolithic.

Mr. CALLARD.—I am rejoiced to find that we are so nearly agreed to-night. I had thought I should have met with strong antagonism ; but, instead of this, one speaker after another seems to have fallen in with my views to so great an extent, that I think we shall go away from this meeting saying we have given up the idea that has prevailed in some quarters as to the great antiquity of man. Professor Boyd Dawkins has been very candid in the letter he has sent, in which he gives up much of the evidence relied on for calculating man's antiquity. There is a little difference between us as to the horse's mane being cut. I have seen the drawing, about which there may be some difference of opinion ; but, to my mind, the shape of the mane indicates clearly that it had been cut and not singed ; and I do not think that on a question of science we ought to be allowed to bring in any fancy we like, in order to get over a difficulty. It is a hog-maned

* The demand for implements from the Swiss lake-dwellings has resulted in the establishment of a large manufactory for their production, near the lake of Biemme !—Ed.

horse : Professor Boyd Dawkins says it is a hog-maned horse, and all we know of such manes is, that they are clipped and not singed, nor were they cut with Palæolithic implements. Therefore, as far as the evidence goes, I think it is on my side in asserting that they were cut ; that, being cut, they must have been cut by something like a pair of shears, and that if they were cut by a pair of shears, that fact brings us into comparatively modern times. (Hear, hear.) With regard to the pottery, it must be borne in mind that I did not say that the mammals referred to lived where they were found in Roman times. I did not even say that they lived at all in Derbyshire in Roman times. My remark was that "as in Devonshire so in Derbyshire the *rhinoceros tichorinus* is found amongst the pottery, the legitimate inference is that he was contemporaneous with the potters." The Roman or pre-Roman pottery, with the associated astragalus of rhinoceros, belonged to Kent's Cavern, not Cresswell, and I think I am justified in saying that they were so associated ; for Mr. Pengelly states that,—“In exploring the North Sallyport the overlying black mould yielded *potsherds*’ (you could not have potsherds unless you first had a potter), “marine shells and bones (chiefly modern, but a few of *extinct* animals), the astragalus of the rhinoceros being the most important of the latter.” You must not blame me, you must blame Mr. Pengelly, for saying that the astragalus of the rhinoceros was found among the pottery, or else you must blame Dr. John Evans for saying that the pottery of the black mould belongs to Roman or pre-Roman times. It is true that finding a tobacco-pipe, with Roman pottery in the *surface soil*, does not prove that these articles were contemporaneous, but it proves that they are both more recent than the stalagmite below them, and that is all that I claim for the astragalus of the rhinoceros. It was found in the black mould with the pottery, and therefore, however recent it may be, it cannot be older than the black mould *i.e.*, 2,000 or 2,500 years. The pottery of Cresswell referred to was Samian. Mr. Mello, whom I am so glad to see here to-night, says respecting the teeth and pottery :—“My first paper must be checked by the more careful work recorded in the subsequent ones.” Well, I am glad to do so, but I think Mr. Mello will have to correct both his second and third reports if I am wrong ; for in his second report he makes reference to “blasting the stalagmitic breccia which covered the cave-earth containing the bones and implements. In this breccia were found teeth of both *rhinoceros* and *hyæna*.” In the third report he says,—“The few remains found in the breccia consisted *as before* of the bones of the hare, a few teeth of the larger Pleistocene mammalia, *rhinoceros tichorinus*, *hyæna*, *bear*, *horse*,” &c. Therefore, if Mr. Mello has come to a different conclusion it must be since he wrote his third report.

Mr. MELLO.—I have come to no different conclusion ; it quite bears out my argument.

Mr. CALLARD.—Then we are to understand that in the breccia covering the cave-earth, as far as it existed, were found the remains of extinct mammalia, and beneath the breccia in the cave-earth were found well-finished implements,—not, it is said, Neolithic.

Mr. MELLO.—All the Cresswell implements were Palæolithic.

Mr. CALLARD.—You showed us or referred to certain specimens of bone implements.

Mr. MELLO.—You get a similar form in the breccia, which I think is identical with the others.

Mr. CALLARD.—My point is established if the breccia was found above the implements, and the extinct mammalia in the breccia, which shows that the extinct mammalia must have lived after the men who made those implements.

Mr. MELLO.—*With* them. We got them in the breccia in a part of the same deposit.

Mr. CALLARD.—Professor Boyd Dawkins is rather particular in calling attention to the stalagmite *above*, and the remains *below*. He says, in his paper at the Conference of May 22, 1877, after describing the bone awls, needles, sketch of horse's head, and associated mammalian remains of the cave-earth, "*above* the strata containing these remains was a layer of stalagmite, ranging from 1 foot to a few inches in thickness." The breccia is equivalent to the upper cave-earth, and the upper cave-earth will always be found to come above those implements that have been mentioned. If it be not so, I shall be happy to withdraw this part of my paper. Does Mr. Mello say that these implements are never found below the breccia in which the extinct mammalia are found?

Mr. MELLO.—Some are and some are not.

Mr. CALLARD.—If any of them are, my point is gained, namely, that some men lived with and some before that mammalia, and made these bone implements.

Mr. MELLO.—The same man lived during the breccia period and the cave-earth period. We had on the left-hand side the cave-earth on which the breccia had been gradually thickening, and on the other side the cave-earth and no breccia, the cave-earth being three times as thick as it was underneath the breccia.

Mr. CALLARD.—Do you claim for the implements so found that they are Palæolithic?

Mr. MELLO.—Yes; they are Palæolithic.

Mr. CALLARD.—That is where I differ from Mr. Mello. Sir John Lubbock, when dividing these periods, speaks of the first, or Palæolithic, age as that of the drift when men shared Europe with the mammoth, and so on; and when we come to the Neolithic age it is one characterised by beautiful weapons and instruments, made of flint and other kinds of stone, in which we find no trace of any metal except gold. Mr. Alfred Wallace, at the geological section of the British Association in Glasgow, in 1876, traces the periods the other way, and says, "as we go back, metals soon disappear, and we find only tools of stone and bone. The stone weapons get ruder and ruder; pottery and then the bone implements cease to occur; and in the earlier stage we find only chipped flints of rude design." Now, if these definitions are accepted, then these chipped flints of rude design belong to the period of

the drift, and further back than the period of *bone* implements. If, therefore, we can find *bone* implements, we are not in Palæolithic times. (Hear, hear.) Reference has been made to instances on the Continent of Palæolithic engraved figures. I simply dispute their being Palæolithic for the reason that the definition given of the term "Palæolithic" does not answer to them. We ought when we reach the Palæolithic period to have got further back than the age of bone implements ; but they are found in the Cresswell caves, and very distinctly in Kent's Cavern, and also at Dordogne. When we have bone needles, bodkins, and other things all of bone, I cannot see how we can associate them with the Palæolithic age. But give it what name you like—call it Palæolithic if you please,—I would merely say it is such a Palæolithic age as Dr. Fisher refers to when he speaks of one man being older than another, and not such a Palæolithic age as has been defined by geologists. With regard to the question of iron implements in Cresswell caves Mr. Mello is right. The term does imply more than the evidence warrants. I should have said *ironstone* implements. I was justified in saying that they were wrought to approved forms. Professor Boyd Dawkins says of the Cresswell cave implements :—"Some of those of quartzite and *ironstone* were of precisely the same form as those of the river gravels of Brandon, Bedford, and Hoxne. They are identical with those found in France from St. Acheul, near Amiens." Does not this imply that they were manufactured into forms of approved types? I quite agree with Mr. Mello as to the desirability of getting our facts together rather than paying too much attention to theories ; but it must be borne in mind that I did not create the theory of the "Antiquity of Man." (Hear.) It was created for me, and I have come here to combat it. I have now to thank you all very much for the kind way in which you have received my paper. I can only hope it may result in a further consideration of the subject, and if in anything I have been inaccurate I shall be thankful to be corrected. At present, however, I feel strong in the position I took when I read my paper. (Applause.)

The Chairman congratulated the meeting on the very interesting discussion that had taken place.

The meeting was then adjourned.

ORDINARY MEETING, APRIL 21, 1879.

H. CADMAN JONES, ESQ., M.A., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

HONORARY LOCAL SECRETARIES :—Rev. N. Hurt, M.A., Wakefield ; Rev. J. M. Mello, M.A., F.G.S., Brampton, Chesterfield.

MEMBER :—T. R. Gill, Esq., New Cross.

ASSOCIATES :—E. Beales, Esq., M.A., London ; A. M. Chance, Esq., Birmingham.

Also the presentation of the following Works for the Library :—

- | | |
|---|----------------------------|
| “Biblical Psychology.” | <i>From L. Biden Esq.</i> |
| “Eruvin.” | <i>From J W. Lea, Esq.</i> |
| “Antiquity of Man.” By Professor T. Rupert Jones. | <i>From the Author.</i> |
| “Testimony of the Stars.” By Mrs. F. Rolleston. | <i>Ditto.</i> |

The following paper was then read by the Author :—

THE RELIGION OF ZOROASTER CONSIDERED IN CONNECTION WITH ARCHAIC MONOTHEISM.

By R. BROWN, Esq., F.S.A.

1. The Classics on the Date of Zoroaster.

ONE of the greatest, yet at the same time most shadowy, figures in the history of the earlier religion of the world, is that of Zoroaster the Magian, to whom aftertimes have united in ascribing high and mysterious doctrine in combination with occult and wondrous lore. His actual historical existence was not doubted by the Greek and Latin writers, but the time when he lived was only conjectured. Thus, Agathias, writing about A.D. 576, observes that the Persians in his day stated that Zoroaster lived in the time of Hystaspes, who, by a not unnatural error, was regarded as identical with the father

of the first Darius; and the historian adds that whenever he lived he was the Persian prophet and "master of the magic rites."* Pliny has preserved several traditional incidents connected with Zoroaster, such as praise of a mysterious stone called *Astriotes*, "the Star-like;"† that he laughed on the day of his birth,‡ a circumstance which those who connect him with natural phenomena would probably regard as indicating the joyousness of the bright heaven or the dread exultation of the thunder-god;§ and that he lived on cheese with great austerity for twenty years,|| a statement which reminds us of the traditional and mythical austerities of Hindu saints and divinities. After referring to the general consent of authorities that he was the inventor of magic, which Pliny judiciously observes was doubtless originally connected with the healing art, the Roman writer states that Eudoxos and Aristotle placed Zoroaster 6,000 years before the time of Plato; whilst Her-*mippos* the philosopher, B.C. 250, who, of all the Greeks, most deeply studied Zoroastrianism, and who wrote a work upon it, now lost, entitled *Peri Magôn*, placed the age of Zoroaster 5,000 years before the Trojan War.¶ With this date Plutarch, in, perhaps, his most valuable tractate, agrees when referring to "Zoroastris the Magian."** Masudi, the Arabian historian, A.D. 950, assigns Zoroaster a date about B.C. 600, a computation probably connected with the view that places him in the period of the later Hystaspes. From these different opinions we gain at least one important fact, that in comparatively late times the people of the country in or near which he was said to have lived still connected him with an Hystaspes (*Vish-taspa*), who, in reality, was the *Kavâ Vishtâspa*, a friend of Zoroaster, who is mentioned in the *Gâthas*.

2. The name "Magian."

The name "magian," whence magic and magician, occurs in both our Testaments. In the Old, the *Rab-mag*, or chief magian, is mentioned amongst the Babylonian princes of Nebuchadnezzar at Jerusalem;†† whilst in the New it is recorded that magians (*μάγοι*) came to worship the infant Jesus.‡‡ In both cases the term implies not merely "wise men," but special experts belonging to a particular country. What, then, is the derivation and meaning of the word, which

* *Hist.* ii. 24.

† *Hist. Nat.* xxxvii. 49.

‡ *Ibid.* vii. 15.

§ Cf. Shelley, *The Cloud*: "I laugh as I pass in thunder."

|| *Hist. Nat.* xi. 96.

¶ *Ibid.* xxx. 1, 2.

** *Peri Is. kai Os.* xlvi.

†† Jeremiah xxxix. 3.

‡‡ St. Matthew ii. 1.

is certainly not Semitic? The Aryan and Turanian families of language have both claimed it. Thus, according to Haug and others, the term "magava" signifies one possessed of *maga*, or power, *i.e.*, spiritual or occult power; and the Magavas were the earliest followers of Zoroaster. Maghavan, "the possessor of riches," is a common epithet of the Vedic Indra, and is also occasionally applied to Agni, the igneous principle. On the other hand, Sir H. C. Rawlinson and M. Lenormant regard Magism as non-Aryan in origin, but engrafted with an Aryan religion.* In this case the word must be Proto-Medic or Scythic, *i.e.* Turanian; and I should be inclined to connect it with the Akkadian *mach*, "very high," "supreme." Thus, in an Akkadian hymn, † translated by M. Lenormant, we read *ana zae mach men*, "God, thou art very high." ‡ Whether, therefore, the term be of Aryan or Turanian origin, it signifies almost equally one exalted by the possession of wealth, of knowledge, or of power.

3. *Is Zoroaster an Historical Personage? His Name.*

According to Sir H. C. Rawlinson, Zoroaster was "the personification of the old heresonym of the Scythic race." § Zara-thushtra or thustra, the Persian and Parsi Zardosht, the Greek Zarastres, Zoroastres or Zoroastris, in his theory is Zera-ishtar, || or "the seed of Istaru," the celebrated Assyrian goddess ¶ of love, war, and the planet Venus, the zodiacal Virgo, and whose two phases, Istar of Nineveh and Istar of Arbela, reappear together in the Phenician (plural) divinity Ashtaroth, the Greek Astarte. M. Darmesteter, who regards Zoroaster as one of the many bright powers of heaven who fight in an almost endless strife against the powers of darkness and evil, observes, "The meaning of the name of Zarathustra is unknown. It is no fault of etymologies; one can count a score, and here is a twenty-first." And he proceeds to trace it to a form *zarat-vat*, corresponding to the Vedic *harit-vat*, which signifies "He-who-has-the-red (horses)," *i.e.* the sun. *Zarat-vat* would thus mean "red," or "gold

* Vide Canon Rawlinson, *Herodotus*, i. 346, *et seq.*; *Ancient Monarchies* ii. 348; Lenormant, *Chaldean Magic*, 218.

† *Cuneiform Inscriptions of Western Asia*, iv. 60.

‡ *Etude sur quelques parties des Syllabaires Cuneiformes*, 12.

§ *Notes on the Early History of Babylonia*, 41; vide also Canon Rawlinson, *Herodotus*, i. 350.

|| Assyrian, *Ziru*; Heb. זִרָוּ.

¶ Istaru means "goddess" (vide Geo. Smith, *Chaldean Account of Genesis*, 58).

colour," "and the entire name would be simply one of the thousand epithets of the bright hero"* of the material heaven. Haug, again, connects the name with the Sanskrit *jarat*, "old," and *uttara-ushtra*, "excellent"; and points out that the superlative form *Zarathushtrôtemô*, "the highest Zarathustra," assumes the existence of several contemporaneous Zarathustras, which term would thus mean "senior, chief (in a spiritual sense), as the word 'Dastur'† does now."‡ Haug is perfectly convinced of the actual historical existence of Zoroaster, and regards the *Gâthas* (subsequently noticed) as really containing "the sayings and teaching of the great founder of the Parsi religion himself."§ He also points out that the sage's real or family name was Spitama, and that, according to the Pahlavi books, a Spitama was the ancestor of Zarathustra in the ninth generation. The word Spitama was erroneously rendered by Burnouf "holy," in which he has been followed by later writers; and the sage's full title would thus be "the Spitaman," or "Spitama, the spiritual chief." Although it may for a moment appear somewhat paradoxical, yet the question of the actual historical existence of an individual Zoroaster but little affects the present investigation; for, just as we might have had Islamism and the *Koran* without a particular Muhammed, or have (as many think) an *Ilias* and an *Odysseia* without a particular Homer, so the existence of the *Avesta* and the Parsi religion is altogether independent of that of a particular Zoroaster; and yet, so far as my own individual opinion is concerned, I certainly agree with Haug and with Mr. Vaux, when he declares, in his excellent little *History of Persia*, "I do not doubt that Zoroaster was truly a teacher and reformer, and, further, that his religious views represent the reaction of the mind against the mere worship of nature, tending, as this does directly, to polytheism and to the doctrine of Emanations. It is, I think, equally evident that such views embody the highest struggle of the human intellect (unaided by Revelation) towards spiritualism [*i.e.* a truly spiritual religion], and that they are, so far, an attempt to create a religious system by the simple energies of human reason. Hence, their general direction is towards a pure monotheism."||

* *Ormazd et Ahriman*, 194, note 1.

† The Dasturs are the present priests of the Parsis.

‡ *Essays on the Parsis*, 296-7. Edited by Dr. West. 1878.

§ *Ibid.* 146.

|| *History of Persia*, 10. (In the series of *Ancient History from the Monuments*.)

4. *Further Classical References to Zoroaster.*

Ere turning to purely Oriental ground, a few other classical allusions to Zoroaster may be mentioned. According to Plato, in Persia it was usual to commit the heir-apparent to the custody of four chosen men, the first of whom instructed "him in the magianism of Zoroaster, the son of Oromasus, which is the worship of the gods."* Here the sage is described as the son of his divinity, the Parsi Ormazd, the Achæmenian Auramazda, the Zoroastrian Ahuramazda. Berosus makes Zoroaster a king of Babylon and the founder of a dynasty of seven Chaldean monarchs,† a complete error; whilst Justin, copying the statement of Ktesias, court physician to Artaxerxes Mnemon, has preserved the tradition that "Ninus, king of the Assyrians, who first made war upon his neighbours," made "his last war with Zoroaster, king of the Bactrians, who is said to have been the first that invented magic arts, and to have investigated with great attention the origin of the world and the motions of the stars."‡ According to Justin, Ninus, who is a personification of the Akkadian *Nin*, 'Lord' or 'Lady,' killed Zoroaster. With this tradition Arnobius is in exact accordance, and asserts that "between the Assyrians and Bactrians, under the leadership of Ninus, and Zoroaster of old, a struggle was maintained not only by the sword and by physical power, but also by magicians [on the Bactrian side], and by the mysterious learning of the Chaldeans"§ on the Assyrian. Here Zoroaster is placed in his true abode, Bakhdhi (Baktria), and the tradition is doubtless founded upon facts, and refers to great prehistoric contests between Aryan, Turanian and Semite. In another passage,|| Arnobius sneers at some statement of Hermippos to the effect that "the Magian Zoroaster" had crossed a mysterious fiery zone; and legends existed which described him as appearing to a multitude "from a hill blazing with fire, that he might teach them new ceremonies of worship."¶ Clement of Alexandria observes that Pythagoras showed that "Zoroaster the Magus" was a Persian,** and identifies him †† with "Er, the son of Arminius," who, according to the story in Plato, †† having been slain in battle, came to life again and related to his friends the destiny of the soul and its journey after death. The legendary con-

* *Alcibiades*, i. apud Jowett, *The Dialogues of Plato*, ii. 472.

† *Chaldaïka*, ii. Fragment, 9.

‡ *Hist.* i. 1. So Moses of Chorene, i. 6.

§ Arnobius, *Adversus Gentes*, i. 5.

|| *Ibid.* i. 52.

¶ Bryce, *Arnobius adversus Gentes*, 43, note 2.

** *Stromateis*, i. 15.

†† *Ibid.* v. 14.

‡‡ *Republic*, x.

nection of such matters with Zoroaster is interesting. Ammianus Marcellinus observes that "Plato, that greatest authority upon famous doctrines, states that the Magian religion, or Magia, known by the mystic name of Machagistia, is the most uncorrupted form of worship in things divine, to the philosophy of which, in primitive ages, Zoroastres, a Bactrian, made many additions drawn from the mysteries of the Chaldeans."* In later classical times many clumsy forgeries were attributed to Zoroaster, as to such personages as Orpheus (the Sanskrit Ribhu) and Hermes-Trismegistos (Tet-Thoth, *i.e.* Thought or Intellect); and there is still extant a work entitled *Magika Logia tôn apo tou Zoroastrou Magôn*. The younger Psellus, A.D. 1020—1105, amongst his numerous writings composed scholia on Zoroastrian literature, and gives as a Zoroastrian saying the dictum that

"The soul, being a bright fire, by the power of the Father,
Remains immortal and is mistress of life."†

And, lastly, Ficinus, who died A.D. 1499, and who wrote a work entitled *De Immortalitate Animi*, states that, according to Zoroaster, certain aquatic and aërial demons "are sometimes seen by acute eyes, especially in Persia."‡ It would be interesting to fully analyze and compare the above and other classical and mediæval statements with Zoroaster and Magism as revealed to us by modern discovery; suffice it, however, to observe here, that on the whole Zoroaster is described as an eminent Baktrian, possessed of mysterious wisdom in matters both physical and spiritual, engaged in contests with neighbouring nations, the author of various occult works, versed in the law connected with demons and the destiny of the soul, closely associated with the reverential or mystical use of fire, connected in the legend of Er, with a resurrection or revival, and the son of Ahuramazda. His *magic* or wisdom appears as a combination of both Baktrian and Chaldean lore, and its mystic name, Mach-agistia, at once reminds us of the Akkadian root *mach*, "very-high," to which I have ventured to refer *magism*.§

* Ammianus, xxiii. 6.

† Ψυχὴ πῦρ δυνάμει πατρὸς οὐσα φαινὸν,
Ἀθάνατος τε μένει, καὶ ζωῆς δεσπότις ἐστί.

‡ Apud Cory, *Ancient Fragments*, 255.

§ Soudas calls Zoroastres an astronomer in the time of Ninus, who wished to be destroyed by fire from heaven, and warned the Assyrians to preserve his ashes. He mentions another Zoroastres, whom he styles a Perso-Median sage, who first established the Magian polity and lived 500 years before the Trojan War, perhaps the most reasonable date given by any

5. *Iranian Sacred Literature.*

Such being the testimony of classical antiquity respecting Zoroaster the Magian, let us next consider him and his religion as they now stand revealed in the sacred books of Iran, translated, or I may rather say in many parts deciphered, by the genius and persevering efforts of Burnouf, Spiegel, Haug, and their several followers. The protagonist in this great work was the Frenchman Anquetil Duperron, whose name must never be forgotten in the history of Zoroastrian literature; arriving at Bombay in 1754, he first revealed to Europeans the treasures of the *Avesta*. The greater part of the sacred writings of Iran has been lost, but judging by those of other countries, and from the testimony of historians, we may well believe that they were at one time of vast extent. Haug quotes the statement of Abu Jafir Attavari, an Arabian historian, that "Zoroaster's writings covered 1,200 cowhides (parchments);"* and Hermippus estimated the verses of the sage at no less than 2,000,000.† According to the best tradition, which is supported by the sacred writings now in existence and by other references to many of the lost works, the entire canon once consisted of twenty-one books, called *Nasks*, the *Visparad* and the *Yasna*. The word *nask* is non-Aryan, and is connected by Haug with the Assyrian *nusku*. Now the Assyrian and Babylonian divinity Nabu (Nebo), the god of intellect, prophecy, and writing, is also known as Nusku; but Nusku, or rather Nuzku, was originally a distinct Akkadian divinity, whose name signified "the High" or "the height of heaven."‡ Hence these sacred books, the *nasks*, purport to be named after the god of the height of heaven, lord of intellect and writing. The *Vendidad* forms the

classical writer. He assigns several works on Nature, Astrology, and other subjects to this Zoroaster. He also mentions a third personage, Zoromasdres, whom he calls a Chaldean and a writer on mathematics and physics. In *masdres* we have apparently the second part of the name Ahuramazda, which, if we accept the derivation from *ziru*, "seed," would give "Son of Mazda" as the meaning of the name, which would thus exactly agree with the statement of Plato that Zoroaster was "the son of Oromasus." The three personages mentioned by Soudas are doubtless identical. Diogenes Laertius says, "From the time of the Magi, the first of whom was Zoroaster the Persian, to that of the fall of Troy, Hermodorus, the Platonic philosopher, calculates that 15,000 years elapsed. But Xanthos the Lydian [B.C. 470] says that the passage of the Hellespont by Xerxes took place 6,000 years after the time of Zoroaster" (*Peri Bion*, introduction, ii.).

* *Essays on the Parsis*, 123.

† "Hermippus qui de tota ea arte diligentissime scripsit, et vicies centum millia versuum a Zoroastre condita, indicibus quoque voluminum ejus positus explanavit." (Pliny, *Hist. Nat.* xxx. 2.)

‡ Vide Lenormant, *Etude*, 325.

19th Nask. The *Avesta-Zend* in Pahlavi (*i.e.* ancient Persian), *Avisták va zand*, or "Text and Commentary," consists of (1) The *Yasna*, or "Book of Sacrifice with Prayers." (2) The *Visparad*, or "All Heads," a collection of prayers. (3) The *Vendidad* (*Vidaeva-data*), or "Law against the Devas,"* contained in twenty-two Fargards or chapters; and (4) The *Khurdah-Avesta*, or "Little Avesta," which consists of Prayers and *Yashts*, or "Invocations." The *Yasna* may be compared in point of priority and importance to the *Rig-Veda* of the Indian Aryans and the *Pentateuch*. It consists of (1) the Five *Gáthas*, or "Songs," which form the most archaic portion of the *Avesta*; (2) the *Yasna of Seven Hás*, or "Sections," written in the *Gátha* dialect; and (3) the *Later Yasna*, which is written in the ordinary language of the *Avesta*. Haug traces the form *avisták* "to *á* + *vista* (p. p. of *vic* to know"), with the meaning 'what is known,' or 'knowledge,' corresponding nearly with *Veda*."† The text of the *Avesta*, as we have it, probably belongs to the reign of Ardashir I., who in A.D. 226 put an end to the Parthian dynasty of Askh (Arsakes) and became the founder of the Sassanids. This monarch made every effort to restore the national religion, which, although tolerated, had necessarily become much depressed beneath five centuries and a half of Greek and Parthian rule. The efforts of Ardashir were successful; the old sacred writings and traditions were collected, and although many of them have been subsequently lost, yet a most important residuum has been preserved to the present day by the Parsis, who left their country for India on the Muhammedan conquest of Persia A.D. 650. The great antiquity of the writings collected by Ardashir is evident, as, amongst other reasons, in his time "the language of the *Avesta* had long ceased to be spoken, and the contemporaries of Ardashir could no more have composed a chapter of the *Vendidad* than an English gentleman of this century could imitate the Anglo-Saxon of King Alfred."‡ As to date of composition, the *Gáthas* and the *Earlier Yasna* may be fairly placed some time prior to B.C. 1200; the greater portion of the *Vendidad* cir. B.C. 1,000; the *Visparad* and *Later Yasna* cir. B.C. 900-800; whilst the *Yashts* may be placed down to cir. B.C. 400. In addition to the foregoing archaic works, there is extant an extensive Pahlavi literature, using that term to denote the language of Persia during the Sassanian dynasty, A.D. 226-641. Two Pahlavi works in particular may be men-

* Vide *inf.* sec. 10.

† *Essays*, 121.

‡ Bleeck, *Avesta*, introduction, xi.

tioned, the *Dinkard* and the *Bundahish* or 'Cosmogony.' The former consisted of nine books, the first two of which are lost; and contains, amongst other things, the opinions of ancient Zoroastrians on traditions and customs and on various duties; the miracles of the Zoroastrian religion from the time of the first man to that of the last of the yet future prophets; details of the life of Zoroaster and an account of the contents of the twenty-one Nasks, great part of which were destroyed in the time of "the accursed Alexander," at which period there were, according to the *Dinkard*, but two complete copies of the sacred books; one of these then deposited in the royal archives at Persepolis was burnt there. The *Bundahish* contains an account of the creation, of the opposition between the good and evil powers, of the nature of the various creatures, and of the future destiny of mankind, including the Resurrection and the Last Judgment. The two latter remarkable features are, in Haug's opinion, "founded on original Avesta sources which are now lost."* An ancient song is embodied in the account of the Resurrection, the burden of which is that although it may appear to man to be impossible that the body when resolved into its elements and scattered to the winds should nevertheless be raised again, yet that to God all things are possible. So, too, the archaic Egyptians held firmly the doctrine of the resurrection of the body,† a dogma in after-ages to provoke the laughter of the Greek, mirth melancholy to the true philosopher, since it sprang from perhaps the most pronounced and at the same time the saddest feature in his character, an intense and passionate clinging to this perishing earth life. Achilles, the Greek ideal, has fitly been made the mouthpiece for that dark sentiment:—

" Rather I'd choose laboriously to bear
 A weight of woes, and breathe the vital air,
 A slave to some poor hind that toils for bread,
 Than reign the sceptered monarch of the dead."

Far different from the gloomy Homeric abode of the departed was the paradise of song‡ that awaited the justified soul of the deceased Zoroastrian.

* *Essays*, 313.

† *Vide* Bunsen, *Egypt's Place*, iv. 641; Lenormant, *Chaldean Magic*, 84. And authorities cited.

‡ Heaven is called *Garôdemâna*, "House of Hymns," and *Ahu vahishta*, 'the best life.' As is well known, *paradise* (*pairidaêza*), i.e. "enclosure," a place securely fenced in, is an Iranian word.

6. *Mythology and Religion.*

Such, then, are the Parsi Scriptures; their composition extended over 800 or 900 years or more, and thus, like the Vedic Hymns, they are the work of numerous individuals; and whilst possessing a kind of general unity of tone, on close examination are found to differ widely in style and religious standpoint as in language. The latest portion of the *Avesta* is replete with archaic ideas of a mythological character, a feature which applies equally to subsequent works, such as the *Bundahish*; whilst in the *Yasna*, and especially in the *Gáthas*, the mythological element is but dimly visible, and the religious element is all-important. And here let me make a remark respecting the spheres of mythology and religion. The former corresponds with the material, the latter with the spiritual portion of the universe; they rise together as twin ideas in the human mind, and at the same time the mental and the physical eye grasp, however dimly, some of the wonders of God and the Kosmos, of soul and body. Mythology did not spring from religion, nor religion from mythology. They were "two sisters of one race," widely differing indeed in value, but at first equally simple, equally pure. To give an illustration: Prof. Steinthal in *The Legend of Samson*,* remarks, "I flatter myself that I know the particle by which was expressed the greatest revolution ever experienced in the development of the human mind, or rather by which *the mind itself was brought into existence* (!) It is the particle 'as' in the verse 'And he [the Sun] is *as* a bridegroom coming out of his chamber; he rejoices *as* a hero to run his course:' Nature appears to us *as* a man, *as* mind, but is not man or mind. This is the birth of mind. This 'as' is *unknown* not only to the *Vedas*, but even to the Greeks."† Previously, it would seem, a most gross and crude mythology had reigned supreme; every one regarded the sun as an actual bridegroom, a real hero, till one bright morning it occurred to the Psalm-writer, *à propos* of nothing in particular, that these expressions were merely similitudes. Surely a stupendous credulity must be required to enable any one to accept such a theory, which is just as true and as false as the appended statement that this wondrous "as" is unknown to the Vedic poets. Take, for instance, a hymn to Ushas, the Dawn. The hymn-writer, after comparing Ushas to a dancer, and to a triumphant maid, continues—

* Appended to Dr. Goldziher's *Mythology among the Hebrews*.

† Sec. xiii.

“As a loving wife shows herself to her husband,
So does Ushas, as it were, smiling, reveal her form.”*

Here the symbolism and simile of the Vedic poet are as clear and pure as the Psalmist's. Both are perfectly aware that sun and dawn are alike merely natural phenomena, and, lastly, there is no monopoly of the mysterious “as.” Steinthal asks, “I wonder whether I am mistaken?” I think we may safely reply that he is. Man, by the necessity of his being, applies anthropomorphisms to the phenomena of nature; from his standpoint the dawn smiles, the thunder shouts or laughs, the sun knoweth his going down, and the deep utters his voice and lifts up his hands on high. Here is no crude ignorance, no grovelling concept, but a rich and splendid vein of natural poetry, sublime because—and this is the real power of all potent thought and beautiful idea—it is practically, nay strictly, true.†

7. Character and Contents of the Gâthas.

To revert to the Gâthas: their supreme age and importance in the inquiry is evidenced, (1) by the exceedingly archaic form of language in which they are composed; (2) by their being frequently quoted or referred to with the greatest respect in other sacred writings, *e.g.*, they are expressly called “the five Gâthas of the pure Zarathustra.”‡ (3) By their being the repositories of numerous ideas and forms of belief which have been subsequently elaborated; and (4) by the uniform tradition on the subject. The word is from the root *gai*, “to sing,” and they are composed in a metrical form for recitation, each verse of the first containing forty-eight, of the second fifty-five, and of the third forty-four syllables. Some of the metres naturally greatly resemble those of the Vedic Hymns. In quoting from them I use the translation of Haug, as that of Spiegel is admittedly inferior, and indeed in many passages absolutely unintelligible. The *First Gâtha* bears the following heading, in the ordinary language of the *Avesta*, and therefore added long subsequent to the composition of all five:—

“The revealed thought, the revealed word, the revealed deed of the righteous Zarathustra; the archangels first sang the Gâthas.” Here it is implied that Zarathustra

* *Rig-Veda*, I. cxxiv. 7 (translated by Dr. Muir, *Sanskrit Texts*, v. 185).

† “Hold, in high poetic duty,
Truest Truth the fairest Beauty.”

Mrs. Browning, *The Dead Pan*.

‡ *Yasna*, lvi. 3.

received these sacred songs through angelic agency, and hence that he was the human author of them and communicated them to the world. The triad of thought, word, and deed, often appears in the *Avesta*; and is used in a somewhat technical sense, as meaning the thoughts, words, and deeds enjoined by the Zoroastrian faith. Thus in a fragment of the *Hádókht Nask*, which gives an account of the progress after death, we find four steps mentioned in the advance of the soul. The first step of the righteous he places upon good thought, the second upon good word, the third upon good deed, and the fourth and last upon the eternal lights. The account of the contrary progress of the unrighteous soul is lost, except the last clause, "The soul of the wicked man fourthly advanced with a step he placed on the eternal glooms," a calmly awful saying, which vies in solemnity with those of our own Sacred Books. The *First Gátha* forms chapters xxviii.—xxxiv. of the *Yasna*, and is to some extent a compilation of independent verses; in one place Zarathustra is spoken of in the third person, but as a rule he is the speaker throughout. In this *Gátha* are chiefly noticeable:—

- I. The theory of Agriculture as a sacred duty.
- II. The theory of the Twin Spirits.
- III. The protest against the Devas and their worship.

In the *Second Gátha* we have, in addition to various references to the foregoing subjects,

- IV. The view of Ahuramazda as the Creator.

The last three *Gáthas* which, on the whole, are not so important, also contain similar references, and a very material passage which explains Zarathustra's view of the theory of the Twin Spirits. These different subjects I shall notice in order.

8. *Agriculture as a Sacred Duty.*

It is remarked of the state of things prior to the creation of human beings, and in a manner indicative of a certain incompleteness, that "there was not a man to till the ground" and the subduing of the earth is expressly assigned to the human race, not in the first instance as a toil to be accompanied by "sweat of the face," but as a high and sacred duty. So in the Greek religious-mythology, Demeter, "the Earth-mother," the earth considered in a state of orderly rule and cultivation, kosmic not chaotic, is the great patroness of Triptolemos and the other noble and nurturing heroes of civilization, who wander over the world, making all men acquainted

with the blessings and benefits of agriculture.* And here I may appropriately notice a link in name between the Aryans, Eastern and Western. De-meter, as is well known, is equivalent to Ge-meter, "Earth-mother." Now the Sanskrit *gâus*, the equivalent of the Greek *gê*, signifies (1) cow, and (2) earth; the earth being thus regarded in a secondary sense as the fostering cow of mankind, a kind of symbolism in exact harmony with the ideas of India, Iran, or Egypt, but which the intensely anthropomorphic spirit of the Greek would have rejected with disgust. So the Ribhus in the *Rig-Vêda* are said to have renovated or cut the cow, † namely, by cultivating the soil; and in this first *Gâtha*, the *Gêush urvâ*, or "Soul of the Cow," i.e. the spirit of the personified earth, is represented as complaining to heaven, and as being informed by Ahuramazda through Zarathustra, that it was to be cut, that is, ploughed, for the good of mankind. So Zarathustra, apparently addressing a large assemblage, and unfolding his doctrines to them, declares:—

"I will now tell you who are assembled the wise sayings of Mazda,

And the hymns of the Good Spirit.

You shall hearken to the *Gêush urvâ*."

That is, "You shall duly cultivate the earth." And again we read of Armaiti, the personification of prayer, and who was in Ahuramazda, ‡ that—

"When Thou (Ahuramazda) hast made her paths that she might go

From the tiller of the soil to him who does not cultivate it.

Of these two (i.e. the agriculturist and the nomad),

She chose the pious cultivator,

Whom she blessed with the riches produced by the good mind.

All that do not till her, § but worship the Devas,

Have no share in her good tidings;"

namely, in the blessings of wealth, order, and civilization generally. The nomadic life necessarily degenerates; it

* For a full analysis of the mythic position of Demeter and Persephone in connection with the Eleusinian mysteries, vide *The Great Dionysiac Myth*, vol. i. 273, et seq. By the Writer. Longmans & Co. 1877.

† Vide *Rig-Vêda*, iv. Hymns 33-37.

‡ "In Thee was Armaiti" (*Yasna*, xxxi. 9).

§ Armaiti is also considered as the angel of the earth, probably because prayers, although heaven-inspired, rise from earth.

becomes by contrast more and more rude and barbarous, and is sooner or later associated with lawlessness and rapine. There are numerous indications in the *Avesta* that the Zoroastrians suffered severely from time to time from the violence of wilder neighbours, and to promote the more settled and orderly life of agriculture thus became a sacred duty. It was in fact a form of the contest between chaos and kosmos.

9. *The Zoroastrian Theory of the Twin Spirits.*

Without here noticing the general view respecting Persian, Magian, or Zoroastrian dualism, I will at once quote the *Gâthas*, in illustration of the Zoroastrian concept of the Twin Spirits:—

“In the beginning there was a pair of twins,
Two spirits, each of a peculiar activity;
These are the good and the base, in thought, word, and deed.
Choose one of these two spirits. Be good, not base!
And *these two spirits united* created the first (*i.e.* the material world);
One the reality, the other the non-reality.
Of these two spirits you must choose one.
You cannot belong to both of them.”

Did, then, the composer of this hymn believe in the actual objective existence from all eternity of two spirits, one the personification of good, the other the personification of evil? Certainly not; and why? Briefly for the following reasons:—

I. Ahuramazda himself is distinctly stated in the *Gâthas* to have created all that is, and is spoken of as “He who created by means of his wisdom the good and evil mind in thinking, words, and deeds.”

II. These twins, called “the two primeval spirits of the world,” are styled “the increaser” and “the destroyer.” This explains the profound Zoroastrian concept; the twins are the two sides of the divine action, like light and darkness; and, as Haug well observes, are “in Ahuramazda.” So, in another passage of the *Yasna*, Ahuramazda declares, “The more beneficent of my two spirits has produced the whole rightful creation.”*

III. In later times, when Ormazd (Ahuramazda) and Ahri-man (Angrômainyush), the “dark” or “hurtful spirit,” had, in the general belief of centuries, been pitted against each other for ages, the mind, still striving after a primitive unity,

* *Yasna*, xix. 9.

derived them both alike from an imaginary personification designated Zarvan-akarana, "Boundless-time," a being unknown to the *Avesta*.*

IV. The dogma of the eternal existence of evil in the past is unknown to any other archaic religious belief; and therefore the most stringent proof of the existence of such a creed must be furnished ere the fact can be accepted. But no such proof can be supplied.

V. On the other hand, the cause and origin of the later Iranian dualism is transparent. The dark spirit of Ahura-mazda, the mysterious side of Providence, which shows itself objectively in the existence of darkness, evil, pain, injuring storms, and noxious creatures, soon naturally enough, and indeed, almost inevitably, received in belief a separate existence; and, as its operations were in apparent contradiction to those of the beneficent God, an imaginary strife arose between them, a contest whose physical counterpart had long before been known to mythology.

10. *The Protest against the Devas and their Worship.*

Zarathustra, like many other great men who have been regarded as founders of religions, was essentially a *reformer*; and whilst undoubtedly claiming to be able to "teach the way of God more perfectly," was far from aspiring to the invention of a new and superior kind of faith. To compare small things with great, any particular religionist who makes a mighty effect upon his age resembles, however faintly, the Founder of our Faith; who at once accepted, illuminated, and fulfilled all past true religion; protested against the degeneracy of the then present religion, and threw a blaze of expanding and intensifying splendour upon the religion of the future. Even men like Muhammed and Sakya-muni were the outcome of terrible corruptions, against which they waged war and protested with immense effect, however great may have been the subsequent failure of their systems; and the creed of Zarathustra, having as its basis-principle the grand truth of monotheism, has survived the vicissitudes of many a stormy age, and still proclaims with unshaken fidelity the doctrine of the archaic sage.† I will next consider the protest of Zarathustra and the Deva-cult. In the *Gâthas* we read:—

* The passage in which Zarvan-akarana is supposed to be mentioned, really reads:—"The beneficent spirit made (them) *in* boundless time" (*Vendidad*, xix. 9), *i.e.* at some time in past period.

† "The Parsis are now strict Monotheists; their one supreme deity is Ahuramazda." (Haug, *Essays*, 53.)

"Ye Devas have sprung out of the evil spirit
 Who takes possession of you by intoxication.
 You have invented spells, which are applied by the most
 wicked;
 May the number of the worshippers of the liar (evil spirit)
 diminish.
 What, O good ruler Mazda, are the Devas?
 Those who attack the good existence (*i.e.* good men, useful
 animals, etc.).
 By whose means the priest and prophet of the idols expose
 the earth to destruction.
 Whoever thinks the idols and all those men besides,
 Who think of mischief only to be base,
 And distinguishes such people from those who think of
 the right,
 His friend or father is Ahuramazda.
 This is the beneficent revelation of the supreme fire-
 priest."

Again, he says of "the priests and prophets of idols," that,
 "They ought to avoid the bridge of the gatherer;
 To remain for ever in the dwelling-place of destruction."

And in the *Earlier Yasna* we find a formal confession of
 faith:—

"I cease to be a Deva (worshipper).
 I profess to be a Zarathustrian Mazdayasnian (devotee of
 Ahuramazda),
 An enemy of the Devas, and a devotee of Ahura;
 A praiser of the immortal benefactors (*i.e.* the Ameshas-
 pentas).
 I forsake the Devas, and those like Devas.
 I praise the Ahuryan religion, which is the best of all that
 are, and that will be."

As it may be objected, *in limine*, that the Deva-cult, which
 is admittedly polytheistic in character, was universal in Aryan
 regions until the age of Zarathustra, it may be replied, *in
 limine*, that Zarathustra no more invented the Ahuryan creed
 than St. Augustine (to take a prominent name) invented the
 Christian. And the evidence is similar in both cases; for just
 as the Bishop of Hippo speaks with approbation of the faith
 of many of his predecessors, and just as the name of Christ as
 a divine personage and as God, is to be met with centuries
 before his day; so, we find Zarathustra alluding to "sayings
 of old" revealed "by Ahura,* praising the ancient fire-

* *Yasna*, xlvi. 6.

priests,* and exhorting his adherents to revere the Angra, known in the Vedic Hymns as the Angiras, an ancient race or family peculiarly connected with religious rites even before the separation of Indian and Iranian; and so also we meet with the sacred name Ahura, as applied to the supreme Aryan divinity, even before the separation of the Eastern and Western branches of the mighty family. Thus the Ahuryan religion, the faith of the Angra-Angiras, was already ancient in Zarathustra's day. Be it also observed that Monotheism does not consist, as one might almost suppose from the manner in which it is frequently treated, in the negation of the belief in the existence of all sentient beings except God and ourselves. For, just as we, who are monotheists, accept the existence of angelic intelligences, good and evil, and of the souls of the dead, holy and unholy; so Zarathustra may have regarded the Devas as actual objective existences, as evil angels or demons, without thereby in any degree infringing on his position as the champion of monotheism. I am not inquiring what his views on the subject were, but merely wish to show that in any case they do not affect the general question, inasmuch as he certainly did not regard the Devas as true gods.

11. *History of the name Asura: meaning of "Ahuramazda."*

It is one of the greatest triumphs of modern scientific research to have revealed, by means of historical and philological investigation, the primitive unity of the Aryan family, a grand fact, which, like all other *facts*, is in perfect harmony with Biblical statement. We now know that there was a time when the ancestors of Kelt, Teuton, Slav, Latin, Greek, Iranian, and Indian, dwelt together as a single nation. Then came a first and great separation, when Iranian and Indian were left together, whilst the others, impelled by the old and mysterious law of "Westward Ho," pushed forward into Erebt

* Vide *inf.* secs. 30-32.

† Erebt signifies "the West," and, similarly, the *Arabs* are the people in the west of Asia. "Erebos" is originally the western gloom after sunset, from the Assyrian *eribu*, "to descend," as the sun. In accordance with this circumstance, the Homeric Erebt lies in the west. The cave of Skylle looks "towards the west, (*i.e.*) to Erebt" (*Od.* xii. 81); Odysseus turns towards Erebt to sacrifice (*Ibid.* x. 528), and thence the ghosts assemble (*Ibid.* xi. 37). Aides, as King of the Underworld, is called "Hesperos Theos" (Sophokles, *Oed. Tyr.* 177); and a "westward position" was generally adopted by the Greeks when invoking infernal divinities (cf. Mitford, *History of Greece*, xxii. 2). The main entrance to Greek temples of gods

now Europe. After a time came a second separation, when the ancestors of the Aryan Indians wandered south-eastwards into the Punjâb, the region of the five or seven streams.* Now the name Ahura, in the form Asura, is one of the most familiar, and at the same time perhaps the most interesting title in the sacred literature of ancient India. In late times the Asuras are represented as demons or fiends confined in hell, and powerless against the gods.† In the *Purânas*, their opponents are styled, by a false etymology, Suras; and they are supposed to be A-Suras, "not-Suras." In the Vedic literature of the second class, the *Brâhmanas*, the Asuras are the cunning and powerful opponents of the Devas or gods. Going back still further, to the Vedic literature of the first class, we find the Asuras described in the *Atharvaveda*, the last and latest of the Four *Vedas*, as evil and tricky beings, who are put down and whose devices are frustrated by the Rishis or Vedic seer-poets.‡ Lastly, we come in an ascending scale to the *Rig-Veda*, in the Tenth and latest book of which the Asuras are still unfavourably described as the opponents of the gods and the good. But in the earlier portions of the *Rik* there are, according to Haug, only two passages§ where the word is used in an unfavourable sense. Thus during the latter part of the long period occupied in the gradual composition of the *Rig-Veda*, the depreciation and degradation of the term *Asura* and *Asuras* went on steadily, until this principle culminated in their position in the late mythology. I will give some instances of the use of the word in a good sense, in the earlier portion of the *Rik*; and I may here remark that the translation by Wilson, which is based upon the views of that Indian Eustathios Sâyana, A.D. 1350, most

was generally on the eastern side; for Zeus and his fellows are the Devas or "Bright-beings," who love the east as connected with the dawn, the light, and the day. But the shrines of heroes faced westward, to show that they had once been mortal and had sunk like the sun in death; for the Sun-god, the Vedic Yama, "was the first of men that died, the first who found the way" (*Rig-Veda*, X. xiv. 1, 2) to the heavenly world (vide *inf.* sec. 24. Cf. "The happy west" in the archaic Egyptian religion). The west being thus connected with the infernal divinities, some Christian writers regarded it as the special region of the devil and evil spirits. The word *erebos* has also been identified with the Sanskrit *ragas*, but this is not approved by the best authorities (vide Prof. M. Müller, *Rig-Veda-Sanhita*, i. 42).

* "Hapta Hindu is the *sapta-sindhavas* of the Vedas, a name of the Indus country or India." (Haug, *Essays*, 230, note 3.)

† Southey's *Curse of Kehama* fairly illustrates this stage.

‡ Vide *Atharvaveda*, IV. xxiii. 5; VII. vii. 2.

§ *Rig-Veda*, II. xxxii. 4; VII. xcix. 5. In the later passage Varchin, an opponent of Indra, is styled an Asura.

famous of native commentators on the *Veda*, is by no means to be relied on in the matter.* Thus we read †:—

“This soma † is to be distributed as an offering among the Asuras” (Haug).

“This soma is to be offered by us for the divine beings” (Muir).

Here the Asuras are simply the gods. And the title Asura is also applied to some of the principal divinities separately; to Indra, § Agni, || Savitri, ¶ to the divine diad Varuna and Mitra, ** but especially to Varuna, †† the archaic head and chief of Vedic divinities, and whom we meet with in the west as Ouranos, so that he was known to the undivided Aryan family. Thus investigation discloses that the name Ahura, in the form Asura, was originally used in a good sense, alike in India and in Iran, and in both countries was especially applied to the supreme divinity. This name and concept were, therefore, the common property of the Eastern Aryans ere their separation into Iranian and Indian. But the term can be carried still further back, for we find it in the Aesir, ††† the general name for the gods of the Teutons and Scandinavians, and in the Erse and Etruscan *Æsar*; §§ and hence it was the common property of the united Aryan race, their ancient and venerable appellation of the Supreme.

Next, what is its meaning? Connected with the Vedic *asu*, ‘breath,’ ‘life,’ Asura is “the Living,” the living God, the Spiritual, and, more generally, “the Divine,” as opposed to the Human. The God of Zarathustra Ahurô mazdâo,

* “Sâyana represents the tradition of India” (Prof. Müller, *Rig-Veda-Sanhita*, Preface, xv.), and “in many cases teaches us how the Veda ought not to be understood” (*Ibid.* ix.).

† *Rig-Veda*, I. cviii. 6: “Somo asurair.”

‡ The Soma-juice, supposed to have been obtained from the plant *Asclepias* (vide Wilson, *Rig-Veda-Sanhita*, i. 6; Canon Rawlinson, *Ancient Monarchies*, ii. 329).

§ *Rig-Veda*, I. liv. 3.

|| *Ibid.* IV. ii. 5.

¶ *Ibid.* I. xxxv. 7.

** *Ibid.* VII. xxxvi. 2; VIII. xxv. 4.

†† *Ibid.* I. xxiv. 14. Here Wilson, under the influence of Sâyana, renders Asura “avertter of misfortune”; adding “It is an *unusual sense of the word*, but it would *scarcely be decorous* (!) to call Varunâ an *asura*.” (Vide also Muir, *Sanskrit Texts*, v. 61.) M. Darmesteter remarks, “Varuna est le dieu le plus fréquemment désigné sous le nom d’Asura” (*Ormazd et Ahriman*, 47).

††† The original form of the word is *ansu* (vide Tiele, *Outlines of the History of the Ancient Religions*, 190; Darmesteter, *Ormazd et Ahriman*, 47, note 4).

§§ “According to Suetonius, *ÆSAR* was an Etruscan word which meant ‘God,’ *Æsar* also means ‘God’ in Erse” (Rev. Isaac Taylor, *Etruscan Researches*, 144). “Aisar means ‘gods’ or ‘spirits’” (*Ibid.* 293).

“the Ahura who is called Mazdâo,” is “the Wise-living-spirit,” or perhaps rather, “the Living-Creator.”*

12. *The Devas and the Deva-cult.*

Such being the god of “the Ahuryan religion,” let us next consider the Devas and their cult. The important root *dyu*, meaning primarily ‘to spring,’ and hence ‘to shine forth,’ has become the parent of a whole tribe of famous words, e.g., Dyaus, a Vedic name for the god of the gleaming heaven, the father; called Dyaus-pitâr, the Greek Zeus-patêr, and Latin Ju-piter and Janus Pater. Juno, Dianus, Diana, are other connected names; as is the German Tiu, which survives in Tues-day. *Dyu* has also supplied the general name for God or gods, *deva*, *theos*, *deus*, *divus*, i.e. “the Bright;” so, conversely, the Vedic *a-deva* is *a-theos*, or ‘god-less.’ The Devas are, therefore, “the Bright-ones,” the divinities of the morning, the dawn, the day, the lighted and gleaming firmament. So we find the dictum,—

“The evening is not for the gods; it is unacceptable to them.”†

Deva, therefore, like *asura*, was originally a good epithet amongst the Aryans; and has continued to be so in India, Greece, and Italy. But just as the Hindu Aryan degraded the latter term, so the Iranian Aryan degraded the former; and in the *Gâthas* and throughout the *Avesta* it is applied to false gods and hostile demons, and at length appears in the late Persian form *dêv*,‡ meaning a fiend or evil spirit. The name *Vendidad* signifies, as noticed, “the Law against the Devas;” and from the Zarathustrian standpoint Aryan India is pre-eminently “the country of the wicked Deva-worshipping men.”§ Now, whatever the Aryan religion in India may have been originally, it undoubtedly at a certain period was, or became, polytheistic; and it will be observed that

* “*Mazdâo* . . . the Vedic *medhâs*, ‘wise’; or when applied to priests, ‘skilful, able to make everything’” (Haug, *Essays*, 301). Prof. Müller and Benfey agree in this connection (*vide* Muir, *Sanskrit Texts*, v. 120, note). M. Darmesteter prefers to derive Ahura from an Iranian word, *ahu*, “master,” form of an Indo-Iranian *asu*, with which he compares the Greek *εὖς*; Ahuramazda would thus signify “the Very-wise Lord.” The Rev. K. M. Banerjea takes a bolder flight, and confidently connects *Asura* with *Asur*, remarking “The name *Ahura Mazda* was derived from ‘*Asur*,’ the Assyrian term for god or lord” (*The Arian Witness*, Preface, xi. Calcutta, 1875).

† *Rig-Veda*, V. lxxvii. 2.

‡ Prof. Müller has elaborately traced the forms of the root *dyu*, such as *div*, *dev*, *dâiv*, etc. (*Lectures on the Science of Language*, ii. 493.)

§ *Vendidad*, xix. 29.

Zarathustra does not proclaim the cult of the Ahuras as against that of the Devas, but the worship of *the* Ahura, Ahuramazda, as against that of the company of Devas, God against gods, monotheism against polytheism. Now Zarathustra, as noticed, was a reformer, refers to good men living ere his time, and did not invent the concept of Ahura; and therefore, so far as the investigation has proceeded, we have exceedingly strong reasons for surmising that the Vedic period was one of gradual degradation, during which, whatever may have been the superior faith or knowledge of individuals, Dyaus, "the Bright," the god of heaven, was by degrees transformed into the Devas or band of bright divinities, in disregard of that profound saying of a Chinese sage, "As there is but one sky, how can there be many gods?"* Ere considering the Vedic religion in this connection, several points alluded to in the foregoing quotations from the *Yasna* must first be noticed.

13. *The Soma-orgies and the Bridge of the Judge.*

The intoxication spoken of in the *Gâtha* is that produced by the Soma-juice; the Karapans or "Performers of sacrificial rites," were accustomed in the days of feud between Indian and Iranian to prepare solemn Soma-feasts for the Indian divinities. The Kavis or Seer-priests of the Vedic Aryans then invoked a particular divinity with hymns, and the god was supposed to descend and partake of the delicious beverage. His votaries next intoxicated themselves more or less, and when sufficiently excited set out on plundering excursions. Hence the horror and abomination with which the Zarathustrians regarded these depraving orgies, which at once vastly debased the concept of divinity and ruined the peaceable and orderly agriculturist. The *Gâtha* speaks of "the priests of idols," an expression which seems clearly to imply an image-worship more or less pronounced. Prof. Müller states that "the religion of the Veda knows of no idols. The worship of idols in India is a secondary formation, a later degradation of the more primitive worship of ideal gods."† Bollensen and others are of a contrary opinion. The truth probably is, that images began to appear towards the end of the Vedic period. These idol-priests are warned to "avoid the Bridge of the Gatherer," the celebrated *Chinvat pûl*. The phrase may also be rendered "Bridge of the Judge," which seems to me to be rather the preferable

* *Apud* Prof. Müller, *Introduction to the Science of Religion*, 195.

† *Chips*, i. 38.

reading. This bridge leads across the aërial abyss to Heaven, and all souls must essay to traverse it; but the righteous alone can succeed, whilst the wicked fall from it into Hell beneath. It is the origin of the Muhammedan bridge Al Sirât, "laid over the midst of hell, finer than a hair, and sharper than the edge of a sword," whence the wicked will fall into the abyss. The root of the idea seems simply to be that Heaven being regarded as above and Hell beneath, the soul at death rises, in the desire to reach the former. But how shall it cross the vast abyss save by some aid, which may fitly be figured as a bridge? The wicked necessarily fail, as they may not enter Heaven. The account of the soul's progress after death is highly interesting; the righteous man is assisted across the Bridge by a beautiful maiden, who is a personification of that holiness which he has chosen when in life, an unique and remarkably fine idea:

"Said Ahuramazda: after a man is dead
At daybreak after the third night he reaches Mithra;"

apparently the solar region.

"The soul goes on the time-worn paths,
Which are for the wicked and which are for the righteous,
To the Chinvad bridge created by Mazda."

Here it is met by the maiden referred to.

"She the beautiful, well-formed, strong, comes.
She dismisses the sinful soul of the wicked into the glooms.
She meets the souls of the righteous when crossing (the celestial mountain),
And guides them over the Bridge of the Judge"

into the heavenly regions, where they are joyfully welcomed.

"Vohu-manô ["the Good-Mind"] rises from a golden throne;
Vohu-manô exclaims: How hast thou come hither to us,
O righteous one!
From the perishable life to the imperishable life?
The souls of the righteous proceed joyfully to Ahuramazda,
To the Ameshaspentas, to the golden throne, to paradise."*

* *Vendidad*, xix.

The corresponding account in a Fragment of the *Hādōkht Nask* states,—

“On the passing away of the third night [after death],
 As the dawn appears, the soul of the righteous man
 appears,
 Passing through plants and perfumes.
 To him there seems a wind, more sweet-scented than
 other winds,
 Advancing with this wind there appears to him what is
 his own religion,
 In the shape of a beautiful maiden.
 Then the soul of the righteous man spoke to her,
 ‘What maiden art thou, most beautiful of maidens?’
 Then answered him his own religion :
 I am, O youth, thy good thoughts, good words, good
 deeds.’”

And then the righteous soul advances the four steps to perfect consummation of bliss, the last being placed upon “the eternal luminaries.”*

14. *The Ameshaspentas.*

The soul of the righteous is said to proceed to Ahuramazda and “to the Ameshaspentas,” the Ameshaspentas of the Parsis, whose name signifies “Immortal Benefactors;” and of whom, as we have seen,† the devout Ahurian is a praiser. These personages may be fitly introduced by a very interesting quotation from Plutarch: “Horomazes [Ahuramazda] having sprung from the purest light, but Areimanios [Angrōmainyush] from the darkness (ἐκ τοῦ ζόφου), they made war on each other: and the one [Horomazes] made six gods, the first (the god) of Good-mind (εὐνοίας). This is Vohumanō, “the Good-mind,” afterwards known as the angel Bâhman, a personification of the nature of Ahuramazda, and who, as noticed,‡ welcomes the righteous soul on its entry into Heaven.

“And the second (the god) of Truth (ἀληθείας).” This is Asha-vahista; the most beautiful truth.” *Asha*, the equivalent of the Vedic *rita*, is the universal order of things, both material as in the kosmos; and religious; as in fitting worship and ritual. Thus the term signifies order, righteousness, truth. Asha-vahista is a kind of personification of light, which is truth-revealing and displays the harmony of the All, in opposition to darkness, which is essentially ignorant and chaotic.

* *Vide* sec. 7.

† *Sup.* sec. 10.

‡ *Sup.* sec. 13.

“And the third (the god of) Good-government (ἐὐνομίας).” This is Khshathra-vairya, “the independent sway.” The Kshatriya, or warrior caste, is the second of the four ancient Hindā castes which appear as early as the *Brāhmanas*.

“And of the rest one was (god) of wisdom.” This is Spenta-armaiti, “the perfect thought,” piety. “And another (the god) of wealth (πλοῦτου).” This is Haurvatad, “Health,” who was afterwards supposed to preside over the fruits of the earth, which spring up from the dwelling of Plutus-Pluto. “And the remaining one, the maker of the pleasures in what is beautiful.”* This somewhat curious definition we can but apply to the remaining Ameshaspenta Ameretad, “Immortality,” in which the righteous shall enjoy the endless loveliness of God. Now these six personifications, the Good-Mind, Truth, Power, Piety, Health, and Immortality, who, together with Ahuramazda, make up the mystic number of Seven Spirits of holiness and purity, afford a striking instance of the intense monotheism of the system of Zarathustra; for they are not distinct divinities in origin, but, as their names show, merely phases of the beneficent action and perfect character of the Supreme. In later times a corresponding list of demons, such as Akem-mano, “the Evil Mind,” Taric, “Darkness,” and Zarc, “Poison,” were excogitated in order to supply Angromainyush with assistant counsellors, and to make a complete system exactly corresponding in its halves, on the principle

“Grove nods at grove, each alley has its brother,
And half the platform just reflects the other.”

This formal and arbitrary arrangement of divinities and supernatural personages—good, bad, and indifferent—is what may be termed *pantheonization*, is purely or mainly artificial, and always marks a late phase in the religious thought of a community. In Greece the Homeric Poems paved the way for the system of Hesiod, from which the class of thinkers who culminated in Socrates and Plato ever recoiled, and which was essentially self-destructive. There is great truth, mixed doubtless with some alloy of error, in the remark of Herodotus, “Homer and Hesiod were the first to compose theogonies, and give the gods their epithets, to allot them their several offices and occupations, and describe their forms.”† But, at the same time, it must be observed that the concept of a Supreme Power associated with six other personages, the whole body forming a mystic seven, is a really archaic idea,

* *Peri Is. kai Os.* xlvi.

† *Herod.* ii. 53.

and one which was not unfamiliar to the undivided Indo-Iranians. Areimanios, says Plutarch, sprang from the darkness, *zophos*, i.e. the west, as *zephuros* is the western wind. Hence he is identical in concept with Erebos, the gloom after sunset.*

15. *Mithra*.

With the exception of Ahuramazda himself, no name is more famous in Iranian religious-mythology than that of Mithra, "the Friend," the Vedic Mitra, the divinity of beaming light, and hence the Sun-god; not by any means the solar photosphere crudely regarded as a sentient being. In the *Mithr-Yasht*, or "Invocation to Mithra," Ahuramazda declares—

"When I created Mithra, I created him as worthy of honour,
As praiseworthy, as I myself, Ahuramazda."

Of Mithra M. Lenormant remarks that his "origin is not clearly explained in what remains of the Zoroastrian books"; but that he "seems to have sprung from Ormuzd, and to have been *consubstantial with him*." He was the "judge after death. His name, title, and high position in the Mazdean faith unquestionably belong to the most ancient phase of this religion."† Elsewhere‡ he alludes to a passage "which has much puzzled the commentators," "the two divine Mithras."§ I understand Spiegel to interpret this of the sun and the planet Jupiter, but as the sun is mentioned almost immediately after, and is styled "the eye of Ahuramazda and Mithra," I suppose rather that "the two divine Friends" are Ahuramazda and Mithra themselves. Now Mithra is almost the only divine personage besides Ahuramazda to whom, in the more archaic portion of the *Avesta*, a distinct, objective, actual, sentient existence is undoubtedly attributed. Thus we read—

"Mithra (who bestows) good dwelling on the Aryan regions,
May he come to us for protection, for joy,
For mercy, for healing, for victory, for hallowing,
Mithra will I honour with offerings,
Will I draw near to as a Friend with prayer.
Give us the favours we pray thee for, O Hero,
Kingdom, strength, victoriousness, sanctification, and
purity of soul,

* *Vide* p. 17, note †.
‡ *Chaldean Magic*, 236.

† *Ancient History of the East*, ii. 33.
§ *Yasna*, i. 29.

Greatness and knowledge of holiness, instruction in the holy word."*

The physical and mythological side of his character, which is also of great interest, I need not refer to in this connection; but it will be observed that Mithra cannot, like the Ameshaspentas, be resolved into a mere personification of a quality or a virtue or the like, and hence in the Zoroastrian system he is not included amongst them. They are but illustrations of the character of Ahuramazda, the Supreme; Mithra, though ever working in perfect harmony with him, though so closely connected with him that M. Lenormant makes use of the remarkable expression "consubstantial," is nevertheless also a distinct divinity, as worthy of honour as Ahuramazda himself. Mithra is not only the support, friend, and protector of the righteous, but also the constant and triumphant opposer of the Devas and of the wicked man. And, like the august concept of the Sun-god elsewhere, he is pre-eminently the judge. So in Egypt the Sun-god, as Ra and as Uasar (Osiris), is the judge of men; whilst, as Fox Talbot has observed, "The great name of the Sun in Assyrian theology was *Daian-nisi* or *Dian-nisi*,† the Judge of men; the Greek Dionysos.‡ Neither Amen, "the Hidden-one," in Egypt, nor Anu, "the High-one," in Assyria and Akkad, nor Ahura, "the Living-one," in Iran, take upon themselves the function of judge of mortals; they delegate the great work to their august representative and manifestation the Sun-god.§ It is impossible not to recall in this connection various statements in our own Sacred Books in perfect harmony with this belief. Thus we are told that "the Father hath committed all judgment unto the Son,"|| who "was ordained of God to be the judge of quick and dead,"¶ "God having appointed a day, in which He will judge the world in righteousness by that man whom He hath ordained."** And this judge is "the Sun of righteousness,"†† "a sun and shield."‡‡ With the later Mithra, who as Mithras in conjunction with Serapis so triumphantly invaded the Roman Empire and drove the classic gods of Greece and Italy from

* *Mihra-Yasht*.

† From the Assyrian *danu*, judge; Heb. *dan* (cf. Gen. xlix. 16: *Dan* shall judge his people) and *nisu*, man.

‡ Vide *The Great Dionysiac Myth*, ii. 209.

§ For a consideration of the concept and position, physical and spiritual, of the Sun-god, vide *The Archaic Solar-cult of Egypt*. By the Writer. (*Theological Review*, October, 1878-January, 1879).

|| St. John v. 22.

¶ Acts x. 42.

** Ibid. xvii. 31.

†† Malachi iv. 2.

‡‡ Psalm lxxxiv. 11.

the field, degrading even Jupiter himself to the rank of a mere planetary genius, I am not concerned. His mysteries, trials, tests, tortures, grades, and their contest and connection with Christianity and Gnosticism, form an exceedingly interesting study, but neither truly Zarathustrian, nor yet archaic. One Euboulos, quoted by Porphyry, wrote a history of Mithra in many books, and connected Zoroaster with his cult.*

16. *Mithra and the Gáthas.*

In the Mithra of the *Avesta* the Sun-god is presented before us in his customary double aspect. Physically, he sees all things, possesses wide pastures, has a chariot and swift horses, or stands clad in gold upon the mountain-tops. But he is far more than this; he is also a mighty spiritual being, the judge, the terrible opponent of evil men and evil powers, the avenger of the broken contract† and the scourge of the liar, the bestower of reward, fame, and holiness to the soul, to whom a man may draw near in prayer as to a friend. Now, as the name Mithra does not occur in the *Gáthas* except in the sense of "contract" or "promise," the next question for consideration is, What is the connection between Mithra and the religion of the *Gáthas*? The general opinion is somewhat as follows:—"Whilst in the *Gáthas* we never find mentioned gods like Mithra and Anâhita,‡ we meet with their names in nearly every page of the later *Yasna*. Here arises the question why the author of the *Gáthas* disregarded these gods and divine beings whom it was afterwards held sinful to neglect? The *only* (?) answer is that he neither believed in them nor thought them to be an essential part of religion."§ So Dr. West observes, "Mithra finds no place in the earlier Zoroastrian scriptures, and his appearance with the other angels, in the later writings, denotes a partial lapse into idolatry."|| Although I dissent with diffidence from such authorities, yet I am compelled to do so in the present instance, and for the following reasons:—

I. Mithra occupied a position of exceedingly high honour and importance prior to the separation of Indian and Iranian.

* Vide C. W. King, *The Gnostics and their Remains*, 97; Porphyry, *Peri apochês tôn empsuchôn*, iv. 16; *Peri tou en Odusseia tôn Numphôn antrou*, 2.

† A promise or contract is called *mithra*, and to break it is "to lie to Mithra" (vide *Yasna*, xlvi. 5; *Vendidad*, iv).

‡ The classical Anaitis and the Chaldeo-Assyrian Anatu. Her case is not analogous with that of Mithra, as she sprang from an entirely different source. Mithra is a purely Aryan divinity.

§ Haug, *Essays*, 260.

|| *The Academy*, June 29, 1878, p. 583.

That position he never lost, either in the *Avesta*, or in the earlier portions of the *Rig-Veda*; whilst various other divinities were degraded either by Indian or Iranian.

II. The authors of the *Gâthas* were perfectly acquainted with the worship of Mithra, but it is never condemned by them; and as, moreover, many *Gâthas* are undoubtedly lost, it is quite possible that Mithra may have been mentioned with approval in these. The *argumentum è taciturnitate* is proved in countless instances to be one of the weakest that can be employed.

III. There are apparently several indirect references to Mithra in the extant *Gâthas*. Thus, as noticed, his name occurs in the sense of 'contract'; and, as mentioned, reference is made to the Bridge of the 'Gatherer' or 'Judge.' Now Mithra, as M. Lenormant notices, was the "judge after death"; and the customary mythologico-religious function of the Sun-god is to be the judge, guide, and conductor of souls, as the one who first passed into the unseen world.* I think, therefore, that Mithra is the personage here alluded to.

IV. In the later portion of the *Avesta* Mithra reappears in a position of the highest honour, a circumstance which I do not regard as a "lapse into idolatry," because I do not think that his concept was originally idolatrous; this circumstance points rather to his having been regarded with unbroken respect.

V. Lastly, the authors of the *Gâthas*, who were making a great monotheistic protest, had an obvious reason for suppressing the name, lest the *nomen* should as in countless other instances, and as was subsequently actually the case here, become the *numen*.†

As M. Lenormant observes, there is doubtless a certain obscurity connected with the Mithraic concept as it appears in the *Avesta*; but I think with him, that we may without hesitation link Mithra with the most ancient phase of the Iranian religion; and, further, that a careful analysis of the archaic concept of Mithra, and especially bearing in mind his intimate relation with Ahuramazda, will make us hesitate ere

* *Vide* the case of the Vedic Yama, and the Hymns on the subject in the *Rig-Veda*, books IX. X. The Greek idea was similar. "Stesichoros, B.C. 632-552, sings how Halios [Helios] Hyperion's sun, went down into his golden cup and sailed away o'er ocean to the deep realms of night, to visit his beloved ones in the sacred laurel grove." (*The Great Dionysiac Myth*, i. 317.)

† Cf. Exodus xxiii. 13: "In all things that I have said unto you be circumspect: and make no mention of the name of other gods, neither let it be heard out of thy mouth."

we pronounce the respect or reverence originally paid him to have been idolatrous. As the Homeric poems contain numerous personifications of ideas, such as rumour, terror, panic, discord, sleep, death, and the like; so, in the *Avesta*, we find disease, decay, poverty, deceit, dwarfishness, sloth, darkness, poison, represented or spoken of as personal demons; and other concepts more august such as Sraosha, the personification of the divine service; Rashnu, the personification of justice; Asha, order, physical, moral, and religious; and the Ameshaspentas equally resolve themselves, so far as actual objective existence is concerned, into thin air. But Mithra, "the mightiest, strongest, most famous, most victorious, most brilliant of the Yazatas,"* or "beings worthy of honour," cannot be so resolved. He is neither the sun, nor the light, but the spirit of brightness and the sentient friend of man.

17. *Ahuramazda as the Creator.*

It remains to notice the statement in the *Gáthas* respecting Ahuramazda as the creator of all things. I have already † quoted a passage which declares that the material world was created by his two spirits, and in another place we read;—

"Armaiti came with wealth, the good and true mind;
She the everlasting one, created the material world."

Now Armaiti, the Vedic Aramati, is the personification of Prayer or Divine Wish; and, as noticed, is "in Ahuramazda," and hence the meaning is that divine yearning tender and benevolent occasioned creation. So, again, we read:—

"That I shall ask thee, tell it me right, O Ahura!
Who was in the beginning the father and creator of
righteousness?
Who created the path of the sun and stars?
Who causes the moon to increase and wane but thou?
Who is holding the earth and the skies above it?
Who made the waters and the trees of the field?
Who created the lights of good effect and the darkness?
Who created the sleep of good effect and the activity?
Who (created) morning, noon, and night?
Who has prepared the Bactrian home?
To become acquainted with these things, I approach
thee, O Mazda,
Beneficent spirit! creator of all beings!
That I shall ask thee, tell it me right, O Ahura!

* The Vedic "Yajata" and the Parsi Izad or "angel."

† Sec. 9.

How may I come, O Mazda! to your dwelling-place (*i. e.*
Heaven)
To hear you sing?"

The touching simplicity of the last question may almost provoke a smile, but let any Lucretius who, either in despairing incredulity or in temporary satisfaction with the water of this life, has

"Dropped his plummet down the broad
Deep universe and said 'No God,'
Finding no bottom,"

commune for a moment with his own heart respecting this sacred thirst of man for the more immediate presence of divinity, this cry of agonizing intensity, "When shall I come and appear before God?" "for all men yearn after the gods."* Is it baseless, a mere desire for *nothing*? I would as soon believe that physical thirst was unaccompanied by an answering actuality. No sadder doom can befall a mortal than to convince himself that this, the noblest aspiration of the soul, is altogether fallacious. To such an one it may almost be said in those words of unapproachable sadness, "The fruits that thy soul lusted after are departed from thee, and all things which were dainty and goodly are departed from thee, and thou shalt find them no more at all." That I do not exaggerate, witness the confession of the candid and most unhappy Physicus, at the conclusion of his able work, "I am not ashamed to confess that with this virtual negation of God the universe to me has lost its soul of loveliness; and when at times I think of the appalling contrast between the hallowed glory of that creed which once was mine, and the lonely mystery of existence as now I find it, at such times I shall ever feel it impossible to avoid the sharpest pang of which my nature is susceptible."† Thank heaven that in ancient Iran we see no such "monumental melancholy gloom," but rather a childlike confidence and simple faith that Ahura will guide through all darkness and difficulty, and that at the last, although in some almost "unimagined fashion," his children "shall see his face."

"Ahura who is giving all (good things) cannot be deceived
All that have been living, and will be living,
Subsist by means of his bounty only,
The soul of the righteous attains to immortality.

* Πάντες δὲ θεῶν χατίους ἄνθρωποι. (*Od.* iii. 48.)

† *A Candid Examination of Theism*, 114 (English and Foreign Philosophical Library, vol. ix.).

Him I wish to adore with my good mind,
 Him who gives us fortune and misfortune according to
 his will,
 He knows with his true and good mind,
 And gives to this world freedom from defects and im-
 mortality;”

for He “only hath immortality.” It will be remembered that I am not speaking so much of Iranian religion generally, nor even of the religion of the *Avesta*, a work of many hands and many years, but of the religion of Zoroaster; and I think it must, upon the whole, be admitted that amongst the various phases of uninspired faith, his will stand almost second to none; and that it is distinctly and essentially monotheistic. Having now considered it in itself, I will next briefly view it in connection with Archaic, *i.e.* pre-Zarathustrian, Monotheism, and with this feature chiefly as it appears amongst the eastern members of the Aryan family.

PART II.—THE EARLY VEDIC BELIEF.

18. *Various Modern Theories respecting the Nature of Vedic Belief.*

As the earliest Vedic literature is admittedly nearer in language, style, and tone of thought to the period of Indo-Iranian unity than the *Avesta* generally, or perhaps even than the *Gáthas*, it is to the *Rig-Veda*, the “Veda of Praise,” which stands at the head of the Aryan sacred literature of India, that we must, in the first instance, turn for information respecting pre-Zarathustrian faith. The *Sanhita* or ‘Collection’ of the *Rik*, consists of 1,017 *Suktas* or ‘Hymns,’ containing 10,580 *Richas* or ‘Verses,’ and is divided into ten Books called *Mandalas* or ‘Circles.’ The work appears to be the production of some 150 writers, and its composition doubtless extended over several centuries. From the nature of the human mind and from the experience we possess of other archaic sacred works, we may expect to discern in it a great uniformity of tone and a general method of treatment, combined with almost infinite variety in detail, often apparently highly conflicting, and a gradual drifting of the mind towards fresh mental stand-points; a phase which shows itself in a fluctuation in the amount of respect paid to various divinities, who thus from time to time fall or rise in the estimation of their votaries. All this we shall find abundantly in the *Rik*. There is, of course, no question that the faith of the Aryan Indian *became* practically polytheistic, although many theistic or even monotheistic features were

retained or added ; whilst pantheism, ever a late form of philosophico-religious thought, likewise appeared in its turn in a most pronounced and developed phase. But the question before us is not what archaic Indian faith had become at the end, but what it was (to go back at present no further) at the commencement, of the Vedic period. And here at the threshold of the investigation, the inquirer must not be discouraged by finding the widest difference of opinion amongst experts. The student, therefore, whilst giving all honour where it is due, will carefully retain the right of private judgment, nor consent to follow blindly the chariot of any particularly great literary conqueror. There is no absolute and inherent necessity that the best philologist should be also the best mythologist, or that the man who possesses the greatest acquaintance with the body of a work should have most truly caught its real spirit. There is, indeed, a decided *a priori* probability in his favour, but nothing more. Professor Müller, with a pardonable preference for his great study, observes, "The Veda, I feel convinced, will occupy scholars for centuries to come, and will take and maintain for ever its position as the most ancient of books in the library of mankind."* I think the *Veda* scarcely possesses this pre-eminent claim to antiquity, but whether scholars will be thus occupied with it or not, sure I am that "for centuries to come" (should the present state of things endure so long) men will investigate with undiminished interest the archaic beginnings of religion, in connection with the supreme question of its truth, and of the reason of its existence amongst mankind. The fact that highly able inquirers have regarded the Vedic religion as polydaimonic or even lower ; as polytheistic, as henotheistic, or as monotheistic, is at first sight very startling ; but even a slight study of the *Veda* almost clears up the mystery, inasmuch as it soon reveals the principles on which the various experts acted. Thus, according to A, the Vedic Indian observing, like other savage or semi-savage tribes, a vast amount of extra-human power around, worshipped it everywhere and in anything or in everything. The principle of anthropomorphism obtained more or less, as of course, and thus the cult was polydaimonic or fetishistic. According to B, the Vedic Indian, like other Aryans, was deeply impressed by the most remarkable phenomena of nature, which he personified and adored ; hence he was a polytheist. According to C, the Vedic Indian had a wonderful sense of the greatness and goodness of the divine, but he was unable to consider the whole except in its parts ; and hence when he

* *Rig-Veda Sanhita*, i. Preface, x.

hymned this or that phase of superhuman potency, it assumed supreme dimensions in his mind, and being, of course, personified, the worshipper thus became a henotheist, or one who adores many gods, any one of whom may be regarded in turn as the highest. According to D, the Vedic Indian originally believed in one God, whose phases of character and material manifestations by degrees became personified; whereby the original, simple and sublime idea was shrouded, and hence forgotten. And are there then passages in the *Rig-Veda* which countenance, or seem to countenance, each of these contradictory opinions? Most certainly, and hence the theories; but here, as elsewhere, let us as far as possible avoid being entangled by what I may call the tyranny of isolated texts. "It is written *again*," must be our constant motto, for the ninety-first Psalm is by no means the only Scripture that may be perverted through this most objectionable principle. What must be sought in an investigation of the *Rik* is, not simply odd passages or quotations which may be used in support of a particular theory, but broad, general principles of belief. To give an instance: no passage in the *Veda* is more familiar and perhaps more remarkable than the famous statement:—

"They call Him Indra, Mitra, Varuna, Agni;
And (he is) the celestial, well-winged Garutmat.
Sages name variously that which is but one:
They call it Agni, Yama, Matarisvan."*

Here, it may be said, we reach monotheism at a bound; here is an explanatory statement in the earliest portion of the *Veda*, giving the general practice and belief. And towards the close of the *Rik* we read similarly:—

"The wise, in their hymns, represent, under many forms,
the well-winged (god) who is but one."†

I value these passages very greatly, but the argument in favour of archaic monotheism must not be allowed to rest upon them alone, or upon any other similar passages elsewhere. And we must be cautious not to strain them; thus it may be asked who is the 'Him,' the 'it,' and the 'well-winged'? It is easy to reply that the Deity is undoubtedly meant, and such very likely *may* be the case; but the great commentator Yaska, B.C. 400, applied the former passage to Agni, whilst Sayana thought that Surya, the Sun, was intended. However, ere examining the principal Vedic concepts, we may remember

* *Rig-Veda*, I. clxiv. 46. The translations of Vedic passages are chiefly taken from Dr. Muir's *Sanskrit Texts*, and occasionally from the work of the late Prof. Wilson, continued by Prof. Cowell. † *Ibid.* X. cxiv. 5.

with comfort a statement of Professor Müller, which is not based upon any particular passage or passages, but upon a wide and careful investigation of the subject, a statement which has my warmest assent, "Like an old precious metal, the ancient religion, after the rust of ages has been removed, will come out in all its purity and brightness, and the image which it discloses will be the image of the Father, the Father of all the nations upon earth."*

19. *The Vedic Divinities.*

The principle of explaining the concept of a mythologico-religious being from the signification of his name, is one which has of late been employed with the most distinguished success; and therefore a first step towards determining archaic Vedic faith is to tabulate the Vedic divinities and to notice the meaning of their names. The following are the principal personifications or divine personages of the *Rig-Veda* :—

Aditi. "The Boundless." "The Infinite."† "The Infinite personified" (Müller). Mother of the seven or eight Adityas: namely, Varuna, Mitra, Aryaman, Amsah, Bhaga, Daksha, Agni, and Martanda. The passages do not absolutely agree respecting the names of the Adityas.

Agni. The Slavonic Ogni. Lat. *ignis*. The igneous principle, which shows itself alike in the terrestrial, aerial, and heavenly flame, visible and invisible. "The Ag-ile."

Amsah. "The Sympathizer" (Roth). "The Sharer" (Tiele). "Portion" (Whitney). Very rarely mentioned.

Aryaman. "The Favourer" (Roth). "Protector" (Whitney). Closely connected with Mitra, and sometimes incorrectly identified with the Iranian Ahriman.

Asura. "The Living."† We often find one Asura particularly mentioned, who is called "Asura of heaven."§

Asvins. "The Horsemen." "The Pervaders" (Goldstücker.) Sons of Asva, the Sun in his aspect of a racer.|| "The two powers which seemed incorporated in the coming and going of each day and each night" (Müller). In the West the Dioskouroi, Castor and Pollux.

Bhaga. "The Distributer." "Fortune" (Whitney). The

* *Introduction to the Science of Religion*, 67.

† *Vide* Prof. Müller's course of lectures *On the Origin and Growth of Religion*.

§ Haug, *Essays*, 269.

† *Vide sup.* sec. 11.
|| Cf. Psalm xix. 5.

Wendic Bogu. The "name became at an early date a general designation of the gods among the Slavs."*

Brahmanaspati. "The Lord of spells." A phase of Agni.

Brihaspati. "The Lord of prayer." A phase of Agni.

Daksha. "The Intelligent" (Roth). "The Power" (Tiele).

"The Powerful in will" (Lenormant). "Insight" (Whitney). "Daksha sprang from Aditi and Aditi from Daksha. Aditi was produced, she who is thy daughter, O Daksha."†

Dyaus. "The Shiner." "The Bright."‡ The heaven and bright heaven god, Zeus.

Hiranyagarbha. "Golden embryo." "The source of golden light" (Müller). A very remarkable hymn § is addressed to this divinity. The poet exclaims:—

"In the beginning there arose the source of golden-light—
He was the one born Lord of all that is.

He established the earth, and this sky;—

Who is the God to whom we shall offer our sacrifice?

He who gives life, He who gives strength;

Whose command all the bright gods revere;

Whose shadow is immortality; whose shadow is death;

He through whom the sky is bright and the earth firm—

He through whom the heaven was 'stablished—nay the highest heaven.

He who is the sole life of the bright gods;

He who alone is God above all gods;

He the Creator of the earth; He the Righteous, who created the heaven."||

Indra. "The Rain-giver." The name is probably derived from *indu*, 'drop.' The Zeus Ombrios, Jupiter Pluvius, who with his thunderbolt destroys the rain-concealing demon and sets free the refreshing waters. A peculiarly Indian divinity who, from the local characteristics of the country, became almost the head of the Pantheon. If the Iranians knew him at all, which is very doubtful, ¶ they degraded him by making him into a demon.**

Maruts. "The Crushers."†† The Storm-winds. Greek, Ares. Latin, Mars.

* Tiele, *Outlines of the History of the Ancient Religions*, 109.

† *Rig-Veda*, X. lxxii. 14.

‡ *Vide sup.* sec. 12.

§ *Rig-Veda*, X. cxxi.

|| Translated by Prof. Max Müller in his *History of Ancient Sanskrit Literature*, 569.

¶ *Vide Darmesteter, Ormazd et Ahriman*, 260, *et seq.*

** *Vide Haug, Essays*, 272.

†† The above is the generally-received interpretation. M. Darmesteter prefers, however, to render *marat* or *marut* "man" (*vide Ormazd et Ahriman*, 164).

Mitra. "The Friend." Iranian Mithra.* Nearly always mentioned in connection with Varuna.†

Prithivi. "The Broad Earth." Greek, *Platūs*.

Purusha. "The Male." The *Purusha Sukta* ‡ gives a somewhat pantheistic account of the Deity under this name. The poet says:—

"Purusha has a thousand heads, eyes, feet. §

Purusha himself is the whole (universe), whatever has been, whatever shall be.

He is the lord of immortality.

All existing things are a quarter of him, and that which is immortal in the sky is three-quarters of him.

The moon was produced from his soul;

The sun from his eye; Indra and Agni from his mouth;

And Vayu from his breath." ||

Pushan. "The Growth-producer." (Tiele.)

Rudra. "The Terrible." This personage forms an excellent illustration of the principle *nōmina numina*, and of the utter baselessness of many of the bugbears which have frightened millions of mankind for ages. His name in origin is only an adjective applied to Agni. Thus we read—

"Agni, the Brilliant, the Terrible ¶ (i.e. Rudra).

Agni, the terrible (*rudra*) king, † he golden-formed." ** Rudra as a distinct divinity continued to increase in importance until as Siva, "the Gracious," a euphemism for his title Sarva, "the Wrathful," he attained almost the first place in the Hindu Pantheon, becoming the Mahadeva, or "Great god," *Megas theos*. His dread consort Kali, "the Black," was merely originally one of the seven fire-tongues of Agni. In such instances as these we see polytheism developing before our eyes, many made out of one.

Savitri. "The Vivifier" (Tiele), "The Inspirer" (Cox). A solar phase.

Soma. "Intoxication" (Canon Rawlinson). Originally the moist, humid, and watery element in nature. †† Also closely connected with Agni.

* *Vide sup.* secs. 15, 16.

† Mitra and Varuna are the subject of a recent monograph by Dr. Hillebrandt, *Varuna und Mitra* (Breslau, 1877).

‡ *Rig-Veda*, X. xc.

§ An early instance of symbolical monstrosity, a principle which has often made art hideous.

|| *Apud Muir, Sanskrit Texts*, v. 368, *et seq.* The hymn affords an exact parallel to some of the later Egyptian hymns to the pantheistic Sun-god. (*Vide The Archaic Solar Cult of Egypt.* By the Writer.)

¶ *Rig-Veda*, III. ii. 5. ** *Ibid.* IV. iii. 1.

†† *Vide sup.* sec. 13; *inf.* sec. 29. Soma is a liquid Agni.

Surya. "The Shining" (Tiele). Greek, Helios; Latin, Sol, the Sun.

Twashtri. "The Creator" (Lenormant). "The Maker" (Müller). A solar Hephaistos.

Ushas. "The Dawn." Greek, Eôs, Aÿs, Auôs. Also called Ahana. Greek, Athena, "the Brilliant;" and Saranyu, Greek, Erinny's, the 'running' light.

Varuna. "The Coverer" (Tiele). Greek, Ouranos. The God of heaven, the Asura and head of the Vedic Pantheon. After having ruled in the Oversea, Varuna in later times was degraded to the Undersea, and became an Okeanos.*

Vayu. "The gentler wind." Cf. Lat. Favonius. The spirit-breath of heaven.

Vishnu. "The Penetrater" (Gubernatis). The Sun, as striding across heaven.

Vivasvat. "The Brilliant" (Roth). Heavenly light and the sun.

Yama. "The Twin." Cf. Lat. Gemini. The Iranian Yima, who reigned in the happy golden age of the past. By Yama and his twin-sister Yamî some understood Day and Night, or Light and Darkness. Yama is especially the western or setting sun. He reigns over the departed, for to die is but to go away; and the fathers, the elder worthies of the human race, dwell with Yama in bliss in the unseen world.

Such, then, are the principal divinities of the *Rig-Veda*. There are also many minor figures, goddesses, who play unimportant parts, for a goddess, to use an Assyrian expression, is originally merely the 'reflection' of her husband-god; ideal personifications, such as Vach, 'Voice,' Sraddha, 'Faith,' and the like; compound names for the supreme divinity, and other heterogeneous concepts; but the foregoing list contains all, or nearly all, the personages of any real importance.

20. *Analysis of the Vedic Divinities.*

Reckoning the Asvins and the Maruts as each one personage, the list contains twenty-nine names, from which we may at once deduct the three special phases of Agni, namely,

* Cf. the position of the Homeric Okeanos:—

Ἐρχομαι ὀψομένη πολυφόρβον πείρατα γαίης,
Ὠκεανόν τε, θεῶν γένεσιν.

Brahmanaspati, Brihaspati, and Rudra. The remaining twenty-six, on analysis, appear as follows:—

I. *Phenomenal Objects.*

1. *Celestial.*

Aditi.
Dyaus.
Soma.
Varuna.

2. *Aërial.*

The Maruts.
Vayu.

3. *The Dawn.*

Ushas.

4. *Semi-solar.*

Agni.
Aryaman.
The Asvins.
Indra.
Mitra.
Pushan.
Tvashtri.

5. *Purely solar.*

Savitri.
Surya.
Vishnu.
Vivasvat.
Yama.

6. *The Earth.*

Prithivi.

II. *Abstractions of Deity.*

Amsah.
Bhaga.
Daksha.
Hiranyagarbha.
Purusha.

III. *The Aryan God.*

Asura.

They may also be further divided into:—

I. *Natural Objects merely so regarded.*

Aditi.
Dyaus.
The Maruts.
Ushas.
Prithivi.
Vayu.

II. *Natural Objects connected with spiritual power.*

1. *Heat and Humidity.*

Agni.
Soma.
2. *The Heaven.*
Varuna.

3. *The Light.*

Aryaman.
The Asvins.
Indra.
Mitra.

Pushan.

Tvashtri.

4. *The Sun.*

Savitri.
Surya.
Vishnu.
Vivasvat.
Yama.

III. *Forms of Deity.*

1. *General.*

Asura.

2. *Abstract.*

Daksha.
Hiranyagarbha.

3. *Connected with Light.*

Amsah.
Bhaga.
4. *Pantheistic.*
Purusha.

21. *Natural Objects merely so regarded.*

In the present day, when knowledge and research have so vastly extended, and when whole books are written on single divinities, it is of course utterly impossible in a brief paper to give anything like a complete representation of the facts, or a full justification of the views adopted. But it is quite possible to indicate a general method of treatment, and, I venture to add, to advance very strong arguments in its favour. Nor is further investigation either into the researches of original students, or by such students themselves, likely, in my judgment, to turn the monotheistic position here adopted. We have a number of names, an apparent polytheism, but in origin a real monotheism. To begin with Infinite Space, Heaven, Earth, Dawn, Wind, and Tempest, six of these twenty-six figures: as far as I am aware there is no passage in the *Rik* which necessarily implies that any one of them was regarded by any poet as an absolutely sentient being of divine nature. As to Aditi, the infinite, she is of course in one point of view mother of everything and of every personage which infinite space contains; but she is no real divinity, being essentially a mere negation, the not-bounded, and space itself is mainly unsubstantial extension. Heaven and earth, again, broadly regarded as the two halves of the all, heaven being all that is above, and earth all that is below, are, anthropomorphically speaking, father and mother of men and things in many a kosmogony; but, as in the case of Aditi, and as in that of the Greek Ouranos and Gaia, this is a mere figure of speech. Thus, the ancient song of Dodona ran, "The earth sends forth her fruit, therefore call the earth mother." Dyaus, in the East, is but a name; in the West he is the true god-father, Zeus. Conversely, Ouranos in the West is but a name; in the East he is the true god-father, Varuna the Asura. Dr. Muir is of opinion that epithets of "a moral or spiritual nature" are applied to the Vedic Dyaus and Prithivi, but such terms as "innocuous, beneficent, wise, promoters of righteousness," by no means necessarily contain such an implication. Thus, for instance, the righteousness spoken of is merely kosmic order; of which heaven and earth are, of course, the two great supporters. The wisdom of heaven is no more than that of the physical sun who "sees all things," and therefore is said to know all things. Beautiful hymns are addressed to Ushas, the dawn; but there is little, if anything, in them which a modern poet might not have written, and there is not a tittle of evidence to show that the ancient poet regarded Ushas otherwise

than a modern Aryan bard would do.* Chateaubriand writes :—

“The dawn peeps in at the window, she paints the sky with red ;
And over our loving embraces her rosy rays are shed.
She looks on the slumbering world, love, with eyes that seem divine ;
But can she show on her lips, love, a smile as sweet as thine ?”†

There is no mystery here ; simply a constant working of the anthropomorphic principle. And so the Vedic Ushas, daughter of the sky, sister of night, bride of the sun, mistress of the world, kinswoman of Varuna, divine, immortal, golden-hued, as we have seen, smiles upon the earth ; and to her, to the region whence all drawn-light springs, go holy souls after death.‡ Again, Vayu, the wind, touches the sky, and is swift as thought ; he does not occupy a prominent position in the *Rig-Veda*, but is very closely connected with Indra, as ruling the middle region. The Maruts are a troop of winds, sometimes said to be twenty-seven in number, sometimes a hundred and eighty. They attend and aid Indra, the god of the bright heaven, who drives away darkness by storm. Thus, this group of divinities, on examination, disappear absolutely, not merely to ourselves, but to the Vedic Indian. They stand confessed as the ordinary phenomena of nature, and nothing more.

22. *The Forms of Deity.*

Twenty personages remain. Let us next take the group of forms of deity. Daksha is merely a personification of intelligence, or intelligent will, which will, as noticed,§ even produced infinite space. Whose will? That of the Asura. Amsah, whose name very rarely occurs, is the “sympathizer,” or “sharer.” But who sympathizes with mankind, or divides amongst them the good things of existence save the Asura? That Bhaga, “the distributor,” is merely another of his names is evident ; amongst other reasons, from the fact that Bhaga became a general name for God amongst the Slavs, and therefore belonged to the period of Aryan unity. He who is Amsah is Bhaga, and both, as noticed, are Adityas. Hiranyagarbha and Purusha are later philosophical concepts of God ; they are therefore identical with each other and with Asura.

* *Vide sup.* sec. 6.

† *Apud* Victor Hugo, *The History of a Crime*, iii. 27.

‡ *Rig-Veda*, X. lviii. 8.

§ *Sup.* sec. 19.

Lastly, there is Asura, and here at length, amid this world of shadows, we "touch earth." The Asura is God.

23. *The Sun.*

So far all has been simple ; we have examined twelve names and found one divinity. But it is far from my intention to attempt to free the Vedic Indians from the charge of polytheism ; as a body they certainly were or became polytheistic, and we can easily see how and why. The time to which our attention is turned is *the commencement of the Vedic age*, and we observe how numbers of the gods resolve themselves into simile. But others are of a different character. We next come to natural objects connected with spiritual power ; and here is the stronghold of Vedic polytheism. And yet even here the evidence of previous monotheism is almost, if not quite, as strong. To take first the sun and the sun-god : Savitri, Surya, Vishnu, Vivasvat, and Yama are each the sun. For mankind, however, there is but a single sun ; they are, therefore, really identical : it is possible that there *may* have been a time when they were regarded as five distinct, objective, sentient personages or solar gods. But there *must* have been a time when the one had not yet become five, for thus to divide and classify requires an elaborate mental effort, and a corresponding period for its development. This division of the sun and of the sun-god is familiar. Thus in Egypt we find the diurnal and nocturnal sun ; Ra, the mid-day sun ; Kheper, the prolific sun ; Haremakhu, the horizon sun ; Tum, the setting sun ; Mentu, the rising sun ; Fenti, the climbing sun ; Atumu, the chthonian sun ; Harpakrut, the new-born wintry sun ; Aten, the power of the solar disk ; Uasar (Osiris), the suffering sun, and the like. The Vedic sun proper is Surya, whose name reappears in the Greek helios and the Latin sol ; and as these are simply names of the solar photosphere and not of the solar divinity, we may fairly conclude that Surya in origin similarly signified the physical sun, just as Ushas means the dawn. Surya, in the Hymns, is the son of Aditi, the son of Dyaus, the husband of Ushas, and the eye of Mitra, Varuna and Agni, expressions which require no comment. In Savitri the solar power rises higher. Savitri is an Asura ; he is especially praised by Varuna, Mitra, and Aryaman, with whom he works in harmonious concert ; he is the lord of all creatures and the bestower of immortality ; he is the sender of blessings, is prayed to deliver his votary from sin,* and to convey

* *Rig-Veda*, IV. liv. 3.

the holy soul to the abode of the righteous.* He is pre-eminently the god of golden lustre, and as a matter of course is sometimes distinguished from Surya, and sometimes identified with him; Surya, speaking generally, being the body, and Savitri, the spirit, of the sun. Altogether, Savitri in position and general concept very closely resembles the Iranian Mithra; and hence we are not surprised to find him identified with Mitra.† Vishnu, “the Penetrater,” is the sun from whose heat nothing is hid; who, forcing his way up from the under world, crosses heaven in three strides and penetrates again into the hidden region.‡ Vivasvat, “the brilliant,” is a minor solar phrase.

24. Yama.

Savitri, who can free from sin and who conveys the soul after death to bliss, glides into Yama and becomes identical with him. In India, as in Egypt, the sun received different names during the different portions of his career; and Yama, as connected with the death of man, and of the sun, and with the unseen world, is associated with the setting sun, and hence with the west. His name, “Twin,” is mysterious. Prof. Roth considers him a representative of one of the original pair of mortals, but this view Prof. Müller rejects. Had the *locus* been Egypt, I should have been inclined to regard the twins as the sun nocturnal and diurnal, but here there is not sufficient authority for such an opinion. I have already mentioned other conjectures.§ In the ninth and tenth books of the *Rig-Veda* Yama is prominently introduced in connection with the doctrine of a future life and the state of the fathers, the departed worthies of the human race. In the *Atharva-Veda* we read:—

“Reverence ye Yama, the son of Vivasvat,||
The assembler of men (in the unseen world);
Who was the first of men that died,
And the first that departed to this (celestial) world.”¶

And this is but the slightly later echo of the *Rik*,—

“Worship with an oblation King Yama, son of Vivasvat,

* *Rig-Veda*, X. xvii. 4.

† *Ibid.* V. lxxxii. 4.

‡ *Vide* the explanation of the Vishnu-myth by the ancient commentator Atharvabha, a predecessor of Yaska (*apud* Muir, *Sanskrit Texts*, iv. 64).

§ *Sup.* sec. 19.

|| The western sun is the son of the brilliant mid-day sun.

¶ *Atharva-Veda*, XVIII. iii. 13.

The assembler of men, who departed to the mighty streams,*

And spied out the road for many.

Yama was the first who found for us the way.

This home is not to be taken from us.

Depart thou, depart by the ancient paths whither our early fathers have departed.

There thou shalt see the two kings,† Yama and the god Varuna,

Meet with the fathers, meet with Yama, in the highest heaven.

Throwing off all imperfection go to thy home.

Become united to a body, and clothed in a shining form." ‡

According to the *Atharva-Veda*, "death is the messenger of Yama, who conveys the spirits of men to the abode of their forefathers."§ Here, then, is the august figure of the sun-god dwelling in celestial light, in the inmost sanctuary of heaven,|| with the Asura Varuna and the elder worthies of the human race. In the sun-god we met with a second undoubted divinity.

25. *The Semi-solar Light Gods.*

I pass on to the semi-solar light gods. Aryaman, "The Favourer," one of the Adityas, is seldom mentioned, and generally with Varuna and Mitra, of whom he is a phase. The favourers of man are the Asura of heaven and the kindly sun-god. The mysterious Asvins are emanations of the bright gods, and have been defined as "the two powers which seemed incorporated in the coming and going of each day and each night."¶ Indra, the god of the bright heaven and slayer of the monster of darkness, is a purely Indian divinity, unknown even to the period of Indo-Iranian unity; he is another aspect of Varuna-Dyaus, whom he to a great extent superseded, and affords a good example of the polytheistic advance. He was certainly regarded as a distinct personage; but as he is not pre-Vedic, the circumstance is immaterial to the monotheistic position. Mitra, the Iranian Mithra, is a veritable divinity, belonging to the period of the Indo-Iranian unity. I shall notice him further when speaking of Varuna, with whom he is

* 'Επ' Ὀκεανοῖο ῥοάων (II. iii. 5).

† I think it quite possible that originally "the Twins" were Varuna and Yama-Savitri. Cf. "the two divine Mithras" (*sup. sec. 15*).

‡ *Rig-Veda*, X. xiv.

§ Muir, *Sanskrit Texts*, v. 303.

|| *Rig-Veda*, IX. cxiii. 7.

¶ Prof. Müller, *Lectures on the Science of Language*, ii. 53. 77.

almost invariably associated in the Hymns, and, as mentioned,* he is identified with Savitri. Pushan, "the Growth-producer," is a phase and name of the sun-god. Pushan guides on journeys and to the unseen world, aids in the revolution of day and night, is an Asura, knows all things, presides over marriage, and conducts the souls of the departed. He is Yama-Savitri. Tvashtri is a personification of skill in divine workmanship, an Indian Hephaistos. We still meet with no absolute separate divinity except the Asura and the divine solar and light-god, whose names are numberless; he is in reality the Savitri-Yama-Mitra-Pushan. So far as I am aware, Savitri, Pushan, and Tvashtri are purely Indian appellations; whilst Yama and Mitra belong to the earlier period.

26. *Varuna.*

Prof. Müller has remarked that an "advantage which the Veda offers is this, that in its numerous hymns we can still watch the gradual growth of the gods, the slow transition of appellations into proper names, the first tentative steps towards personification;" and that "the feeling that the various deities are but different names, different conceptions of that Incomprehensible Being which no thought can reach and no language express, is not yet quite extinct in the minds of some of the more thoughtful among the Vedic bards."† This Being is especially mirrored in the Vedic Varuna, whose name belongs to the period of Aryan unity, and who is identified by many with the Varena of the *Vendidad*. Varuna is "the Coverer," "the Encompasser," the all-surrounding, all-space-filling. He is pre-eminently the Asura‡ and the King (*Raja*), king of the universe, king of all that exists, king of gods and men, universal monarch, far-sighted and thousand-eyed. He made the revolving sun to shine, the wind is his breath, he witnesses man's truth and falsehood; through him it is that though all the rivers run into one ocean yet they never fill it;§ his laws are immutable, and they rest upon him as on a mountain. He has fashioned and upholds heaven and earth, and dwells in all worlds,—

"Lives through all life, extends through all extent,
Spreads undivided, operates unspent."

He is frequently celebrated alone and frequently together with Mitra, and between the two the closest harmony exists.

* *Sup. sec. 23.*

† *Lectures on the Science of Language*, ii. 454.

‡ "The epithet *asura* is frequently applied to Varuna in particular."
(Muir, *Sanskrit Texts*, v. 61.)

§ Cf. *Ecclesiastes* i. 7.

Mitra, on the other hand, is hardly ever hymned alone. Varuna and Mitra together are styled sun-eyed, kings, strong, terrible (*rudra*), divine (*asura*), upholders of the earth and sky, placers of the sun in heaven, guardians of the world, awful divinities, haters of the lie, acquainted with heaven and earth, lords of truth and light who made wise the simple, and avengers and removers of sin.* In a word, Varuna is the Asura, God Almighty; and Mitra is the high and holy Sun-god, ever in the closest union and harmony with him. Varuna can only be beheld in beatific vision:—

“When I have obtained a vision of Varuna,

I have regarded his lustre as resembling that of Agni.”†

As Sir G. W. Cox well observes “a pure monotheistic conviction is pre-eminently seen in the following prayer:”‡

“Let me not yet, O Varuna, enter into the house of clay,

Have mercy, almighty, have mercy.

If I go along trembling like a cloud driven by the wind,

Have mercy, almighty, have mercy.

Whenever we men, O Varuna, commit an offence before
the heavenly host,

Whenever we break thy law through thoughtlessness,

Have mercy, almighty, have mercy.”§

And here we may inquire, Is Varuna, the Asura, identical with Ahuramazda? Windischmann thought not, and Prof. Spiegel seems inclined to agree with him; but, on the other hand, Profs. Roth and Whitney are strongly in favour of the identity, which certainly is not denied either by Prof. Müller or Dr. Muir; whilst in my opinion, the recent researches of M. Darmesteter|| demonstrate their unity beyond reasonable doubt. With the degradation of Varuna, the gradual process by which he was at length reduced to complete insignificance, I am not here concerned.

27. *The Ameshaspentas and the Adityas.*

As Ahuramazda stands at the head of six divine personages, the Good-mind, Truth, Power, Piety, Health, and Immortality, the whole forming a sevenfold aspect of the One; so, Asura-Varuna stands at the head of six personages, the Friend, the Favourer, the Sympathizer, the Distributer, the Intelligent,

* I omit for brevity references to texts in support of each of these statements. † *Rig-Veda*, VII. lxxxviii. 2.

‡ *Mythology of the Aryan Nations*, i. 331.

§ Translated by Prof. Müller in his *History of Sanskrit Literature*, 540.

|| *Ormazd et Ahriman*, 1877.

and the Personified Fire, a corresponding group though not perhaps quite so severely monotheistic. Mithra, excluded by an intensity of monotheism from the Iranian Seven, appears amongst the Vedic Seven,* but alike in both regions the gods, when traced to their origins, resolve themselves into Ahura and Mithra, Asura and Mitra.

28. *Martanda, the eighth Aditya.*

In *Rig-Veda*, X. 72, we read :—

“ Let us celebrate with exultation the births of the gods.
In the earliest age of the gods, the existent sprang from
the non-existent.”

And after mentioning Aditi as the daughter of Daksha, the poet continues :—

“ When ye, O gods, like devotees, replenished the worlds,
Then ye disclosed the sun which had been hidden in the
ocean.

Of the other sons who were born from the body of
Aditi,

She approached the gods with seven, but cast away
Martanda.

For birth as well as for death she disclosed Martanda.”

The important *Satapatha-Brahmana*† thus comments on the foregoing passage :—“ Aditi had eight sons. But there are only seven whom men call the Aditya deities. For she produced the eighth, destitute of any modifications of shape (without hands and feet, etc.). He was a smooth lump.”‡ Roth and Darmesteter render Martanda “ Bird,” in which case we should have the familiar myth of the Phœnix, the solar bird ; but the preferable derivation is from *mrityu*, “ death,” and *anda*, “ egg,” the name thus signifying “ the Egg of Death.” Prof. Müller renders Martanda “ Addled Egg,” but I do not think that such imperfection is intended. Martanda

* For instances of the recurrence of the number seven, vide *The Great Dionysiac Myth*, ii. 225, *et seq.*

† *Brahmana* signifies, “ That which relates to prayer, *brahman*.” The *Brahmanas* form the second portion of Vedic literature, each of the four Vedas being divided into *Sanhita*, *Brahmana*, and *Sutra* or “ Band.” The *Brahmanas* are founded upon the *Sanhita*, and the *Sutras* mainly upon the *Brahmanas*. The chief object of the latter “ is to connect the sacrificial songs and formulas with the sacrificial rite. We find in them the oldest rituals, the oldest linguistic explanations, the oldest traditional narratives, and the oldest philosophical speculations.” (Weber, *History of Indian Literature*, 2nd edit. 1878, p. 12.)

‡ *Apud* Muir, *Sanskrit Texts*, iv. 15.

differs from his seven brethren in two respects, in form and in being subject to death. Now his seven immortal brethren are of divine form, and it is undoubtedly implied that the divine form is also more or less anthropomorphic; but Martanda is an egg, a circle,* a lump without hands and feet, in a word, the solar photosphere, the golden egg of the heavens, which dies daily.† Martanda is, as it were, thrown out by Aditi from the company of the gods and the splendours of the invisible world, into the inferior, visible, and material world, to live and die daily in the sight of men. He is thus a type of the humiliation of the divine nature by its alliance with material form and subjection to death; and so the converse of Yama, in which we see the human nature raised to the divine and perfected. An even the glorious sun himself, protagonist of materiality, when disgraced by idolatry becomes to us as it were Martanda, an addled egg; even as that venerable relic the Brazen Serpent became Nehushtan, for "The gods that have not made the heavens and the earth, they shall perish from the earth and from under these heavens."‡

29. *Soma*.

The Vedic divinity Soma affords an excellent instance of the process by which the human mind constantly converts into obscure mysterious things in themselves exceedingly simple. Soma is (1) a plant, the juice of which was largely used in connection with religious ritual; § and (2) the principle of humidity, which shows itself in rain, sap, dew, and otherwise. In illustration of this, it may be observed that in several passages of the *Atharva-Veda* Soma is identified with the moon; and it is stated that "the Sun has the nature of Agni, the moon of Soma;" that is to say, the sun is igneous, the moon humid. The moon is the night-queen, and the night is the time of growth (symbolized by the increasing moon),|| dew and humidity generally. Thus Apollo is Sauroktonos, "the lizard-slayer," ¶ for the lizard was a symbol of humidity

* Plato's commendation of the circular form in the *Timaios*, may be accepted except so far as a tangible sentient divinity is concerned. Such a god must be more or less anthropomorphic, and will yet be the *χαρακτήρ* and *εἰκὼν τοῦ Θεοῦ τοῦ ἀόρατου*.

† The egg-sun is familiar in Egypt (*vide The Archaic Solar Cult of Egypt*. By the Writer). In the frontispiece to *The Great Dionysiak Myth*, vol. ii., I have given a Hellenico-Egyptian representation of the winged sun, Dionysos Psilas (*vide Pausanias*, iii. 19), supported by the twin serpents of plenty.

‡ Jer. x. 11.

§ *Vide sup.* sec. 13.

|| One of the Akkadian names of the moon is Enzuna, "the Lord of Growth." Cf. Deut. xxxiii. 14: "The precious things put forth by the moon."

¶ Pliny, xxxiv. 8.

because supposed to live upon the dew. We can therefore easily see the process by which Soma or humidity generally became identified with the moon, the queen of humidity. Soma is the Iranian Haoma, the Omômi of Plutarch,* and the whole of the ninth book of the *Rig-Veda* is devoted to its praise; illimitable power, benefit, and efficacy being ascribed to the personified King Soma, the Asura. Now, after making all due allowance for the wonder and delight which may have been produced in the human mind by wine (using that word in a general sense), and also for man's appreciation of, and thankfulness for, moisture in its various forms, there still remains something unexplained and mysterious in the intensity of the Soma-cult and in the apparent extravagance of the Soma laudation. But the great idea behind these lower ones involves man's yearning for continued existence, and the line of thought is as follows:—Moisture, drink, wine of heaven, water of life, renews the face of the earth, man and nature in the present physical and visible state of things. But man is to live hereafter in another and a higher world; then must there be some subtle *nektar*, some elixir of immortality, which, when procured, shall be in him as a well of water springing up into everlasting life. This is the true Soma, of which the other is but the shadow, nor can it be too highly praised, too ardently desired. This view alone enables us to understand such aspirations as the following:—

“Where there is eternal light, in the world where the sun
is placed,
In that immortal imperishable world place me, O Soma.
Where life is free, in the third heaven of heavens,
Where the worlds are radiant there make me immortal.
Where there is happiness and delight, where joy and
pleasure reside,
Where the desires of our desire are attained, there make
me immortal.”†

And this poetic prayer we might transcribe in words more familiar:—May He who is the light of light,‡ dwelling in the world, whose sun goes not down, whose service is perfect freedom, in whose presence there is fulness of joy, and at whose right hand there are pleasures for evermore, clothe our mortal with immortality in the third§ heaven of heavens.¶ Speaking elsewhere of Dionysos as Theoinos, I have considered

* *Peri Is. kai Os.* xlv.

† *Rig-Veda*, IX. cxiii. 7.

‡ “The Deity who is, as an ancient Christian lamp attests, Φῶς φῶρός.”
(W. R. Cooper, in *Faith and Free Thought*, 246.)

§ 2 Cor. xii. 2.

¶ 1 Kings viii. 27.

the Vedic Soma, the Iranian Haoma, the Assyrian "water of life, the drink of the gods," the living water of Egypt, the mead in the halls of Odhinn, and the bowls of wine in the Garden of Delight of the *Koran*, and in summing up the phase of Bakchos Theoinos, I observed:—"We recognize reverence for the principle of humidity, without which all is parched and sterile, when earth pants and gasps under the influence of the burning Typhon, the scorching dog-star of ruin, the choking, rain-restraining Vedic snake, or the consuming Athamas. Opposed to these are the all-fostering Okeanos, the rivers, symbols of the force and flow of life, the beloved Zeus-rain, and Dionysos lord and first cause, not only of wine, but of the whole humid nature.* But, secondly, and distinct from the foregoing train of thought, is the yearning for immortality coupled with the idea that as ordinary food and drink sustain ordinary mortal existence, so superhuman nourishment, 'angels' food,' will sustain, or is required to sustain, the immortal life, which it is possible for some at least to become possessed of."†

30. *The Physical Agni.*

A single Vedic divinity remains for examination, Agni, who stands in the front rank, and whose importance at once appears by the fact that no less than fifty-three out of one hundred and ninety-one hymns of the first book of the *Rik* are addressed to him either solely or with others. But Agni, who is seen in the West as *ignis*, a name, not a god, is a vast and difficult concept. We may, therefore, say with the Stranger in Plato's *Sophistes*, "The object of our inquiry is no trivial thing, but a very various and complicated one. This is a very questionable animal—one not to be caught with the left hand, as the saying is."‡ Agni appears in almost as many aspects as Osiris, and therefore the question for consideration is, What concept of Agni will include all other narrower and derivative concepts, and hold true throughout their divergent modifications? Working from the known to the unknown, from the obvious to the obscure, we notice Agni in his first and simplest phase as ordinary terrestrial fire; and as such he is described in the hymns with great power and variety of imagery. Thus, he is the son of the ten fingers and of the two sticks,§ wriggles like a serpent, cannot be

* Plutarch, *Peri Is. kai Os.* xxxv.

† *The Great Dionysiac Myth*, ii. 111.

‡ R. W. Mackay, *The Sophistes of Plato*, p. 89.

§ As to the "Suastika," a word which, according to some, is equivalent

suckled by his mother, is butter-fed, and wind-driven, sees through gloom, has blazing hair, a golden beard, sharp weapons, and burning teeth, is footless and headless, thousand-eyed, thousand-horned, all-devouring, roars like thunder, like the wind, like a lion, bellows like a bull, has a hundred manifestations, and is the youngest of divinities, because constantly produced.* These physical epithets and characteristics require no explanation; but what a world of simile and symbolism is involved in them, leading to subsequent trope and metaphor still more obscure, and thus to mythologico-religious mystery. So the web of mythology is woven, and here we behold its pristine simplicity. And now let me ask, With what mental feeling did these Vedic Indians regard the Agni which they produced day by day? Did they crudely *worship* the mere flame in fetishistic imbecility? To believe this would be to give the lie direct to every noble passage in the *Veda*, even to the very existence of these hymns, for no fetish worshipper would ever have produced a single strophe. Be fetishism ancient as well as modern, or modern only,† that the Vedic poets were infinitely superior to such grovelling concepts is as certain as any fact in history. Let those who are compelled by the necessities of theories of evolution, physical and mental, persistently endeavour to degrade archaic man. Freethought, truly so called, is warped by no such trammels; and, whilst fully admitting that the Deity might, in the abstract, have worked by evolution as well as in any other way, believes that there is no real evidence He has done so, and that the whole theory is "not proven." And yet I would remark, in passing, that a man cannot fairly be made answerable for the follies of his extreme followers; and that I respect the caution and wonderful powers of observation of a Darwin, as much as I despise the baseless dogmas of a Haeckel. The Indian Aryan, then, may not have known that heat was but "a mode of

to *sv̄ iari* "as the sign of good wishes," 卍, *vide* Schliemann, *Troy and its Remains*, 101, *et seq.*; Waring, *Ceramic Art in Remote Ages*, plates xli.-xliv. It appears equally in Akkad. "The ideograph +, with the determinative of wood, certainly appears to contain the elements of the primitive fire-stick." (Mr. St. Chad Boscawen in *Transactions of the Society of Biblical Archaeology*, vi. 281.) The investigation into the pictorial meaning of the ordinary Assyrian cuneiform which, through the archaic Babylonian, still in numbers of instances directly or indirectly *represents* the object or idea signified by the word, is a study of the highest interest, and one which promises very important results.

* Cf. Yavishtha-Hephaistos *i.e.* Juvenis.

† *Vide* Prof. Max Müller's Paper, *Is Fetishism a primitive form of Religion?* (Macmillan, June 1878.)

motion," but he certainly did know that flame was but flame. And why, then, did he so reverence it, for its physical aspect does not fully explain his respect? Because he knew that the mere ordinary earthly flame, born so mysteriously, is but the last and lowest link in a wondrous chain, which includes all fire, aerial and celestial, all light, all heat, and hence all life; a chain which descends from the abode of "those primeval heats whereby all life has lived," from the dwelling-place of Him who is "a consuming fire." And this aspect of Agni will explain why the different divinities are identified with him, and also his varied parentage. Thus, he is the son of heaven and earth, because they, regarded as the two halves of the all, necessarily include the sum total of igneous effulgence. He is the son of Dyaus alone, for he manifests himself in the visible sky, in lightning, and in the sun. He is produced by the dawn, a time when, as an old English poet tells us, "The light shoots like a streak of subtle fire." He is produced by Indra between two clouds, struck together like the sticks on earth. He is made by the gods, yet conversely he is also their sire; for without Agni how could mortals know aught of the bright Devas, or how could they even exist? Lastly, he is the son of Daksha and Aditi, that is to say, he is the manifestation of the Supreme Spirit throughout space. Whatever produces or occasions light and heat is the sire or mother of Agni; and the result is real consistency accompanied by an apparent contradiction.

31. *Agni, a Combination and Manifestation of the Vedic Divinities.*

Let us next notice how the Vedic divinities are identified with and combined in Agni. We read:—

"Thou Agni, art Indra, thou art Vishnu, the wide-stepping,

Thou, Brahmanaspati, art a priest.*

Agni, when kindled, is Mitra; Varuna is Javatedas,"†

i.e. "All-possessing," a frequent epithet of Agni.

"Thou, Agni, art born Varuna, †

Thou art Aryaman in relation to maidens;

In thee, son of strength, are all the gods.‡

Thou, Agni, art the royal Varuna,

Thou art Aryaman, thou art Tvashtri,

* *Rig-Veda*, II. i. 3.

† *Ibid.* III. v. 4.

‡ *Ibid.* V. iii. 1, 2.

Thou art Mitra, thou art Rudra ;
 As Pushan, thou cherishest those who offer worship.
 Thou art the divine Savitri, thou art Bhaga.*
 Thou encompassest the gods as the circumference the
 spokes (of a wheel).”†

By the sacred radiance of Agni

“ Varuna, Mitra, Aryaman, and Bhaga shine,‡
 and through him they triumph,§ for he is the

“ Immortal sustainer of the universe, exempt from death.||
 Whatever other fires there may be,
 They are but ramifications, Agni, of thee.¶
 By thee, Agni, Varuna, and Mitra and Aryaman are ani-
 mated.

So that thou hast been born comprehending them all,
 Universally in all functions,
 And encompassing, as the circumference the spokes**
 Agni is associated with heaven and earth,
 As (a husband with) one only wife.††
 I, Agni, am the living breath of threefold nature,
 The measure of the firmament, eternal warmth.‡‡
 I offer praise to Agni, the creator, the first.§§
 He who has hidden darkness within light.
 He has spread out the two sustaining (worlds) like two
 skins :

Vaisvanara comprehends all energy.|||
 A steady light, swifter than thought,
 Stationed among moving beings to show (the way) to
 happiness.¶¶
 Agni knows all that exists,***
 Appropriates the prayers addressed to the Eternal
 Creator.”†††

Elsewhere a poet exclaims,—

“ May our sin, Agni, be repented of;”††††
 and Agni, who is styled Asura, is besought to preserve from

* *Rig-Veda*, II. i. † *Ibid.* V. xiii. 6. ‡ *Ibid.* VIII. xix.
 § *Ibid.* I. cxli. 9. || *Ibid.* I. xlv. 5. ¶ *Ibid.* I. lxix. 1.
 ** *Ibid.* I. cxli. 9. †† *Ibid.* III. vii. 4. ‡‡ III. xxvi. 7.
 §§ *Ibid.* V. xv. 1.
 ||| *Ibid.* VI. viii. 3. Vaisvanara signifies “ He who is beneficial to all,”
 like Mitra, “ the Friend.” ¶¶ *Ibid.* VI. ix. 5. *** *Ibid.* III. xii. 4.
 ††† *Ibid.* I. lxxii. 1. On this passage Wilson observes, “ This looks as if
 a first cause were recognized, distinct from Agni and the elemental deities.”
 (*Rig-Veda-Sanhita*, i. 190.) †††† *Ibid.* I. xcvi. 1.

sin.* I have already† quoted the celebrated passage where Agni is said to be a name of the One, and is identified with Yama. As throughout this Paper I have as much as possible avoided, though by no means ignored, the mythological element, I shall not quote here any of the numerous passages which treat of the physical functions of Agni in connection with the Devas. But, on the foregoing extracts, we may observe that the identifications are not to be regarded as implying a strict and absolute monotheism, as if there were really only one god, Agni; what they undoubtedly show is that all the divinities are of the same igneous nature, and that Agni who, in his lowest manifestation is ordinary earthly flame, in his highest is identical with Varuna himself, is the Asura, ultimate source of all light, heat, life and energy. Agni as the ritual-fire, is a priest and sage, messenger and link between God and man, and bears to heaven the prayers addressed to the Eternal Creator. How clearly in these Hymns we see the struggle between monotheism and polytheism; the poets are apparently inconsistent and contradictory, there is but One and yet there are many; there are many, but yet they are merely names of the One. Again and again through the increasing clouds of ignorance and error, the supreme form of the Asura of heaven breaks forth upon His children like the blue sky of His abode.‡

32. *Agni the highest Manifestation of Divinity.*

It is stated that,—

“The gods formed Agni for a threefold existence.”§

According to the great commentator Yaska, B.C. 400, and his predecessor Sakapuni, this triadic existence refers to the igneous principle—(1) on earth, (2) in the air, and (3) in the sky, as fire, lightning and sun. In another passage Yaska observes:—

“Owing to the greatness of the Deity, the one Soul is lauded in many ways. The different gods are members of the one Soul. It is soul that is their car, steeds, weapon,

* *Rig-Veda*, VI. xv. 12.

† *Sup.* sec. 18.

‡ Prof. Müller observes that Vedic poets, Zoroastrian worshippers, Hebrew prophets, and Homeric singers “had no name for that which is the sky’s own peculiar tint, the sky-blue, the cœruleum.” (*Contemporary Review*, May, 1878, p. 230.) I do not feel sure of this. The *blue*, formerly *bleue* sky, is the *blew-en* or blown sky, from which the clouds are driven, so that the vault of heaven appears. In Assyrian the same ideograph stands for *samu*, “blue,” and *samu*, “sky;” therefore in Mesopotamian regions, blue = sky colour.

§ *Rig-Veda*, X. lxxxviii. 10.

arrows, soul is a god's all. There are three deities according to the etymologists; Agni, whose place is on earth; Vayu or Indra, whose place is in the atmosphere; and Surya, whose place is in the sky. These receive many designations in consequence of their greatness or from the diversity of their functions."*

Yaska had before him the interpretations of Sakapuni and Aurnavabha, two very ancient and famous expounders of the *Veda*, so that he was well-acquainted with archaic tradition; and Dr. Muir observes on the passage that,—

“Agni, Vayu or Indra, and Surya appear to have been regarded in the time of Yaska as the triad of deities in whom the supreme spirit was especially revealed.”

And, according to Yaska, even these three “agree in one,” and are merely protagonistic manifestations of the only Soul or Spirit. But by this time the One Spirit has become semi-panteistic. According to a passage in the *Atharva-Veda*,—

“Agni becomes Varuna in the evening, rising in the morning he is Mitra;

Becoming Savitri he moves through the air, becoming Indra he glows in the middle of the sky.”†

Agni is thus,

“That light whose smile kindles the universe.”

Highest and brightest manifestation of divinity,

“Ignis ubique latet, naturam amplectitur omnem.”

And according to the *Avesta*,—

“Son of Ahuramazda, giver of good, the greatest Yazata,”‡ and it is in this connection that Zarathustra styles himself “the supreme fire-priest,” § the priest of the Iranian Atash or Atar.¶ Lastly, Agni, like Yama, conveys to bliss the soul of the righteous after death:—

“When thou hast matured him, O Jatavedas,

Then send him to the fathers.

As for his unborn part,¶ do thou kindle it with thy heat;

Let thy flame and thy lustre kindle it;

* *Apud Muir, Sanskrit Texts*, iv. 160.

† *Atharva-Veda*, XIII. iii. 13.

‡ *Khurda-Avesta*, xi.

§ *Sup.* sec. 10.

¶ “Atar et ἀθήνη sont deux formations de la même racine. Il est impossible de séparer Atar du védique athar, et entre athar et ἀθήνη il y a, quant à la racine, le même rapport qu’entre la racine manth (dans *pramantha*) et la racine μανθ dans *προμηθεύς*.” (Darmesteter, *Ormazd et Ahri-man*, 34, note 3.)

¶ The germ of immortality.

With those forms of thine which are auspicious convey it to the world of the righteous."*

33. *The Essence of the Vedic Divinities.*

Such, then, are the Vedic divinities; from being few they become many. In various passages thirty-three gods are alluded to, but, according to others, there are one hundred and eighty Maruts alone; and elsewhere it is said that three thousand three hundred and thirty-nine gods have worshipped Agni. Thus Pantheons extend. As time goes on, other important figures appear upon the stage; Brahmâ, a personification of "the magic power hidden in the sacred word and in prayers;"† Siva,‡ Krishna,§ but these are not Vedic divinities, and therefore do not concern us. Goddesses also play an important part, a sure sign of degeneration; the miserable doctrine of the transmigration of the soul, entirely unknown to the *Rig-Veda*, makes its appearance to the torment of mankind; and, after many a weary age, including the reaction of Buddhism and its suppression, we reach a vague and atheistic pantheism or a grovelling superstition; a truly remarkable instance of mental evolution, although at the same time undoubtedly a *descent* of man. And, amid the crowd of shadowy forms that make up the group of Vedic divinities, where do we find reality save in the Asura, Varuna, Mitra, Surya-Savitri, Yama, and Agni? And these, again, resolve themselves into God, the sun-god, and the universal spirit of divinity. They are all known elsewhere; alike in name (Ahura, Ouranos, Mithra, Helios, Yima, Ognî) and in reality.

34. *The Law of Circle.*

Thus we can see how, long ere the days of Zoroaster, there

* *Rig-Veda*, X. xvi.

† Tiele, *Outlines of the History of the Ancient Religions*, 125.

‡ Siva, "the Gracious," is merely a euphemistic appellation of Sarva, "the Wrathful." And Sarva, in turn, is merely an epithet of Rudra considered as the Mahadeva (Megastheos) or "Great god." And Rudra, "the Terrible," is as noticed (*sup. sec.* 19), merely an epithet of Agni. Thus much out of little. The Hindu Trimurti, Brahmâ, Vishnu, and Siva, is a modern philosophical concept, arbitrarily attached to these names. (*Vide* Tiele, *Outlines*, 153.)

§ Krishna, "the Black," "the hidden sun-god of the night" (Tiele, *Outlines*, 145), is undoubtedly a very ancient mythological figure, but probably non-Aryan in origin. The nocturnal sun is a remarkable feature in Egypt and Akkad, and the dark colour harmonizes with the complexion of those dusky races who were subdued by the lighter Semites and Aryans. Shem is probably connected with the Assyrian *sâmu*, "brownish," and Japhet (יָפֶֿתֿ) with *ippu*, "white," *ippatu*, "white race." (*Vide* Rev. Prof. Sayce, *Assyrian Lectures*, 145.)

existed a practical monotheism, to which he endeavoured to return, as good men in all ages have looked back wistfully to a "higher, holier, earlier, purer church." It is easy to deny this great fact on the ground that we everywhere encounter numbers of figures of divinities; but a careful analysis of these shadows will resolve them into their kindred air, and the result will be the same, whether the process is applied in Vedic India, or in Iran, Scandinavia, Germany, Italy, or Greece. Nor does this principle obtain in Aryan regions only. Prof. Sayce affirms* that Babylonian and Akkadian religious mythology is essentially solar; that is, that we shall meet again with Mitra and Savitri and Yama and Agni, under other names indeed, but veritably the same personages in reality; and M. Chabas, who is well-entitled to speak for Egypt, says that "the Egyptian doctrine revealed to the initiated the unity and incomprehensibility of God, while the multitude was abandoned to the cult of material symbols."† And these moderns have been anticipated by an ancient writer, who has left it on record that—

“ Πλούτων, Περσεφόνη, Δημήτηρ, Κύπρις, Ἐρωτες,
 Τρίτανες, Νηρεὺς, Τηθύς, καὶ Κνανοχαίτης,
 Ἐρμῆς θ', Ἡφαιστός, τε κλυτὸς, Πάν, Ζεὺς τε, καὶ Ἥρη,
 Ἄρτεμις, ἠδ' Ἐκάεργος Ἀπόλλων, εἰς Θεὸς ἔστιν.”

The theory of an archaic monotheism has been objected to on the ground that the instance of Plato and the other philosophical Greeks of the great ages shows that the monotheistic idea is the culmination and end, not the beginning of human thought. But the reply is obvious. Doubtless it required the intellectual might of a Plato to free the human mind from the meshes of a long-established polytheism, but there is no evidence that any such powers are needed for the original reception of the simple truth that "there is one God, and none other but He." Monotheism is simpler than polytheism, even as

* "The more the Babylonian mythology is examined, the more solar is its origin found to be; thus confirming the results arrived at in the Aryan and Semitic fields of research." Except Anu and Hea, "the great deities seem all to go back to the Sun" (*Trans. Soc. Bib. Archæol.* ii, 246, note). We are thus, it will be observed, left with a triad, namely (1) Anu, Akkadian Ana, "the High" God: called Zi-Ana, "Spirit of the heavens"; Pater. (2) The Sun-god; Potentia. (3) Hea, the lord of wisdom and of the deep, called Hea-Ana, Gk. Oannes, "the god Hea," Mens.

† *Records of the Past*, x. 6. "There may be truth in the assertion that the esoteric religion of ancient Egypt centred in a doctrine of divine unity, manifested through the heterogeneous crowd of popular deities." (Tylor, *Primitive Culture*, ii, 322.)

one is simpler than numbers. And the Platonic age affords us an illustration of that mysterious Law of Circle, which rules alike in nature and in thought. The heavenly bodies, circular in form, constantly describe their circling movements; the sun has his zodiac, and *annus* the year is but *annulus*, a ring. Eternity is fitly symbolized as a serpent, tail in mouth, and "He that sitteth upon the circle of the earth," has, from remote antiquity, been described as a circle whose centre is everywhere, and its circumference nowhere. Nature abhors a straight line as she is said to abhor a vacuum, and Nature is "the earliest gospel of the wise;" poetry, philosophy, religion are essentially cyclic, and history repeats itself.* Human progress is no straight line of continuous advance. The world-poet saw this when he spoke of "the whirligig of time," and told us that "our little life is rounded." And the great truth is "an anchor of the soul," for it assures us that as from God we come, so to God we shall return. The poor, blind, stumbling world, at whose ignorance heaven winked, despised by chosen nations and peculiar people, still dreamed of its divine Asura, still chanted that archaic song heard amid the oaks of Dodona, "Zeus was, Zeus is, Zeus will be. O great Zeus!"† or raised the piteous cry, "Doubtless thou art our Father, though Abraham be ignorant of us, and Israel acknowledge us not; thou, O Lord, art our Father, our Redeemer." And in the latest days of the old-world of heathenism, "a pagan suckled in a creed out-worn," could yet so distinguish substance amid shadow and reality from illusion, as, addressing the Asura of heaven by a name known centuries earlier on the banks of the Indus, and grasping the grand principle of circle, to exclaim:—

"O Thou whose power o'er moving worlds presides,
Whose voice created, and whose wisdom guides!
From thee, great Zeus! we spring, to thee we tend,
Path, motive, guide, original, and end!"

* Thus the philosophical Thucydides is satisfied if his history "is judged useful by those who may desire an accurate knowledge of the past as a clue to that future which, in all human probability, must repeat or resemble the past." (Prof. Jebb, *Greek Literature*, 108.)

† *Pausanias*, x. 12. "There is little or no trace of mythology in this" [song]. (Prof. Max Müller, *Lectures on the Science of Language*, ii. 482.) As Prof. Jebb well observes, "There was a time when they [*i.e.* archaic men] had begun to speak of the natural powers as persons, and yet had not forgotten that they were really natural powers, and that the personal names were merely signs." (*Greek Literature*, 16. Vide *sup.* secs. 6, 21, 30.)

THE RELIGION OF ZOROASTER CONSIDERED IN CONNECTION
WITH ARCHAIC MONOTHEISM.

Synopsis.

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ADDITIONAL NOTES.

P. 253.—*Earliest Notice of the Avesta.*

The earliest historical notice of the Avesta occurs at the close of the Median version of the Behistun (*i.e.* Baz-istan, "Place of the god") Inscription of Darius Hystaspes, cir. B.C. 516. This Inscription, which is about 400 feet from the ground on the rock of Behistun, near the western frontier of Mada (Media, *i.e.* "the country"), and contains more than 1,000 lines of cuneiform writing, concludes:—

"And Darius the King says:—

'I have made also elsewhere a book in Aryan language, that formerly did not exist.

And I have made the text of the Divine Law (Avesta), and a commentary of the Divine Law, and the prayer, and the translation.

And it was written, and I sealed it.

And then the ancient book was restored by me in all nations, and the nations followed it.'—(Translated by Dr. Oppert in *Records of the Past*, vii. 85, *et seq.*)

Darius thus made a translation of the *Avesta* from the original Baktrian into the Persian of the Achaemenian period.

P. 256.—*Dialect of the Gáthas.*

For an account of the linguistic peculiarities of the *Gáthas*, vide Prof. C. de Harlez, *Manuel de la Langue de l'Avesta*, 105, *et seq.*

P. 259.—*Non-reality.*

Expressions such as "non-reality," "nonentity" (*Rig-Veda*, X. cxxix. 1), and the like, when occurring in archaic poetry, are used in a physical, not in a metaphysical sense, and refer to what may be called Primitive Negative Concepts (*vide* Dr. Hyde-Clarke, *Researches in Pre-historic and Proto-historic Comparative Philology*, 21, *et seq.*). Amongst these are Woman, *i.e.* Not-man, Night, Darkness, Black, Evil (Not-good), Not (*i.e.* nought), Death, Dream, Shadow. The reappearance of heaven and earth after the darkness of night is regarded by the Vedic poets as a sort of re-creation, a rescue from the realm of non-reality.

P. 264.—*Asu-Asura.*

"The root *as*, which still lives in our *is*, existed in its abstract sense previous to the Aryan separation. The simplest derivation of *as*, to breathe, was *as-u*, in Sanskrit, breath; and from it probably *asu-ra*, the oldest name for the living gods." (Prof. Müller, *Lectures on the Origin and Growth of Religion*, 191-2.) Prof. de Harlez gives in his Lexicon, "*Anhu* (*ah*, être + *asu*). 1. Monde. 2. Maître, chef"; and "*ahv* (*ah* + *asu*), être, vie, monde, —maître, chef." The Vedic *s*, except sometimes in a final syllable, appears in the language of the *Avesta* as *h*; *e.g.* Soma, Haoma; Asura, Ahura.

P. 265.—*The Deva and Ahura Cults.*

M. Julius Jolly has recently remarked that "the theory of a religious schism, which was supposed by Dr. Haug to have brought about the separation of the Iranians from their Indian neighbours, has been entirely disposed of by M. Darmesteter's researches, and the revolution theory has been replaced by an evolution theory." (*Academy*, February 1, 1879, p. 102.) I greatly admire M. Darmesteter's very able work (*Ormazd et Ahriman*) but am unable to come to any such conclusion. Haug has probably pushed his views on the matter too far, and three of the demons of the infernal council of Ahriman, *i.e.* Saurva, Andra, and Naonhaithya, in all probability are not identical with the Vedic Shiva or Siva, Indra and the Nasatyas or Asvins. But thus much granted, the conclusion by no means follows. The remarkable career of the words *deva* and *asura* appears to be regarded by M. Darmesteter as "an accident of language." But to say that such and such a circumstance *happened* to occur is a re-statement of the fact, not an explanation. Moreover, M. Darmesteter's theory depends upon the negation of an historical Zoroaster, a negative which is incapable of demonstration. Haug's views are in the main accepted by Bunsen, Max Düncker (*Geschichte des Alterthums*), Lenormant (*Manual of the Ancient History of the East*), and Justi (*Handbuch der Zendsprache*), and are not denied by Prof. Spiegel.

P. 276.—*The name "Avesta."*

Dr. Oppert observes that in the Behistun Inscription, clause li. "the Persian affords us the true origin of the word *Avesta*. It is *Abastā*, the Divine Law; it is explained by the Assyrian *Kinat*, the laws." (*Records of the Past*, vii. 107, note 1.)

P. 281.—*The Connection between Agni and Soma.*

As to the very intimate connection between Agni and Soma, who sometimes form a dual divinity, Agni-Shomau, and represent two variant yet constantly intertwining phases of the Visible-external in its relations with the Invisible-external, *vide* M. Abel Bergaigne, *La Religion Védique d'après les Hymnes du Rig-Veda*, tome premier, 11-235.

P. 292.—*The Unanthropomorphic Sun.*

As Martanda, the Vedic egg-sun, is "a smooth lump, destitute of any modifications of shape," so in the Egyptian *Funereal Ritual*, cap. xlii., we read of the justified and triumphant Usarian, or follower of Osiris, who has been made like his lord, the Sun-god, that,—

"He is in the [Solar] Eye and the [Solar] Egg.
 He is the Day for race after race of men.
 He is the Germ emanating from the firmament.
 He is the Golden Ape of the gods *without hands or feet*.
 He goes forth, the Ape goes forth" [on his celestial path].

The CHAIRMAN.—I am sure all will join in thanking Mr. Brown for his very interesting paper : it is now open for any one to offer remarks thereon.

Rev. Dr. RULE.—I have read Mr. Brown's paper as carefully as possible, and should be glad if he would instruct us as to some conclusions, towards which the particulars we have in his paper do not in my opinion lead us. The cry certainly is not piteous wherewith the Hebrew acknowledged God to be his father,—“father of Abraham”; and here I cannot exactly understand why we should limit our recognition of the Godhead to Zeus. With regard to Zoroaster, I believe the main doctrine of that author was that of duality—that of two gods, a god of darkness and a god of light. We have a book which contains a distinct historic reference to this idea. We have in that book the name of a person distinctly known in history, whose successor Darius, son of Hystaspes, waged war against Magism, which was associated with Zoroastrianism. We find there a doctrine against that duality, and I think we have materials there, which are distinctly historic, and the account of God which we have, is not imbued with the vague superstitions of heathenism, but it is distinctly stated at the very beginning of the Bible and is historically continued all through as *revealed monotheism* as proved by all prophecy,—prophecy fulfilled, associated and linked in with the general history of the whole world. It does appear to me, whilst anxious to second the vote of thanks to Mr. Brown for the great pains he has taken with this paper, that we should be anxious inquirers into Revealed Truth. I think if we were to take some firm basis in regard to this great subject of monotheism whereon to rest our researches, we should obtain some place on which to rest our inquiry. I think, however, that Mr. Brown's paper has teuded to furnish us with a very striking illustration of an undoubted proof, that none, by searching, can find out God ; and that those historians who have searched have most singularly failed, and have deprived us of any idea that the notion of Professor Müller, which is adopted very warmly by Mr. Brown, will ever be realized. The words are these, and I think more distinctly than in any other part of the paper, they express the conclusions arrived at at the foot of page 278 :—

“However, ere examining the principal Vedic concepts, we may remember with comfort a statement of Professor Müller, which is not based upon any particular passage or passages, but upon a wide and careful investigation of the subject, a statement which has my warmest assent, ‘Like an old precious metal, the ancient religion, after the rust of ages has been removed, will come out in all its purity and brightness, and the image which it discloses will be the image of the Father, the Father of all the nations upon earth.’”

Now, it does seem ungrateful—very ungrateful—to forget that Divine Revelation and the coming of Christ into the world have not thrown the rust of ages upon the ancient truth, but have rather removed the rust of ages and brought life and immortality to light, and that whatever great change in the world has taken place in religion since the time of Zoroaster, must be attributed to that Divine interpretation which we find recorded in the Bible. Therefore, I should be glad if we could be conducted by Mr. Brown to a

more definite conclusion than that with which he has favoured us, and I trust that he will accept my strictures in the spirit of courtesy and kindness in which I have intended to give them.

Mr. ENMORE JONES.—I am sorry that I have not been able thoroughly to study the paper, and would ask the author whether he could favour us with his idea as to when Zoroaster really lived? The last speaker has referred to revelation. Before he spoke, I had in my mind the fact that there is a book called Job, which contains a clear statement as to the Great One God, and therefore I felt anxious to know whether Job was first or Zoroaster.

Mr. BROWN.—On page 253 I give as a conclusion that as to date, the composition of the Gáthas may be fairly placed at some time prior to B.C. 1200, and Zoroaster may be put from 1500 B.C. to 1200 B.C.

Mr. JONES.—There seems at any rate to be a vagueness about the date, whereas if we take Job, as a book of itself, it has a clear and definite idea given in it of the Creator 2,300 B.C.—say one thousand years before Zoroaster; and it has this advantage, that it contains a series of historical incidents. I think it is very important that in searching amongst the ancients for the philosophy of the ancients, we should not forget the vital knowledge we have through the Scriptures. We have the Jewish Scriptures and the Christian Scriptures; and they both certainly teach us that there is one God, that He is *the* one God, the Creator, the Preserver, and Governor, not only of all the countries of this world, but of the universe. I must say it struck me that in the history we call our Scriptures, we have a much clearer narrative there of the workings of the Deity in nature than we have in Zoroaster, or in any other teacher. I think that the principles which have guided the Institute ought to be kept clearly before our minds.

Mr. J. E. HOWARD, F.R.S.—I should like to make a few observations as to the age of Zoroaster and his religion. I do not wish to put aside the very well-intentioned observations of those who have preceded me; but I think there is another aspect of the question, to which they have not perhaps given as much attention as they might have done. I refer to the very interesting abstract which this paper contains of the doctrines of Zoroaster. And suggest that it becomes the duty of our missionaries and those who are in contact with the Parsees in India, to make themselves acquainted with the religion which they have there to combat; otherwise they might be placed under a great disadvantage. Perhaps it may be known to some here, that a great controversy took place on the occasion of one of the Parsees being converted to the Christian faith, when the Parsees took up many popular ideas, and showed that theirs verged very much on the Zoroastrian religion. For instance, that popular hymn—well, I cannot call it that,—but that translation of an old Roman verse—

“Vital spark of heavenly flame!
Quit, O quit, this mortal frame.”

That is entirely, though unintentionally, Parseeism. This controversy shows that, at all events, the Christians who come in contact with these doctrines

ought to know very well what they are about ; I trust that the writer of this paper has no intention to depreciate Christianity by those expressions which have been noticed by previous speakers. The great idea which he endeavours to bring out, that monotheism is really at the bottom of this religion, is no doubt correct. The question as to the age of Zoroaster is a very difficult one, and I confess that I cannot get at the bottom of it. I have studied the very elaborate examination, by Dr. Chwolson, of St. Petersburg, of Eastern authorities respecting this matter ; and he seems to prove that the change in the religion of Persia is from Sabaism to the religion of Zoroaster. Early idolatry began, according to the Eastern authorities, with Tammuz. Dr. Chwolson says (i. p. 347) that we know almost nothing of the religion of the old Persians, and that it would not be correct to identify that which prevailed in the northern provinces with the peculiar Persian religion. In Bactria and Media the religion of the *reformer Zoroaster* was prevailing long before Cyrus ; but the old Persians were probably no adherents of the religion of Zoroaster, but, as the geographer Dimesqui asserts, were Sábians. "In early days men worshipped God and the angels whom He sent" (vol. ii. pp. 606, 459, 206), but Tammuz endeavoured to lead his sovereign into idolatry,—to worship the heavenly host ; and to consider the stars, and particularly the planets, as the gods and directors of mankind ; who governed everything that took place on earth. The result of this was that, according to the tradition, Tammuz was put to death by his sovereign ; and his bones were ground in a mill, and scattered to the winds. He was put to death in a very cruel way ; and in consequence of his death all the gods came together at a temple in Babylon, and spent the whole night in weeping and bewailing the death of this prophet ; and then betook themselves to their respective homes all over the world. This gave occasion to the ceremony of weeping for Tammuz, which is alluded to in our prophets. They kept up that festival, with this peculiarity about it, that the women were not allowed during its course to have anything that was ground in a mill, because the bones of Tammuz had been ground in a mill. Now, this was a world-old institution. [According to Mr. Boscawen, "the god Tammuz is evidently the Dumzi," the son of life, "to seek whom Ishtar descends into Hades." The deification of Tammuz, and the complication with, perhaps, a solar myth, seems engrafted on the original story. More light will probably be thrown on the obscurities of the subject. In the meantime, the tradition strongly indicates that, before the introduction of idolatry, a purer religion prevailed. The attempt to restore this is perhaps to be attributed to Zoroaster. Is it not probable that he is identical with Búdâsp ? (confounded with Buddha) ; of whom Masudi relates that he came from India, travelled through Sind, Segestân, and Zabulistân, and again to Kermân ; until at last he came to Persia, everywhere giving himself out as a prophet, and maintaining that he was one sent from God, and a mediator between Him and his creatures. This took place, according to some, in the reign of the Persian king Thamûrath according to others, in the time of the King Jemschid.—Chwolson, vol. .

p. 208.] I hope that the subject will be again taken up by some member of the Institute.

Mr. MACDONELL.—I am much pleased to hear the remarks of the last speaker. I think that two of the previous speakers have not done sufficient justice to this remarkable and interesting paper, one that evidently contains the result of very great information and research,—a paper that ought not to be treated in a light manner. It is full of other persons' thoughts, and containing authorities that are not within the reach of most people. It gives extracts from literature of a most interesting character, and quotes novel and beautiful poetry. Now, it seems to me that the paper is not open to the observations made by the first speaker. So far as I can gather from the statements that were made, there was no such feeling as he referred to running through the paper at all. On the contrary, frequent allusions were made in the paper by which we were reminded of the superiority of the Scriptures. So far as I understand the paper, it goes to show that, even in early times, there was a groping after some form of monotheism. This of itself would be a most valuable result. Having said so much in praise of the paper, may I be permitted to put one or two questions to the lecturer? I was curious to see what opinion the lecturer had arrived at as to the precise age at which Zoroaster lived. At page 247 he states that Endocos and Aristotle placed Zoroaster 6,000 years before the time of Plato, and Hermippos placed the age of Zoroaster 5,000 years before the Trojan war; while another authority, Masudi, gives another date, namely B.C. 600. Mr. Brown himself arrived at a fourth opinion, which was somewhat different. With respect to the ground upon which he arrived at that opinion, or, in fact, the grounds upon which he has arrived at any of his opinions, I think there is room for further enlightenment. It is one thing to know when Zoroaster lived, and it is another, almost as important, to know whether he lived at all; and I think this is fairly open to doubt. At page 248 we have the opinion of Sir H. Rawlinson, to the effect that Zoroaster was "the personification of the old heresonym of the Scythic race." At the same page we have the opinion of a learned foreigner, M. Darmesteter, who regards Zoroaster as "one of the many bright powers of heaven who fight in an almost endless strife against the powers of darkness and evil;" and at page 249 we have the statement of Mr. Brown himself that the question whether Zoroaster lived or not is of comparatively little importance. Then, further on, it is said that Zoroaster might be regarded as the founder of a religion and as one who was essentially a reformer; and, if so, I suppose that at some time or other he lived. I should like to know from Mr. Brown whether there are any solid grounds for believing that Zoroaster was an historical personage, or whether Zoroaster is merely the name in which were included a vast number of religious reformers and teachers, perhaps of different ages? There is another remark I should like to make. I would venture to ask whether the method of inquiry pursued by the lecturer in the latter portion of the paper is a method of inquiry that is likely to result in really sound conclusions? It seemed to me that the mode of reasoning which he followed was one which

might lead to false conclusions. He took up a divinity named Agni, and endeavoured to find the various forms under which that divinity was expressed and discovered. He found a constant reference to fire, and then grouping the various descriptions together, he arrived at the conclusion that Agni was the God of fire. Now I think this is a dangerous way of reasoning. Suppose that 5,000 years hence some person with the same means of reasoning with respect to our society, as Mr. Brown has with respect to ancient Persia, should get information with respect to ghosts that have been seen in the 19th century, and putting all together should ask himself what there was in common? Mr. Brown has found that by common consent Agni in all respects was fire. What would a person considering the question of ghosts 5,000 years hence find? He would observe that they were always seen robed in white, and probably conclude that the idea of a ghost in the 19th century, by common consent, was inseparably connected with white calico. (Laughter.) Such a course of reasoning strikes me as rather dangerous, and I would suggest that Mr. Brown should state what portion of his paper he really considers conjecture, and what portion he considers as sound and based upon undoubted evidence. I think that there are two elements in the paper we have heard to-night, and that the valuable element which I have referred to is of no small extent. (Hear, hear.)

Mr. D. HOWARD.—I think the subject of the paper well worthy of careful consideration, for it involves the whole question of early religions. There is a certain school of thought which tells us with all the boldness which modern scientists alone can command, especially when they are not quite sure of their subject, that man is an improving subject, and that man's religion in the beginning was not monotheism. It does seem to me that the more we study the early histories of religious thought, the more profoundly we are convinced that there is no truth whatever in this conception. I should not venture to enter into the question as to how far Zoroaster was responsible for the dualism in which his followers indulged; but still it is most interesting to find that at that early age you have a reformer appealing not to progress, but to antiquity. He does not appeal to the growing intellect of man, but he appeals to antiquity. He looks back to monotheism, not forward; and I say that from this point of view we cannot too carefully consider this ancient record. It is still more interesting to find the same monotheistic idea running through the religious books even of those he opposed. It is, indeed, true that there is a school of thought which goes to those books to find the origin of the Old Testament revelation. We may study Plato to see what the lights of the Greek mind were, and we may study St. Paul without thinking that St. Paul borrowed from Plato, and it seems to me that we may well study the longings of the human mind for a purer religion, that purer religion being monotheism; and we shall find that in the past and better ages the religion of our fathers was monotheism. Any one coming fresh to the confused thoughts and to the muddled ideas of the books we have been considering, will all the more value the ideas contained in the book of Job, and it is interesting to find in that book those allusions to kissing the hand to the sun, which was the very

beginning of that nature-worship which has degenerated into that horrible and barbarous system which we now see practised in India. Then, again, it is interesting to watch those attempts at reformation that are not founded upon revealed religion, but on human intellect. Another thing which renders the Zendavesta and Persian thought a matter of interest, is the amazing influence the Persian thought had on early Christian thought and on the speculations of the Gnostics.

Rev. J. JAMES.—I should be glad to say a word or two in the same direction that has been pursued by the last two speakers; namely, that I do not see in the paper the slightest tendency to disparage the revelation we have in the Bible. On the contrary, every reference to the Christian faith in this paper is a loyal and warm tribute to the doctrines of the Gospel. I wish also to say that I look upon the paper as a very valuable contribution to the true philosophy of Religion. As has been observed by the last speaker, it seems to be a valuable contribution to the argument, that the degraded forms of religion which are found in all the heathen nations of the earth are not aboriginal, but descendants from an original higher height, and that that higher height is the highest height of monotheism. One passage has been referred to as an objectionable one, but which I must say, in my opinion, is a very valuable thought. It is Max Müller who says, "like an old precious metal, the ancient religion, after the rust of ages has been removed, will come out in all its purity and brightness, and the image which it discloses will be the image of the Father, the Father of all the nations upon earth." True, the Gospel supplies us with religion free from rust; but what we want is to see that that rust which has grown upon the earlier and purer forms of pagan faiths is capable of being rubbed away, and that underneath we shall find tokens if not proofs of an aboriginal religion, which is a faith in the one God. I wish to join in the thanks to the author of the paper for his valuable contribution to this important argument. I should like to know, with reference to the passage in Greek given in the paper, where the words are taken from. The words are these:—

"Πλούτων, Περσεφόνη, Δημήτηρ, Κύπρις, Ἐρωτες,
Τρίτωνες, Νηρεὺς, Τηθύς, καὶ Κυανοχαίτης,
Ἐρμῆς θ', Ἡφαιστὸς τε κλυτὸς, Πάν, Ζεὺς τε, καὶ Ἥρῃ,
Ἄρτεμις, ἡδ' Ἐκάεργος Ἀπόλλων, εἰς Θεὸς ἴστιν."

Mr. BROWN.—I believe the passage is quoted in Athenæus, and I think it has been attributed to Hermesianax.

Mr. J. FERGUSON (Ceylon).—Seventeen years' residence in the East has led me to think that one important point in the preparation for missionary work is a knowledge of the religious beliefs of the people among whom Christianity is to be taught, and a sympathy, so far as possible, with precepts and doctrines not distinctly evil in their tendency. I believe our most successful missionaries in the East have been those who have not only learnt the language of the people amongst whom they have laboured, but who have been enabled to translate their sacred and other notable books, and

thus to obtain the sympathies of the enlightened among the natives. I think that this paper will be particularly valuable to Christian teachers going to work in Northern and Western India, and Persia, and I hope that it may pass through the hands of our more enlightened fellow-subjects in India. I think the value of such papers as this is very great to missionaries going to the East, who ought to get an idea of the religions they are about to controvert.

Mr. R. W. DIBDIN.*

Captain F. PETRIE.—We all know that it is unfortunately too common a thing in these days to find people instituting such inquiries as Mr. Brown has, with a very small portion of those abilities which he has brought to the task; such inquirers are unhappily only too eager to publish to the world the results of their investigations, which being imperfect, and generally very incorrect, naturally give false impressions; it is amongst the writings of such inquirers that the advocates of infidelity find weapons ready forged for their use. I think we may congratulate ourselves that the subject of inquiry in the present paper has been taken up by Mr. Brown, for few in England have had the training to enable them to investigate it with such understanding.

Mr. BROWN.—I have to thank the meeting for the attention they have given to my paper, and, at the same time, to say a few words on one or two points which seem to require a reply. Dr. Rule has said that the Hebrew cry was not piteous, I did not say that it was; but that the words were spoken in that piteous way in which enlightened man would speak. He doubted whether the conception of Zoroaster was monotheism, and remarked that it was mere duality; but he did not allude to the opinions of the latest investigators on this point, and he quoted the Scripture, "Canst thou by searching find out God?" I would answer by another passage of Scripture—"You shall find Me if you seek Me with your whole heart." Mr. Jones followed, and seemed to hope that I had not intended to degrade Christianity.

* Mr. Dibdin has sent the following report of part of his speech:—"I cannot at all agree with the statement to be found in Section 6 of the paper, where the author says:—'And here let me make a remark respecting the spheres of mythology and religion. The former corresponds with the material, the latter with the spiritual portion of the universe; they rise together as twin ideas in the human mind, and at the same time the mental and the physical eye grasp, however dimly, some of the wonders of God and the Kosmos, of soul and body. Mythology did not spring from religion, nor religion from mythology. They were "two sisters of one race," widely differing indeed in value, but at first equally simple, equally pure.'—If by religion Mr. Brown means revealed religion, it seems to me that the best that can be said of mythology is that it is a debased distortion of it, and to call it 'equally pure' with it is certainly not the manner in which the Hebrew prophets alluded to the mythology of their times."—(It seems desirable to mention that the author of the paper has used the word "religion" in its strict sense.—Ed.) "The author strives very hard to show that the Gáthas did not teach the existence of two spirits, one of good and the other of evil; but the passages quoted by himself in Section 9 seem rather to confirm the popular view of the teaching of Zoroaster."

Certainly not. I can yield to no man present in my respect for Christianity and the Holy Scriptures. The object of this paper is their defence, and I should have thought it almost unnecessary to point it out. I am glad to find that other speakers have relieved me from the charge. This paper was not written merely for persons who accept Holy Scripture. It is a paper intended for the whole world. The object of this society is to set forth the truth of religion, and in doing so it must start from a common basis. It is no good appealing to people on grounds which your opponents disavow. You must say, "I will look at the question from your own point of view": that is the basis of this paper, and that is why extracts from the Scriptures are not more introduced, as the second speaker appeared to wish. The object is to show that the statements of the Bible are supported by history. We believe the Bible to be inspired; but, at the same time, we are not on that account to neglect the teachings of nature. We should make a threefold cord that cannot be easily broken. This paper, I trust, may be examined by people who have not a belief in Holy Scripture. If it only has the effect of bringing them to a more careful study of these questions, it will lead towards the truth. Mr. Howard has alluded to Tammuz as a prophet. I think that he will find that Tammuz is the Assyrian Dumuzi, and that the women who wept for him wept for the setting sun. One gentleman has alluded to the great differences of opinion which exist as to the age of Zoroaster. I have given all the different opinions as to the age of Zoroaster, not because I follow them, but because I wish to give something like literary completeness to my paper. The highest authorities, who have devoted many years to this subject, place him at B.C. 1400, or 1300, and they educe this from the progressive state of the language. That is the chief means of fixing his date. As to the evidence, that is also comparative. You cannot call direct evidence of the original fact whether there was such a man or not, but I will read you a letter which I have received from Professor Sayce, of Oxford:—

"I am altogether of your way of thinking in regard to the historical personality of the Iranian prophet. The character of Zoroastrianism seems to me to postulate an individual founder, just as much as Christianity, Muhammedanism, or Buddhism."

One gentleman has objected to my analysis of the Vedic Agni, and asked how it was that he was fire? We have the word "ignis," and we know that "ignis" means "fire." As to mythology and religion, my meaning is simply this, that mythology is the result of man's childlike and simple considerations of the world around us. If I may quote from a passage in a note on page 302 of the essay, I would say,—

"Prof. Jebb well observes, 'There was a time when they [*i.e.* archaic men] had begun to speak of the natural powers as persons, and yet had not forgotten that they were really natural powers, and that the personal names were merely signs.'"

That, I take it, was the simple primitive origin of mythology, and that is

what I mean by calling it the younger sister of religion. The great point which this paper aims at is, to show that mankind began well. That is our fundamental doctrine as Christians. However the book of Genesis may be understood, it certainly lays down most precisely that man began well. If that position can ever be turned, and it can be shown that man began badly, or as a being evolved out of some lower form of life, with no knowledge of God or of religion at all, but that he was a creature moving about in a world half-realized, then the position of Christianity would be turned ; but I am as certain of the fact as that I am here, that this can never be shown, and that the position of Christianity is impregnable. It is my wish to set forth that as far as we can extend our researches into these early records side by side with the Bible, we find them in perfect harmony with the Biblical statements. I am exceedingly obliged to the meeting for the manner in which they have listened to my paper, and especially to Mr. James for his kindly remarks.

The meeting was then adjourned.

ORDINARY MEETING, MARCH 3, 1879.

ADMIRAL E. G. FISHBOURNE, C.B., R.N., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

ASSOCIATES :—G. B. Harriman, Esq., M.D., United States ; Rev. P. V. M. Filleul, M.A., Weston-super-Mare.

Also the presentation of the following Works for the Library :—

“Proceedings of the Royal Society.”	<i>From the same.</i>
“Proceedings of the Royal Geographical Society.”	<i>Ditto.</i>
“Studies on the Times of Abraham.” Rev. H. G. Tomkins.	<i>Ditto.</i>
“Irenicon.” By the Rev. H. Griffiths.	<i>Ditto.</i>

The following paper was then read by the Author :—

*THE PRESENT STATE OF THE EVIDENCE BEARING
UPON THE QUESTION OF THE ANTIQUITY OF
MAN.* By T. McK. HUGHES, M.A., Woodwardian Pro-
fessor of Geology, Cambridge.

THE subject before us is one of very great interest. It refers to times so far removed from our own that the wild interest of an unexplored land belongs to it, and yet so near that we can entertain the possibility and indulge the hope of exploration; and when we know that man was there, our interest grows still greater, and we look at it as on a wild region into which a tribe had wandered and got lost, of whom we think we might get traces yet if we could follow.

The subject embraces a wide field of inquiry, and may be approached from many sides. Philologists are questioned about the original oneness of language, and then, on the assumption of a common origin, are asked to estimate how

NOTE TO PROFESSOR HUGHES' PAPER.—For some years the Institute has encouraged research bearing upon the question of the "Antiquity of Man," more especially because the extreme views incautiously advanced by many, tended alike to injure the cause of Science and those higher interests with which this Society has also identified itself.

Professor Hughes' very high standing as a Geologist, and his painstaking accuracy, and caution, alike fitted him to take up the subject, and the following pages were written by him after a further examination of the reported evidences of the antiquity of man. It will be seen that Professor Hughes holds that the earliest known evidences of man's antiquity are amongst the Post-glacial Gravels, the period of which is almost the latest in Geological time; those therefore who have claimed for man an extreme antiquity will find his origin brought forward through well-nigh incalculable ages.—The Institute is much indebted to Professor Hughes, and also to those who have kindly discussed the subject, or sent in the after-communications, each of which is left to rest upon its own merits.

In the present state of the controversy we can only discern that cautious, accurate inquiry, and an avoidance of imperfect generalizations and hasty conclusions, will promote the cause of *Truth*.—Ed.

long, according to observed modes and rates of change, it would take to develop the manifold speech of to-day.

Physicists are called upon to tell us for how long the great lamp of heaven if not replenished can have burned; for if its age must be reduced, and yet include all the æons of geologic time, how very short the part through which man lived.

Biologists are asked if they can say what is man's place in nature among the groups of living things that people earth, and, on the hypothesis of evolution, how long it is since he has become that which we call man.

None of these questions are for me to-night. Though I must mention a theory of works of art of ancient date referred by some to "man's precursors," I shall dismiss that case on other grounds.

I take the question to refer to man,—man as we know him—of whom we all agree to speak as man.

I will suppose that I am asked first this: In what formations have we found conclusive evidence that man was there? and, secondly, having satisfied ourselves as to the relative position of the beds in which his works are found, can we assign any exact numerical estimate of years since those beds were laid down? and if we give that up, whether we can trace him back to a remote antiquity, and from what evidence we derive the impression or conviction that that was far removed from earliest history?

This part of the question is entirely geological. We may consider that we have proved the relative position of the beds with which we have to deal. But to refer to them by name without more explanation, I will first give a sketch of these from older up to newer as they come.

After the period when the present forms of life appeared upon the earth in numbers marked and well-defined—a period named from this the "dawn of recent days," the *Eocene*, there came a time when over Europe and beyond, the crumplings of the crust of earth left basins here and there not quite coincident with those that were before, and by this change drove out some forms of life, and let others in, which may have existed elsewhere before that time. Still few were there like those now seen in recent times, and hence they call the period by the name *Oligocene*.

When later on, by waste of shore and continent, hollows were silted up, and with that too the land was raised; less sea, more land, with lakes and streams, prevailed. England then stood above the waves, and here and there small peaty patches tell of swamps with reedy margin, where the leaves of plants blown in accumulated deep in mud.

In France the land was still more lowered, and received from lake and sea more mud and sand, and therefore deeper, wider beds there represent the time when a less number of the very same life-forms prevailed than afterwards. These beds were hence called *Miocene*, and in them it has been said that evidence of man's handiwork has been found.

Next came the *Pliocene*; in which we place the Crag, marine deposits of shingle, sand, and shells, found in our eastern counties; and on the Continent made up of various kinds of beds, but all containing more of the forms of life that now exist, and hence the name. In this, too, evidence of man's art is seen by some in rude drilled bones and teeth, such as are strung by savages for ornament.

After that followed a time, when from the great upheaving of the land the snow lay thick on all the northern heights of Europe, and glaciers crept down into the sea, and icebergs, with earth and stone fallen from crag or picked up on the shore, floated far south, melted and dropped their load. We need not now discuss the probability that then there might have been such combinations in the heavens as would intensify the extremes of heat and cold at either pole. This is a fair field of inquiry, and if we could obtain some means for correlating marked periods on the earth with cosmical events, then we might hope to arrive at some more accurate chronology; but we have too many unknown quantities to solve this problem with the data yet before us. Such questions we pass by, and only note that we had once within the later times such cold that frost held fast our northern shores, and ice came down in glaciers from the heights. When, later on, the land began to rise from underneath the sea, and the high ranges sank, and a more uniform temperature prevailed over all north-western Europe, the ice fell back, and could not gain in winter what it lost under the summer's sun. Then the streams, filled with melted snow and heavy rain, came down in floods over all the lower plains. The wandering animals, and even man, were often caught by the sudden rise of rivers winding about across the widening valleys, and their remains were buried in the mass of débris carried down. As time went on, the rivers, finding their way to lower levels, cut back waterfall and rapid to the hills, and left, now here now there, a terrace as a mark where once in ancient days the stream had run; and throughout all these later ages it is said that man was there, holding his own among fierce beasts, in forests and in caves along the river banks and rocky shore.

Now we will criticise the evidence adduced of man's existence at these different times, and, having satisfied ourselves

as to which cases we may accept as proved, will then consider the changes which have taken place since the date to which in the present state of the evidence we can with certainty assign his earliest known appearance.

We may dismiss at once the case reported from the Dardanelles of works of art found in deposits said to be of Miocene age. The descriptions* prove that it was not given on the authority of one competent to judge in such a case, and it never was confirmed.

Another instance referred to the same period we must consider more in full, because the evidence has been accepted by men of high authority in France.† In beds said to be Miocene, at Thenay, near Pontlevoy, the Abbé Bourgeois found flints which he supposed were dressed by man. These flints are now exhibited in the Museum at St. Germain, where I saw them with Sir Charles Lyell several years ago, and again with others since. Some of them seemed entirely natural, common forms, such as we find over the surface everywhere, broken by all the various accidents of heat and frost and blows. A few seemed as if they might have been man's handiwork, —cores from which he had struck off flakes such as we know were used by early man, of which I show examples. Yet this is not quite clear, for, had the evidence been good that they were found in place there still would have been a doubt whether they were man's work. But when we came to inquire about the evidence that they occurred in beds of Miocene age, we learned that only those that we put down as natural were found by the Abbé himself; the others were brought in by workmen, picked up, we may suppose, upon the heaps turned over by their spades, and so perhaps just dropped down from the surface.

When all the other higher forms of life were different it was not probable that man should have been the same, even when we remember that his intellect allowed him to adapt himself unmodified to different states of life, taking the clothing of the meaner brutes for his own use, and lighting fires and building homes, anticipating the future in more various ways than they. It would require the clearest evidence in such a case to prove that man was there, or that some other form as "man's precursor" represented him, but such evidence there is not.

* *Journ. Anthropol. Inst.*, vol. iii. April, 1873, p. 127.

† Bourgeois, "Étude sur des Silex Travaillés trouvés dans les Dépôts Tertiaires de Thenay (Loir et Cher)." — *Congrès International d'Anthrop. et d'Archéol. Préhist.* 2me. Session, Paris, 1867. Hamy. *Paléont. Hum.*, 1870.

Next in the Crag the teeth of sharks, bored through, as if for wear, were found,* part of a string of ornaments such as commonly are worn by savages. Of these I give examples: one a boar's tusk, from the lake dwellings of Switzerland; another, a tooth from a deposit of palæolithic age, in a cave just above the miraculous grotto of Lourdes in the Pyrenees.

But let us see whether such holes are not sometimes the work of nature, and inquire more carefully whether these from the Crag were probably produced by nature or by art. For this purpose I have examined fragments of bone and teeth of various size and shape, and found them marked over the surface with many a pit or deeper hole, or even perforation irregularly placed, not as if by design, but accident. There they were in every stage, all over, yet of one type. One sawn across explains the whole. The chamber of a shell which bores its way into the solid rock or softer shale was clearly shown. When the mass lay embedded in the mud it was but touched here and there. If it was thin the animal bored right through into the sand or clay below, and showed the tooth pierced through—a perfectly well-turned and finished work, so good they thought it was man's. But if the mass was thick and near the surface, the little mollusc made a home entirely within it, and its shell often remains there, and reveals the history and manner of formation of the holes.

To the Miocene and Pliocene have been assigned some bones of large sea mammals marked as if cut by implements, and some fashioned as if for use as batons, swords, or clubs. Of these I have seen some, and in those cases certainly would not admit the evidence. There are so many common natural accidents that scratch and cut and break, that it requires far more accumulative evidence of design in the resulting form than any I have seen before we could assume man's agency. Some bones when fossilised break with a clean fracture, and show a smooth and even surface. Some of the specimens are held to be of doubtful origin, but in the best of those that I have seen, though I had no reason to suspect the origin, I felt it was too much to say that it was shaped by man.

An account has also been given by the Abbé Bourgeois of flints from Pliocene beds at St. Prest, near to Chartres, said to be worked by man, but this we may dismiss on the same ground as those before referred to given on the same authority.†

* *Journ. Anthropol. Inst.* vol. ii. April, 1872, p. 91.

† Bourgeois, *Congr. Inter. d'Anthro.* 1867, p. 67

Another case brought forward from abroad but recently, has found much favour here as there.* Around the Lake of Zurich there are left traces of ancient lakes at somewhat higher levels. A bed of clay below with glacial stones, a bed of plants between half-turned to coal, a mass of clay moraine-like on the top, tell of the time when Alpine ice crept further down the hills, and touched upon the lake, now more, now less encroaching. In these beds the peaty mass of lignite, known as Dürnten coal, was largely dug for fuel. I have worked a long time down below to see the evidence myself. The sequence of the beds is clear. But recently two Swiss professors have proclaimed that they have obtained proofs incontestable that man was there, and wove a basket, fragments of which were found among the drifted plants which formed the coal. These fragments, it is said, consist of pointed sticks, sharpened across the grain, not tapering naturally, and a cross set of binding withies, all now pressed and changed, but by such characters referred to work of man. Now I have found myself along the shore fragments of wood and twigs half decomposed and waveworn till they were cut to a point obliquely to the grain, as they describe the Dürnten sticks. Across such fragments often others fell, and when the whole was then compressed what wonder if they left a mark of wattle or of basket-work? and the whole mass has suffered such great pressure from the superincumbent weight of clay that all the round twigs and stems are squeezed quite flat, as in the specimens before you. These Dürnten pointed sticks, however, I have not seen, and, therefore, speak with caution, showing only how I think the thing might be otherwise explained.

More recently the legitimate ambition to be first to make a great discovery, not controlled and kept subordinate to judgment, has adduced other examples, where the age of man has been too hastily referred to glacial or inter-glacial times. Whatever may be found hereafter, the evidence on which this case has now been based was not such as would justify the statements founded on it. Widespread beds of loam and sand, and gravel, cover the lower levels of East Anglia; and, probably ranging over a vast period, have been collectively described as "middle-glacial," for below are glacial beds, and in the middle series boulder clay, and over them, whether in part *remanié* or not, another boulder clay. Lying in hollows and on the flanks of valleys, cut through this ancient loam and other beds, are river terraces of later date;

* Rüttimeyer, *Archiv. für Anthropologie*, 1875; Heer, *Primæval World of Switzerland*.

and these, because in great part made up of the older beds, are like them, and require experience to distinguish. In these old terrace deposits implements of man's undoubted work have long been found; but recently it has been said that some of these beds belong to the older series.* This, then, becomes a matter of opinion. For my part, being well acquainted with the deposits in question, and having listened to the evidence, I give my testimony quite against the glacial or the interglacial age of any of the beds from which the hatchets came. It is, however, said that other evidence has since been found, conclusive as to this. I can but criticise that which has been adduced; but I will say that if such has been found and been so long withheld, while there are so many deeply interested, and so many who would like to verify at once and on the ground the statements made, then I do hold that there has not been shown that love of full investigation which is the soul of science.

Upon the screen I give diagrammatic views of some of the sections showing the newer beds in which the implements were found, and older middle glacial, from which their relative position may be seen. These I have more fully described elsewhere.†

In many countries where rocks of limestone tower in cliffs and crags above the valleys, and are tapped below by undermining streams, the rain which falls upon the higher ground is lost in cracks and joints, and carries off the rock dissolved in water, which contains a little acid caught by the falling rain or drawn from decomposing plants. The fissures thus enlarged into the gaping chasms called "swallows' holes," the "katabothra" of the Greeks, admit a copious torrent, carrying stones and sand which grind and bruise and open out the jointed rock into great caves and subterranean courses. These, when tapped at lower levels, are soon left dry, and offer to prowling beasts of prey a safe retreat, and often man availed himself of them, as testify the Adullamites and Troglodytes of every age.

From such a cave up in the crags of Craven some evidence is adduced that man existed far back into glacial times, and this, perhaps, is the best case that has been urged.‡ There a large group of animals, such as occur elsewhere along with man, and more doubtfully traces of man himself, were found in beds overlapped by glacial clay which had sealed up the mouth of the vast den in which these relics lay. This excavation I have watched myself at intervals from the commencement, and I hold

* *Mem. Geol. Surv. Geology of Fenland.*

† *Journ. Anthro. Inst.* vol. vii. November, 1877, p. 162.

‡ Tiddeman, *Brit. Assoc. Reports*, 1870-8.

that as the cliff fell back by wet or frost, and limestone fragments fell over the cave mouth, with them came also masses of clay, which, since the glacial times, had laid in hollows in the rock above. We dug and found such there, and, more, I observed that the clay lay across the mouth as though it had thus fallen, and not as if it came direct from glacial ice that pushed its way athwart the crag in which the cave occurs. It seemed to have fallen obliquely from the side where the fissured rock more readily yielded to the atmospheric waste, so that it somewhat underlay the part immediately above the cave. On the inside the muddy water which collected after flood, held back by all this clay, filled every crevice and the intervals between the fallen limestone rock, while still outside was the open *talus* of angular fragments known as "screes."

These are the most important cases that I know where man has been referred to glacial or inter-glacial times; but all, it seems to me, quite inconclusive. On the contrary, there is much in them, and much besides pointing the other way. In support of which opinion I will now offer some independent evidence, showing that some similar beds with man and the beasts that are found with him in earliest times can be proved to be post-glacial.

There are river gravels, as near Cambridge, at Barrington and Barnwell, which contain an ancient group* of mammals, earlier, it would appear, than those which most commonly occur with man, and yet the gravel in which they are found is made up largely of the washings and siftings of the boulder clay, which, therefore, was more ancient.

In a cave high in the limestone rocks that overhang the Elwy, in North Wales, are found human remains associated with rhinoceros, hyæna and cave-bear; but underneath and in the beds in which they lie are found fragments of rocks which must have come from other basins, transported by glacial agency across the watershed, and washed in where they are found, out of the boulder clay, which, therefore, in this case also is shown to be more ancient.† We should expect before the glacial times a somewhat different group, but on this head more evidence is wanting.

I will not waste time to discuss whether the objects we refer to man now found in numbers in post-glacial river gravels are really of human work.‡ That is now generally allowed, and I have placed upon the table specimens from some of the more

* Fisher, *Camb. Phil. Soc.* February, 1879.

† *Journ. Anthro. Inst.* vol iii. 1873.

‡ See Evans, *Ancient Stone Implements of Great Britain.*

important places. Accepting such things as human work, I will just enumerate a few of the many districts where they are found, to show that it is not an exceptional case to be explained by some local cataclysm caused by the sudden upheaving of the land, perhaps with earthquake shocks, or to the bursting of a barrier where the waters long pent up rushed down and filled the valley. We have to deal with facts so clear, so numerous, so widespread, and so similar everywhere, that we see we must at once refer them to the common ways of river denudation.

Along the Somme, loam, sand, and gravel, nearly a hundred feet above the river level of to-day, have yielded these works of man. We know that they are river gravels, from the shells that they contain. Similar implements are found along the Garonne, and in the basin of the Loire. They are brought from Africa and from India. In our own country, in the valleys of the Thames, the Ouse, the Medway, and the Avon, at 40, 50, 60, 80 feet above the river level; along the Solent and the coast near Barton, and near Bournemouth, and in the Isle of Wight, in terraces of ancient rivers, 100 to 150 ft. above the sea, they have been found. Everywhere in these older beds, with nearly the same groups of animals, the same types of instruments are found, distinct from later forms, quite recognisable.

And in caves we find traces of man with the extinct and migrated mammalia. In the Dordogne they have been classified by date, La Madelaine, the two Laugeries, and Le Moustier, the oldest being Le Moustier. In our own country, on the coast of Devon, in the cliffs of Yorkshire, Derbyshire, in Wales both North and South, along the Wye, and almost wherever limestone crags are found, these caves have furnished shelter to an early race of man. I do not know that as yet any exact relation has been established between a cave with works of man and any terrace with the samé. A diagram on the screen shows the position of one of the celebrated Pyrenean caves (Gourdan)* with reference to the higher terraces of river gravel opposite to it. They stand at the same height above the river. This cave contains the usual group of extinct and migrated mammalia, and of man abundant evidence in bone and stone, of which examples lie upon the table. The terraces immediately opposite have not, so far as I am aware, yielded remains of man, but lower down the river instruments of palæolithic type have been procured by M. Noulet, and may be seen in the Museum at Toulouse.

* Piette, *Acad. des Sci.* 31 Jul., 1871; *Matériaux pour l'Hist. de l'Homme*, 1871, p. 494.

Perhaps no cave-deposits that we know are quite so old as the oldest river terrace that has yielded traces of man, still all the earlier ones may be included in the same bracket, and referred to the oldest stone or palæolithic times.

From the caves we cannot get much evidence of the lapse of time. The circumstances that affect the mode and rate of their formation, or the growth of travertine, or the slow infilling of the cave with mud, are far too variable, and dependent upon too many local causes to found on them a date. I have myself found modern bottles under as great a depth of stalagmite as elsewhere covers mammoth bones.

But from the terraces we may derive some help to form an estimate of the great lapse of time, though we may not as yet assign a term of years. What, then, are these terraces, and how formed? It might appear at first an explanation not quite consistent with known facts to state that all the valleys with which we are concerned in this inquiry were scooped out by the gradual action of the streams, and that the terraces but mark old margins, where the streams once ran at higher levels. Why, it is said, if so, do we not find at every intermediate step of this continuous gradual waste the marginal deposits? Elsewhere* I have more fully dwelt upon this question, pointing out that every river only just hands on along the flat the mud and gravel it receives from higher lands, but at the rapids and the waterfalls it still cuts back its channel, lengthening the lower reaches of the river at the expense of the upper. The terrace generally marks the vertical height of the higher above the lower reach. It is clear that synchronous deposits may be found at the two levels, but it is also clear that, if we see a terrace far above the level of the present stream and far down the valley from the waterfall or rapid that tumbles from the level of that terrace higher up the stream, then we may measure the antiquity of that terrace by the time that it would take the waterfall or rapid to cut back from where it was when the terrace was being formed to where we find it now. Some circumstances we must take account of which would increase the *rate* of waste, and so reduce the *time*. If an upheaval take place near the sea where formerly the long low flats were added to, not cut through by the river, then the flood, tumbling over the now-raised soft deposits of mud or sand or gravel into the sea, would soon cut back its channel. Also movements in the hills might cause some changes; or again, a not unimportant thing in chalk districts, the gradual removal of a clay covering which caused the water to collect in runlets first, then streams, would let the water soak into the porous

* Royal Institution, March 24th, 1876.

beds below, to find its way out in springs at lower levels, or, possibly, beneath the sea, and so all denudation by the streams be stopped. No observations have, as far as I can tell, been made in any of the river basins with which we are now concerned upon the rate of retrocession of the rapids or falls, such as would enable us to form a numerical estimate of the number of years that must have elapsed since the implement-bearing terrace gravels were left where they now lie.

But there are circumstances that give the impression which, in most of those who have seen many similar examples, amounts to a conviction, that the time must have been in most cases enormously long.

At the Reculvers, on the Thames estuary, a bed of gravel caps the cliff quite 50 feet above the sea. This has flint weapons in it. When the Thames ran at that level down by its mouth, it cannot have run at a lower level by London; yet, as far as we know from old remains, London was as now 2,000 years ago. Teddington, to which they say the tide came up when first it got its name, was then no higher, and so we trace the valley far up into the oolitic hills, so far I doubt whether now we could identify the corresponding levels. How long did it take to cut back such a valley and so far, seeing that within the time of history we know of no great difference in its channel?

So for the Somme. The Romans left what they lost down in the peat quite 80 feet below the terrace on which the city of Amiens stands. This terrace we can trace much further both up and down the valley. Beds of the same age, too, are found at Menchecourt at a lower level. They may be synchronous with those of Amiens, if the rapids then came between. The rapids had passed Amiens before the Roman times. Where are they now? Far back towards central France. How long it took to cut the valley back so far I will not try to speculate, having no data, but I feel that it must be something very great, seeing that the historic period of 2,000 years has done so little.

Another line of inquiry I will mention to conclude with. In the long periods of geologic time races appear and last awhile, and then are not, and a new group of living things represents them in the next succeeding age. How they went out we cannot tell. It was not by cataclysms, for they go one by one, and the deposits tell of slow accumulation; but more as if some gradual changes over various regions of the earth made each successive place in time unsuitable for all the life that once was there. First, those which were most susceptible and able to migrate went off. So nature has arranged for a constant succession upon earth's surface;

and having regard to some forms, fixed as the oyster on the solid rock, immovable, lest in these changes they should be all destroyed, provided that their young should freely swim till they had found a station suitable for them, then plant themselves for life; so also do the seeds of plants. And thus we have learned to look upon the fact that there had been great changes in the forms of life between two periods, as proving also a great lapse of time, seeing that all the indications we can trace show that these things were gradual.

In the same beds with man's remains are creatures now extinct: the mammoth, for example, and others too, more numerous, now only found much further north or south, which once lived there, but migrated. It is not sufficient explanation to remark how such large animals, as being fierce wild beasts or good for food, are often now killed off or driven out by man. For with them in this case are some small shells, one (*Corbicula fluminalis*) now found no nearer than the Nile; the other (*Unio littoralis*), gone as far as the rivers of France; but they once lived with the extinct mammalia and with man in Britain. It seems more likely that we have but the continued working of the laws which from the earliest geologic ages have determined the range in time of genera and species, and as all through the early epochs of the world the greater changes in the life were carried out in very long periods as deduced from independent reasoning, so it appears that in these later ages during the time required for the formation of the valleys and their terraces a corresponding change was brought about in the great groups of life that dwelt with man in north and western Europe, and this fact much strengthens our belief in the vast time which has elapsed since his appearance there.

Such, then, it seems to me is a fair statement of the present state of the evidence for the antiquity of man. First, it has completely broken down in all cases where it has been attempted to assign him to a period more remote than the post-glacial river gravels, and there is much reason for thinking that should evidence be hereafter forthcoming on which he may be relegated to a more remote antiquity, it will not be found in northern Europe. And next, although we cannot offer any numerical estimate of the antiquity of the human remains found in the river gravels, still, having regard to the geographical and palæontological changes which have taken place since the period when those gravels were deposited, as compared with the changes which have taken place during the eighteen centuries which in our country we may call historic, it would appear that the age of man must be a very large multiple of the historic times.

The CHAIRMAN.—We are much indebted to Professor Hughes for this very interesting and important paper, all the more so because, in spite of his labours in his professional work, he has given so much valuable time to its preparation. Indeed, he has been so much occupied as not to have been able to send in the MS. in time for the Council to have it printed. I hope, however, that the meeting has gone sufficiently far with him to be able to discuss the paper.

Mr. J. E. HOWARD, F.R.S.—There are a few observations I should like to make with regard to what has been said about the Valley of the Somme, and the degree of rapidity with which rivers have worn down that and other valleys. The valley of the Thames is one with which, of course, we are all more or less familiar, and we know that the deposits under London and in the neighbourhood disclose something as to the antiquity of the work that has been accomplished. We thus obtain some measure of the time which we may suppose the river to have taken in excavating the valley, supposing it to have been excavated in the same way as has been suggested with regard to the valley of the Somme and other valleys in France. The first of the strata at which you arrive in digging the foundations of houses in London,—and I have had personal experience of this recently within a few hundred yards of St. Paul's,—consists of sand and gravel, and contains some remains of the Roman period. Then, beneath these, you arrive at strata which (I am told) contain the bones of the mammoth and other extinct animals. These, it seems to me, indicate a state of things belonging to the Pliocene period, or the period of the extinct animals. I do not think we can arrive at the conclusion that there has been, since then, any excavation, but quite the reverse, when we find these strata superimposed upon each other about 20 or 30 feet under London. (Hear, hear.) [The magnificent tusks of the mammoth, now in the British Museum (found at *Ilford*), show that the tributaries of the Thames flowed at about the same level when this creature was drowned at the ford over the Roding.] We know that the rivers in the neighbourhood of London do not now excavate the valleys at all; it is rather the contrary, for they appear to fill up very considerably. (Hear.) This I know to be the case in regard to the river Lea, near which I live, and in the neighbourhood of which I have works, and have seen excavations. The Lea valley, in the vicinity of Bow, has been filled up since the Roman period to the extent of 5 or 6 feet, as is shown by the excavations that have been made; for the workmen have found, and I have received from them, many curious and interesting relics of Roman times. Therefore, I am unable to understand the argument we have heard as to the formation of valleys by slowly-flowing rivers such as the Thames. It does not appear to me that in any conceivable time,—even if you were to take an eternity,—you could excavate the Valley of the Thames by means of the river flowing through it: it would rather, as I have already said, have a tendency to fill up the valley. With regard to the valley of the Somme,

it was at one time asserted that the deposits found there were of extreme antiquity,—I allude to the deposits in which the earlier works of man were found. This was the theory in England ; but it was not exactly this supposition that set M. Bouchier de Perthes, who was the first great explorer in that region, to work. He started on the basis of a very definite theory, which he explains in his elaborate books, certainly interesting, and which I have perused since I read my last paper here. His supposition was that man was contemporaneous with the mammoth (of which there can be no doubt); and that wherever the bones of these great extinct animals are found, there also, in the course of time, would be found the works of man and his remains. This was his theory, and he began to examine what was then called the diluvian strata, which I think in England are now called the drift. He set to work to find such remains in the drift, and although he was ridiculed, he persevered for many years, and never ceased till he had found, not only the works of man in the *diluvium*, but also what were clearly his bones. (Hear, hear.) The works of M. Boucher de Perthes prove that the diluvian strata are not formed by pluvial deposits, but by some great cataclysm. I do not believe that any of the causes at present at work have formed the valleys or can account for the configuration of the hills ; but that we must go to much more powerful causes in order to account for what we see. (Applause.)

Mr. D. HOWARD, F.C.S.—With regard to the level of valleys, it is sufficiently ascertained that the deposit made in the valley of the Lea is now going on, and that there is no denudation ; in fact, it would rather appear that there has been an actual rise in the level of the valley. The points traditionally referred to as being where, at the time of King Alfred, the Danes sailed up, are at such a level that it would be impossible for them to sail to at the present day. But that there is some foundation for this tradition is shown by the fact that some remains, which appeared to be those of a Danish vessel, were found near Old Ford, at a spot to which the tide would not, apart from the question of the gateways which prevent its flowing freely, now allow such a vessel to reach. But, with regard to the question that has been raised in reference to these valleys, there is one point which I have never heard fully explained, and that is, how far the bones of man are found in them. Undoubtedly, the presence of the bones of man would be much more satisfactory than the finding of flint implements. The vagaries of flint when weathering are so extraordinary, that it requires cumulative evidence to give satisfactory proof of the pieces that are found having been made by man ; but bones are things that require no cumulative evidence, because it can be shown at once that they either are or are not of human origin. (Hear, hear.)

Mr. T. K. CALLARD, F.G.S.—I am afraid that we are somewhat at a disadvantage to-night, in not having had the paper which has been read, in a printed form before us, and Professor Hughes will excuse me if I am not able to deal with the subject as readily as I might have done had I been able to refer to the paper, and mark it as he went along. I am very pleased

to find that with the usual candour and skill with which Professor Hughes deals with all geological subjects, he has cleared away to-night some of the supposed evidences of the antiquity of man, and brought us down to two or three important points, which we can discuss much better than if we had to be thinking of Swiss lakes and kitchen middens, and going here and there for evidence. (Hear, hear.) He has cleared the way a great deal, and shown that the antiquity of man, as far as we yet know, does not extend so far back as has been thought by many scientific men. I would, however, make this remark, that Professor Hughes has dismissed any discussion with regard to the flint implements before us, in what I think rather too rapid a manner, because I certainly have not been able to understand on what ground he says, so positively, that they are of human workmanship. They may be ; but, on the other hand, we may be deceived in forming such a conclusion. (Hear, hear.) The Brandon gravels have been referred to, and I have here some flints from the Brandon gravels. May I trespass so far as to ask Professor Hughes if this one, with the point broken off, is in his judgment, an implement ? (Showing it to Professor Hughes.)

Professor HUGHES.—Certainly, I should accept it as such.

Mr. CALLARD.—Here is another from St. Acheul. Would you accept that as an implement ?

Professor HUGHES (examining it).—No.

Mr. CALLARD.—You accept one flint readily, the other you as readily refuse to accept ; but I think that if they were handed round the room, there are very few gentlemen who would be able to see much difference between them. This [referring to a third one] I picked up on the surface of the soil near St. Acheul, and I see no reason to believe it to be of human workmanship ; but, at the same time, I think it looks as much like the work of man as the flint you have accepted as an implement from Brandon.

Professor HUGHES.—Respecting the third specimen, it might have been made by man, or it might have been the result of accidental fracture. I could not be certain. My reason for thinking that man might have made the one and that he never made the other I will state when I reply, and I will then point out what constitutes the difference between them to my eye.

Mr. CALLARD.—That some of the best specimens have the appearance of being made by man I readily admit ; but seeing that the naturally fractured ones so nearly resemble them, it would suggest the need of great caution in pronouncing any specimen to be of human origin in the absence of collateral evidence. There is a flint which you accept at once ; now here is another, exactly like it, which never has been out of its matrix, and which man could not have made. These are the things which make me say, we must pause before we decide that man has done this or that. If man has not made these implements, then of course the whole argument falls to the ground, as far as evidence from the gravel is concerned. Then, again, Professor Hughes has taken it for granted that the river Somme cut the Somme valley. Now, I certainly should not take it for granted. I have been

all over the ground and examined it carefully, and, as far as I saw, I came away with the clear conviction that the Somme river, although running through the Somme valley, never excavated that valley.* There are about twenty-eight miles of the valley between St. Acheul and Moulin Quignon, in both of which places implement-bearing gravels are found. St. Acheul is 149 feet above the level of the sea at St. Valery, and Moulin Quignon 106 feet above the same level. If, then, the river ever ran at the height of these gravel beds, the fall would be 43 feet between these places. A fall of 43 feet in twenty-eight miles gives a good deal less than 2 feet per mile. When I looked at this fact, I asked myself the question,—“Is it possible that a river flowing with a fall of less than 2 feet per mile could have eroded this immense valley?” (Hear, hear.) Then it must be borne in mind that the Somme is but a small narrow river, while the valley through which it flows is wide, being sometimes two or three miles in breadth, and I would venture to say that if you could spread the river all over the valley I could walk across it without having my shoes covered with water. I am sure Professor Hughes will agree with me that there is no erosion going on at the present time, and if that be so, the data for calculation is taken away. I may add that I took a boat and rowed for five hours up the river, to see whether I could find the continuation of the banks that could have kept the river in, for we know that where there are no banks there can be no river. I had a friend with me, and the conclusion we reached was that there was an absence of continuous embankment necessary to keep the water up to the height where the implements were found, namely among the gravels of M. Tattegrain Brulé, 80 feet above the level of the Somme. I crossed on my next visit to Amiens, Pont de Camon, to see how high the bank was on the other side, and I am quite certain I am right in saying there was not sufficient height of bank to have kept the stream in so as to have occasioned it to reach the higher parts on the St. Acheul side, where erosion is said to have occurred and the implements are found. Correctly speaking, there was no bank at all, but simply a rising ground stretching back into the country. [The speaker here pointed out on the map what he was describing.] From all the appearances I saw, it was clear to me that the water had never flowed up to the points I have indicated. I recrossed the river, and came along the banks on the south-western side, and before I had reached the peat beds of Longueau I could see that I was getting many feet below where the implements were found, and I suppose I shall be justified in saying that the minimum of the banks must have been the maximum of the stream. If the water, half a mile from St. Acheul, had come this way [pointing to the map], it would have flowed out upon the surrounding country, whereas a river that could have done the amount of erosive work attributed to the Somme ought to have been well stemmed in, but no signs of this exist.

* See Mr. J. Parker's view. (Vol. viii., p. 51. An extract from his paper will be found in the appendix.)

I presume that the sections on the wall have been taken from measurement?

Professor HUGHES.—They were sketched by the eye when standing at a distance, and to make the diagram clear the vertical heights have been exaggerated.

Mr. CALLARD.—I certainly saw the locality different. You have got the height equal on the right and left.

Professor HUGHES.—The view you have taken is from a different line of sight.

The CHAIRMAN.—I think it would be better to allow Professor Hughes to answer any remarks that may be made at the end of the discussion.

Mr. CALLARD.—I had two friends with me, and we were not casually looking about, but were there for the purpose of examining the valley, and I am prepared to say that the opposite side [pointing to the map] was not sufficiently high to allow the river to touch the place where the implements were found. If you admit there has been some alteration in the contour of the country, some change in the level of the land, then I say all the data for the argument from erosion is gone; but with the contour of the country the same as now, if I were on the spot with Professor Hughes, I think I could convince him that the river never could have touched the place where these implements were found. (Applause.)

Mr. T. JONES.—I would ask permission to make a remark. Some years ago a shock of earthquake was felt all along the coast of Wales, and so marked was the tremulation of the earth that at the Greenwich Observatory the telescope was seen to rise and fall. On the following morning the observer found that the time at which he had seen the instrument rise and fall agreed with the time at which the earthquake was travelling along the coast of North and South Wales. Now, this being so, it seems very possible that there may be occasional changes in the contour of the country so affected, and that after a shock of earthquake the land does not revert back to exactly the same level it had before, if this be so, it seems to me that it has a tendency to disturb the erosive principle that has been contended for.

Mr. J. THORNHILL HARRISON, F.G.S.—I do not agree with the author of the paper when he says that the peculiarities of the Glacial and recent periods cannot be explained by the occurrence of cataclysms, but upon this question I cannot now enter. I would call attention to the raised beaches in the West of England and on many parts of the coast, and suggest that in times past the tide rose in the Exe, the Teign, the Axe, and very probably in the Thames and other rivers, to a much higher level than it does at present, owing to the altered configuration of the coast by the encroachment of the sea. I consider the valleys of these rivers were formed by other processes of nature than the erosive action of the water falling within the river basins and flowing down their channels. (Hear, hear.)

Rev. G. HENSLOW, F.G.S. (a visitor).—I think the discussion has been somewhat diverted from the subject of the paper, which is "The Antiquity of Man," as far as the best evidence is concerned. The last speakers seem rather to have entered on the question of physical geography. Most of them have criticised Professor Hughes's remarks; but I should like to say

that I agree with him from beginning to end. I hold that the records of mammalia in the Eocene and Miocene periods are such that it is impossible even to expect to find man's remains in these deposits. For given reasons Professor Hughes says that the remains of the animals, I presume he alludes to the mammalia, found in them are so different from those of later times, that man, if he existed at all, must have been different also. If we take Professor Gaudry's deductions, I think he shows conclusively that not only is there not a single species of mammalia that lived at the time of those deposits to be found in existence at the present moment ; but that those which did exist then *have given rise*, by evolution, to the modern species. In those days there was no such hyæna as we have now ; I take it that the horse did not exist, but its earliest ancestor, if we may accept the theory that they sprang one from the other, was the *Eohippus*. Similarly, if we reason by analogy, and draw a comparison between the mammalia of those periods and the mammalia of the present day, assuming that the ancestor of man must have been subject to the same laws of evolution as they ; then, man, as he is now, *could not* have existed. Whether there was any intermediate, half-rational being, and whether he could make and use flint implements, is another question. It is, however, certain that man, as we know him, could not have existed in the Miocene or Eocene periods, if we are to judge by analogy. I would submit this view to the consideration of Professor Hughes. With regard to another point that has been referred to, we know that rivers do cut out the material from the channel through which they flow, and that they also may become silted up, these two operations going on together. But the whole gist of the paper lies in the fact that it brings us to this,—that all the evidences of the existence of man are confined to the Post-glacial period. Whether he can be carried beyond that is another matter ; but I see no reason why he should not be. The horse existed before the Glacial epoch, and therefore man might have existed as well ; but as far as these northern regions are concerned, I see no evidence whatever that he did.

The CHAIRMAN.—I think that what was said by Mr. Henslow was quite to the point, because the paper certainly dealt with those physical conditions which we see around us as affording a chronology by which we are to measure the age of man. I could not help thinking that if you gave me an earthquake, I would give you almost any physical condition you please. (Hear, hear.) Perhaps most of you may not be as well acquainted as I am, from the circumstances in which I have been placed, with some of those great physical changes that do occur at intervals in different parts of the world. It is but a few years since a district comprising 1,800 miles of South America was raised a considerable height, and remained in its altered position. Such a fact, of course, alters all the physical conditions affecting the adjacent rivers. I may mention another interesting fact which shows how little the chronology to be derived from the mud deposit of rivers can be relied on. Sir William Parker took his fleet up a branch of the Yang-tsi-Kiang in 1841 ; and in 1851, when I went up, that branch had become all solid land, and I sailed up a new branch altogether. (Hear, hear.) Not only was this the

case, but within the memory of man, where the river was there are now islands and cities, with thousands of inhabitants upon them. (Hear, hear.) You see, therefore, in how short a time the whole of the physical features of a large tract of country may be altered, and how the chronology to be derived from any particular river may be entirely upset. (Applause.)

Mr. S. R. PATTISON, F.G.S.—I should like to say a few words before Professor Hughes replies. Every one must have been pleased with the attractive tone and moderation of the paper, but I am not sure that the conclusion was quite so satisfactory to me as the title and general contents seemed to indicate. The title and general contents of the paper are "On the Evidences already obtained as to the Antiquity of Man"; and as to his statement of these evidences,—especially with regard to certain distinct operations which he has brought before us,—this is quite satisfactory; but when at the end of his paper he infers from the state of things he describes that the river Somme has cut its way, since the formation of the flint implements, to an extent that implies an enormous lapse of time, I fail to see that he gives us sufficient evidence in support of his conclusion; and when he says that the geological evidence is such that there has been a total extinction of the mammalia, and that therefore it must have taken the enormous amount of time implied by such a state of things, I fail still more to see any evidence to support that proposition. Now, it seems to me in reference to that which has been offered to this Society, that there are factors in the business that have not been taken into sufficient account by Professor Hughes. He has not considered those violent actions of nature referred to by the Chairman, in the case of the sudden changes that have taken place in rivers by reason of earthquakes, nor has he alluded to those changes which take place with equal suddenness, and also with very great force, by reason of severe and exceptional floods. (Hear, hear.) But beyond all this we have in the ancient Somme valley proofs of a continuous course of rapid erosion,—far more rapid than the erosion now going on, which is proved to be *nil*, or next to *nil*. We have the fact that the valley has been eroded in a rapid and turbulent or tumultuous manner, with intervals of rest, during which the materials were deposited,—so that we have evidence of a state of things in existence at one time of which we have now no example there. It is clear that the Somme valley must have been cut where it is, and not by the present stream, and therefore that it must have been subjected to forces which are not now in operation, and the moment we have to introduce into the discussion forces that are not now in existence, we necessarily introduce a different and an unknown measure of time; so that I am at liberty to say that the excavation of the valley took place under circumstances which necessarily imply great rapidity, because the employment of great force means rapidity of action. (Hear, hear.) Consequently, I am free to say, from the same evidence as Professor Hughes refers to when he says, "I see the proofs of immense periods," I can only see proofs of short periods. (Hear, hear.) However, I will not dwell upon this. I will only add that, with all due respect for the more competent knowledge of Professor Hughes, I think the evidence he

has adduced indicates a course of things leading to the proposition that the inferences he has drawn are not quite so satisfactory as the fascinating narrative he has given us.

REV. H. MARTYN HART, M.A.—Before Professor Hughes replies, I think I may say that we all agree in one thing, and that is in being thankful that he has given us a specimen of the cautious accuracy with which a man thoroughly acquainted with a subject proceeds to discuss it. I am quite sure that what we call religion will not suffer at the hands of Professor Hughes. The cause of truth only suffers at the hands of the incautious and inaccurate, and of those hasty generalisers who can never wait patiently for an accumulation of facts; but upon some one or two isolated cases hurry to a conclusion,—a conclusion often very far from being warranted. As an example of the unjustifiable manner in which this subject has been treated by a certain class of writers, I may mention that some time ago a periodical, the *School Magazine*, was edited by Dr. Morell, one of H.M.'s Inspectors of Schools, and in its first number was an article on Man. One paragraph ran,—that human remains had been found at a depth of 600 feet in the Mississippi Delta, and that Dr. Benet Dowler had proved, by “a hard and indisputable process of calculation,” that man has been upon the Delta of the Mississippi for 57,000 years. I wrote to the writer for his authority. After one evasive letter, he wrote a second time to intimate that I could not have much acquaintance with the subject if I was not familiar with Nott and Gliddon's *Types of Mankind*; and, referring me to the page, he said I should find “the hard and indisputable process of calculation” there. I found the volume in the British Museum, and there read,—that at New Orleans borings had been made to a depth of 600 feet, and that the base of the alluvial deposit had not been reached, and that when excavations for certain gas-works were being made, under the fourth forest level, and at a depth of 60* (not 600) feet from the surface, a skeleton was found. The cranium was in a state of good preservation. The trees were cypresses, and by counting the rings of growth, and by calculating the time the great river takes to make a deposit of an inch,—the Egyptian Nilometer being appealed to for the exact number of years!—the precise number

* Mr. Hart's absence prevents an apparently needful correction being made. Sir C. Lyell, in the fourth edition of his *Antiquity of Man* (1873), refers to only two instances of fossil human remains having been found in the Mississippi valley; the first being that of the skeleton of a Red Indian, the cranium in good preservation, found 16 feet below the surface when excavating for some gas works: Dr. Dowler considered it to be 57,600 years old. Sir C. Lyell cites his opinion with apparent approval (p. 46), and gives his reasons, founded upon a calculation as to the rate of deposit of the mud; but Messrs. Humphreys and Abbot, quoted by Sir C. Lyell in the later edition of his work as reliable authorities, have calculated that the whole ground on which New Orleans stands, down to a depth of 40 feet, has been deposited in forty-four centuries. In regard to the second instance of fossil human remains, Sir C. Lyell says, “It is necessary to suspend our judgment as to the high antiquity of the fossil” (p. 239).—ED.

of 57,600 years was arrived at, during which the bones had lain in their grave, and during which vast lapse of time the cranium had been enabled to resist the process of decay. The calculation itself, moreover, was transparently inaccurate. And although this article had been put into the hands of thousands of school children, with the authority of one of H.M.'s Inspectors, yet I was unable to persuade them to withdraw or even correct the gross mis-statement, and the sole result has been that I received a challenge from Mr. Bradlaugh to meet him in discussion anywhere. Let all take a leaf from Professor Hughes's book, and hazard no definite calculation ; but let us wait patiently for more data, resting quite sure, as again and again we have been taught, that the records of the Book of Nature will never contradict the assertions of the Book of Grace,—

“ Read each aright, and each will read the same.”

REV. H. G. TOMKINS.—Since the Nile has been mentioned in connection with calculations as to the lapse of ages and the antiquity of man, I may be allowed to remark that the deductions of Mr. L. Horner from his observations in the Delta have been set aside by more recent inquirers,—“ The whole inquiry,” says Dr. Birch, “ is for many reasons more than unsatisfactory.”—Wilkinson, *Anct. Egyptians*, New Edition, 1878, vol. i., p. 9, footnote.

MR. W. TOPLEY, F.G.S. (a visitor).—I should like to say with regard to the Brandon flints, that Professor Hughes probably may not be aware of the fact that some memoranda have been sent in to the Royal Society on the subject, and are now in the hands of the Secretary, and I hope will be gone into. A large number of people disbelieved the evidence that was adduced ; and although I do not argue the point, I must say that I thought the evidence insufficient. But all the officers of the Geological Survey who have seen the place, say they have not the slightest doubt but that the implements found in the brick earth have been undoubtedly overlaid by a boulder glacial deposit. I do not think Professor Hughes was so clear when he passed onwards a little period. I should like to know his opinion as to the actual antiquity of man. It may be useful to take the historic age as a multiple ; but what multiple is it ? Of course, the whole of his argument is called in question upon the authenticity of these flint implements ; but, according to his showing, the Somme and the Thames have for the last 2,000 years been in pretty much the same state as they are now. Assuming it is only 2,000 years ago since the change began, what multiple is that with regard to the period to which we are to go back to find the age of these implements ? I should like Professor Hughes to state whether, according to his view of the evidence, although it has been called in question, he, in common with a great many geologists, would stretch the chronology of man to its utmost limits ? He might tell us of the wonderful succession of events that have taken place in Kent's Cavern, where, below the hyæna beds and flint implements, there is a great gap, and then still earlier deposits and flint implements, and along with these a totally different fauna, the hyæna and the elephant being altogether absent, and the remains are almost exclusively bears ; so that one can hardly but believe that

a great gap did separate that lower deposit from the upper. He says it is difficult to correlate the ages of the cave deposits with the gravel, and in that I agree with him ; but if the fauna of the caves containing hyænas is in any way comparable with the fauna of the river gravels containing implements, how much older must be the fauna of Kent's Cavern containing bears and rough implements ?

Professor HUGHES.—I must apologise that owing to pressure of work and to my being called off unexpectedly, I was unable to send in my paper in time to have it printed before the meeting. The discussion has covered a very wide field, a wider field than I had anticipated would have to be traversed, so that I must go quickly over the notes I have taken. The first speaker talked principally about the Thames district, and brought examples from London of Roman remains which have been found over the deposits to which I have called attention. But I fail to see how these Roman remains bear upon the question I was dealing with. The Roman remains were dropped on the surface and buried in the ground, and still more recent things have been found nearer the surface. What I stated was that the formation in which the mammoth and man were found was an alluvial deposit which must have been left by a river behaving as rivers usually do. All the earlier speakers laid great stress on the fact that in the Thames valley near London the river is not doing any work of excavation at the present time. With that I entirely agree, and one of my chief arguments is founded on it. The Thames in the lower part of its course deposits what it got from higher ground ; for the denudation we must go higher up the valley.

Mr. J. E. HOWARD.—The mammoth remains show no denudation since that period. The Thames has not cut down the valley since the time the mammoth inhabited the district.

Professor HUGHES.—[Professor Hughes described on the black-board the mode in which he asserted the denudation to have taken place.] He continued,—I was glad to hear that all the speakers allowed a long time to have been required to form the valley at the present rate of waste ; but the point which has been lost sight of is the denudation which takes place at the rapids and waterfalls, and though, as has been mentioned by one speaker, the river bed of the Somme at the period of the deposition of the flint-implement-bearing gravels may have fallen at the rate of 2 ft. in a mile, even that would admit of rapid denudation if the fall were not uniform along the whole length. The denudation would go on at the rapids where the valley was being *cut back* (not *cut down*) and in the lower reaches below the falls and rapids there would be no excavation going on. Earthquakes might modify the conditions by producing fissures, but we ought to go and examine the ground in each case and see whether there is any evidence of such cracks. I have noticed how the rate of waste would be affected by upheaval and depression, but we have no evidence in these cases of exceptional or cataclysmic action. If there had been such we should see masses of stone and coarse material carried to points where the velocity of the water was checked. But I ask you to look at the sand and gravel and

say whether you think they can have been deposited that way. You find shells and you find loam interstratified with the gravel, and it is quite clear from their character and arrangement that they were not carried by great cataclysms. The raised beaches of the coast are quite different from the river terraces of which I speak. They are sea beaches at a higher level than is now reached by the tide, and though some can be explained by the action of the sea on a sloping shore now cut back to a cliff, no tide could carry the shingle up and form a beach several hundred feet above the sea. Again, with regard to the width of the valley we have no reason to suppose that it was ever filled with water right across. A river is continually shifting its channel on the low ground. I have walked over many dry places in Wales where I have myself known the river once ran. A river does not cut straight down along the whole of its course. What a river does is this. [Here he illustrated his remarks by sketches drawn upon the black-board.] When it is checked at any point by an obstacle, such as a hard rock or by its having reached low flat ground, it is thrown across the valley from side to side, partly by the weir-like banks thrown up by itself, and undermining first one side then the other, forms in time a wide valley. When it has cut down through the obstacle, or upheaval has put an end to the ponding back by the sea, then the river excavates a deep channel through the alluvial plain which was formed during the stationary period, and patches of the old alluvial deposits are left as terraces. The next point was that there were no human bones found. Now, we must remember that in all the explorations made by the *Challenger* and the various ships that have been sent out for the purpose of dredging, no single human bone has been dredged up, and yet how many thousands have gone to the bottom of the sea. Again, when the Lake of Haarlem was drained not a human bone was found; so that there is not very much importance to be attached to the absence of bones in the gravel. I take my stand upon this, that here [pointing to the flint implements] you have the work of man. Three pieces of flint have been put before me by way of test. I suppose the gentleman who questioned me knew something of them, but I knew nothing. I recognised these pieces [showing them] as the work of man, from the combination of blows that have produced the form usually associated with man's handiwork; but with regard to this [holding up another piece], I do not know how it has been produced, but I am certain that nature alone has been at work here. In the implement which I say is the work of man I find that blows have been delivered all round the edge with the evident and definite design of producing this form. We can recognise these implements from the outline, and refer them to a certain date by their known association. It is possible that in some cases the flint may have received a blow or two to try it, and then have been thrown away. Here is one of such pieces [showing it]. It is not dressed round the edge; it is a mere rough piece, such as we find abundance of. I have expressed a doubt as to this [producing a piece of flint], in the production of which only three blows have been required. The reason why I have a doubt about it is this:—We have found the old

workings, where the ancient people dug down to the flints and dressed them, leaving the bits they knocked off behind them, and these bits have been found lying about in heaps of hundreds.

Mr. CALLARD.—Do you find them at St. Acheul. This [the flint in question] comes from that place. I brought it myself, and, as far as I know, there is no indication of any workings there.

Professor HUGHES.—In the particular place where you picked that up they may not have been working ; but they did not use these implements only in the place where they were worked. You may find them carried by man or by streams. Then there were half-made implements and misfits. That is one reason why we find such an immense number ; they threw these away. Mr. Topley has asked me to say what multiple I will take. That I will not say ; but I think it must be a large one. That, however, is only my opinion ; I have no data to go upon. I think, however, we must feel that the time is much greater than we have been accustomed to deal with in studying history. When I am asked how far off a man is, I may say I do not know the exact distance ; but I can say whether it is further than Westminster. And when astronomers tell us that they knock off two or three millions from the distance of the sun, do we feel inclined to say to them, “As you are not sure about the distance, perhaps the sun is only a mile or two off ?” No, we do not ; we allow the correction, still leaving as the measure of the sun’s distance those enormous quantities which it is difficult to grasp at all. As to the distribution of the bears and the other mammalia, I think I have left a sufficient margin. I talked of a period within which all those palæolithic times are included. When subdivisions could be made to correspond, well and good. There is reason for the bears and hyænas not being found together. The bears did not get on well with the hyænas, and where you do find them together the bears have the worst of it. In some great caves in the Pyrenees there is hardly anything but bears, and there the skeletons of the bears are found quite whole and entire. These were the dens they lived in, and whither they dragged themselves to die ; in other caves there were only found portions of the remains of bears, because these were parts of carcasses dragged in by other creatures and eaten. Then, in the older cases, the groups of life are so different from those of to-day that if we were to find any traces of man we should not expect to find him as he is now, and it was on this hypothesis that some French *savans* said they would refer the earlier instances to Man’s precursors. (Applause.)

The meeting was then adjourned.

REMARKS BY HIS GRACE THE DUKE OF ARGYLL, K.G.

I CONCUR entirely in the general argument of Professor Hughes on the antiquity of man.

I would observe, however, that it assumes, as most geologists do generally assume, that the gravels which have been found to hold human implements are exclusively *river-gravels*.

I entertain great doubt on this point. The distribution of our superficial gravels seems to me to indicate that some of them do not belong to any river system, but that they have been spread over hill and valley by marine action. If human implements have been found in gravels of marine origin, an entirely new element is introduced into the question.

My own belief is, that a submergence under the sea to the extent of upwards of 2,000 feet has been one of the very latest of geological changes. During part of this submergence, glacial condition prevailed over a large part of what is now Europe.

My further impression is, that man appeared on the scene when the land was emerging, and that the elevation was comparatively rapid. During this period it is most probable that heavy rains prevailed, and if so, the double action of elevation and of continual floods would greatly shorten the time required for the cutting out of the beds of streams or the deepening of valleys.

The Palæolithic weapons indicate a people somewhat in the condition of the Eskimo, and they may have been the outliers of races in a very different condition, who lived in non-glacial climates to the South.

I wish the attention of geologists were more directed to the questions connected with the admitted fact of sea-gravels at a high elevation on our Welsh and Scottish mountains.

REMARKS BY PROFESSOR T. R. BIRKS, M.A. (CAMB.).

PROFESSOR HUGHES'S paper seems to me fully to confirm two principles which I hold: 1st. That there is no genuine scientific evidence for a pre-*quaternary* existence of man, *i.e.*, for carrying him further back geologically than the close of the Glacial Drift period. 2nd. That the only *definite* scientific ground alleged for assigning an immense antiquity to that Drift period is the hypothesis of Mr. Croll, which would fix it definitely to a distance of either 200,000, or 800,000 years.

When Mr. Croll's theory is taken out of the way, the geological evidence for the high antiquity of man resolves itself into two questions:—1st. Does the contemporaneity of man with certain extinct mammals prove the antiquity of man or the comparative recency of those mammals themselves? 2nd. Are the conjectural estimates with regard to the growth of stalagmite, and the periods required for the erosion of certain beds of gravel, involving many elements of a most vague and conjectural kind, a sufficient ground for uperseding and treating as non-existent the distinct and definite statements of Scripture with regard to man's creation and the period when it occurred?

These estimates would all be modified at once by the physical consequences which must have resulted from such a fact as the Flood of Noah, however brief the period of its actual duration. With regard to erosion, five months, under the circumstances narrated in Gen. ix., might, and probably would, produce effects which could not be wrought by 50,000, or even 800,000 years of change under the present and modern conditions of gradual and almost insensible change, when the deep has been shut up in its "decreed place," and the surface of the ground has been dry, and when great but more moderate changes of the sea-level have only occurred at intervals of many thousand years.

The six days of creation in the first page of Scripture are, in my judgment, a definite line of separation, drawn by God Himself, between indefinite ages of chaos and darkness and the successive seasons of a Divine cosmos. I have little faith in the success of those who take their stand on the edge of chaos, and gaze intently on its darkness only, in measuring out intervals of time in that dark chaos so exactly as to form any scientific presumption whatever against conclusions drawn from an inductive study of the whole testimony of Scripture with regard to the plan and course of Divine Providence for the last 6,000 years.

I think Professor Hughes's paper is a valuable contribution towards a fair and impartial estimate on the conjectures on the one side and the definite evidence on the other.

REMARKS BY REV. HENRY BRASS, M.A., F.G.S.

A VERY able, thoughtful, impartial paper, and a valuable contribution to this important controversy; but the concluding remarks are to me far from satisfactory.

(1.) It is assumed that no changes in the level of the valleys of the Thames, Somme, &c., can have taken place during what the author calls "a very large multiple of the historic times." Yet such changes of level have recently

been, and are still taking place in many parts of the world—*e.g.*, the coasts of Scandinavia, Greenland, Cutch, South America, Pozzuoli, &c.*

“Will the geologist declare with perfect composure that the earth has at length settled into a state of repose? Will he continue to assert that the changes of relative level of land and sea, so common in former ages of the world, have now ceased? If, in the face of so many striking facts, he persists in maintaining this favourite dogma, it is in vain to hope that, by accumulating the proofs of similar convulsions during a series of antecedent ages, we shall shake his tenacity of purpose:†—

‘Si fractus illabatur orbis,
Impavidum ferient ruinæ.’—Hor., lib. iii., ode iii.

(2.) It ignores altogether the world-wide tradition of a recent great Deluge. Even if this were not universal, the forces which produced such a great catastrophe would probably more or less affect the levels of many distant parts of the earth’s surface.

(3.) It is assumed that flint flakes and implements are necessarily the work of *man*.

(4.) Allowing them to be the work of man, are they of necessity contemporaneous with the gravel-beds in which they are sometimes found? How is it the *bones* of man are “conspicuous by their absence”? Did primæval man never die? Have these beds never been visited in subsequent ages for their rich stores of flint? What has become of the immense number of chippings of “the great *gun-flint* period”? Have any of them found their way into the museums of collectors amongst “undoubted relics of the great antiquity of man”? The notorious “fossil jaw” of Amiens reminds us that great men are not infallible, and that a gravel-bed may be disturbed without its being suspected.

REMARKS BY PROFESSOR W. BOYD DAWKINS, F.R.S.

I ENTIRELY hold with Professor Hughes in the view which he takes relating to the antiquity of man, and the necessity of looking narrowly into facts

* The following remarks by Professor Huxley, made (August 22, 1879) at the meeting of the British Association, are interesting:—“The question as to the exact time to be attached to alluvial remains in the Somme valley cannot be settled satisfactorily. Few persons except men of science are aware that there have been enormous changes during the last 500 years in the north of Europe. The volcanoes of Iceland have been continually active, great floods of lava had been poured forth, and the level of the coast had been most remarkably changed. Similar causes might have produced enormous changes in the valley of the Somme, and therefore any arguments based as to time upon the appearances of the valley were not to be trusted.”—ED.

† C. Lyell, *Principles of Geology*, 8th edition, p. 450.

bearing on the question. All the alleged cases of the existence of man before the Palæolithic age, on the Continent, seem to me on a careful inquiry to be unsatisfactory. If the flints found at Thenay, and supposed to prove the existence of Meiocene man, be artificial, and be derived from a Meiocene stratum, there is, to my mind, an insuperable difficulty in holding them to be the handiwork of man. Seeing that no living species of quadruped was then alive, it is to me perfectly incredible that man, the most highly specialised of all, should have been living at that time. The flints shown in Paris by Professor Gaudry appear to be artificial; while those in the Museum of St. Germain appear to be partly artificial and partly natural, some of the former, from their condition, having been obviously picked up on the surface of the ground. The cuts on the Meiocene fossil bones discovered in several other localities in France may have been produced by other agencies than the hand of man.

Nor in the succeeding Pleiocene age is the evidence more convincing. The human skull found in a railway cutting at Olmo, in Northern Italy, and supposed to be of Pleiocene age, was associated with an implement, according to Dr. John Evans, of Neolithic age. Some of the cut fossil bones discovered in various parts of Lombardy, and considered by Professor Capellini to be Pleiocene, were undoubtedly produced by a cutting implement before they became mineralized, a point on which the examination of the specimens leaves me no reason for doubt. I do not, however, feel satisfied that the bones became mineralized in the Pleiocene age; and the fact, that only two species of quadruped now alive then dwelt in Europe, renders it highly improbable that man was living at this time. This zoological difficulty seems to me insuperable.

The only other case which demands notice is that which is taken to establish the fact that man was living in the Interglacial age, in Switzerland. The specimens supposed to offer ground for this hypothesis consist of a few pointed sticks in Professor Rüttimeyer's collection at Basle, of the shape and size of a rather thin cigar, crossed by a series of fibres running at right-angles. They appear to me after a careful examination to present no mark of the hand of man, and to be merely the resinous knots which have dropped out of a rotten pine trunk, and survived the destruction of the rest of the tree. As the evidence stands at present there is no proof, on the Continent or in this country, of man having lived in this part of the world before the middle stage of the Pleistocene age, when most of the living mammalia were then alive, and when mammoths, rhinoceroses, bison, horses and Irish elks, lions, hyænas, and bears haunted the neighbourhood of London, and were swept down by the floods of the Thames as far as Erith and Crayford.

REMARKS BY J. THORNHILL HARRISON, ESQ., F.G.S., M.I.C.E.

THE author's first question is, "In what formation have we found conclusive evidence that man was there?"

Leaving the earlier formations, he brings within view the latest beds known to geologists, the Tertiary and Post-tertiary. These beds bear evidence of the truth of the Mosaic record, as to the creation on the sixth day, first of the mammals, then of man.

The Tertiary beds contain remains of mammals, but, as the author says, the evidence is insufficient to prove that man was there.

In the Post-tertiary beds remains of man are, for the first time, found embedded in the earth; but when within the range of this deposit was man created? That is the question.

Lyell subdivides the Post-tertiary into Post-pliocene and Recent. *The former* embraces the period known as Glacial; part, often a considerable part, of the mammalia of this period belongs to extinct species; whereas the mammalia as well as shells found in deposits of the *Recent* period are identical with species now living.

That man existed on the earth during the deposit of beds of the Recent period there is no question. The objects found in caves and in the Post-glacial river-gravels are admitted to be really of human workmanship. The point chiefly contested by the author is the existence of man in Glacial and Inter-glacial times; and upon this he says that "all the evidence is to him quite inconclusive," at the same time he admits that traces of man with the extinct mammalia have been found in caves and Post-glacial river-gravels.

Let me ask, What evidence is there of the existence of the mammals during the Glacial period which does not equally apply to man? There is evidence of the pre-existence of the mammals, and we conclude therefore their continued existence during the Glacial period, but it by no means follows that during that period man was not co-existent. It is admitted that man lived along with the extinct mammalia, and it seems to me probable that he did so only during the Glacial period. Let this question be answered, What occasioned the extinction of the mammals, and how does man survive?

The author says, "In the long periods of geologic time races appear and last awhile, and then are not, and a new group of living things represents them in the next succeeding age. How they went out we cannot tell. It was not by cataclysms, for they go out one by one, and the deposits tell of slow accumulation; but more as if some gradual change over various regions of the earth made each successive place in time unsuitable for all the life that once was there."

It was not thus the mammals ceased to be; they *were* in man's time, but *are not*. There still remains, within the polar circle, undissolved throughout

many recurring generations, ice of the Glacial period. What does it record? The sudden destruction and instantaneous preservation of numerous mammalia, which year by year released from their icebound prison, are devoured by ravenous bears and other denizens of the polar seas. Numberless tusks lie scattered over Asia, imperishable records of a sudden destruction which overtook the animals in whose heads they grew. Is it not probable that these animals and men were overwhelmed, and, it may be, frozen as those now found nearer the Pole, and that as the ice dissolved their bodies were devoured, and the tusks alone remain the record of their pre-existence?

These did not go out one by one. By a cataclysm alone can this sudden destruction and preservation be accounted for; we do not know of any "every-day operations which are capable of producing such effects."

The author's second question is, "Can we assign any exact numerical estimate of years since these beds were laid down?"

He remarks, "We have to deal with facts so clear, so numerous, so widespread, and so similar everywhere, that we must at once refer them to the common ways of river denudation."

Were it necessary to refer the geological facts alluded to, to the "common ways of river denudation," the conclusion of the author "that the age of man must be a large multiple of the historic times" would possibly be inevitable; but I do not think that such necessity exists, or that such reference can explain the facts referred to.

It appears certain that man did live with the extinct mammalia during part at least of the Glacial period. During that period the atmosphere of the temperate zone would be most conducive to health and longevity; the sky cloudless, the air dry and moderately warm, the ground wetted by dew alone. (For God had not yet caused it to rain on the earth.) The theory I would suggest as worthy of consideration is, that when the glaciation attained its maximum degree, the disturbance of the equilibrium of the crust was so great, owing to the enormous accumulation of ice and snow at the poles, that a cataclysm did occur, by which the ice-bound regions were plunged towards the Equator; that the ice and snow were launched from their seat; and that the consequent dashing to and fro of the waters caused a universal deluge, the deluge of the Bible, when Noah and his family, by the interposition of the Almighty, were saved, whilst the rest of mankind with the extinct mammal were overwhelmed and perished.

I cannot expect this theory to be accepted without proof; I therefore propose to adduce some reasons for its suggestion.

The frequent reference by the author and by Lyell to instances of "depression" and "upheaval" of the surface of the earth is an admission that the earth's crust has a considerable freedom of motion *vertically*. Accepting this view (to a limited extent), the effect of any considerable weight added to one part of the surface would be to destroy the equilibrium of the crust, considered as a spheroidal shell, and at the weakest parts to crush it, and elevate new mountain chains, and simultaneously, by volcanic action, to force from

the interior large masses of molten matter, which distributed by water would become stratified rocks of varied thickness and of distinctive character.

The former action is exhibited during the Tertiary period by the upheaval of the Alps, Apennines, Carpathian and Himalayan ranges, and *the latter* operation is exemplified by the formation of newer Pliocene beds of Italy and Sicily. Respecting these Lyell says,—

“There is probably no part of Europe where the newer Pliocene formations enter so largely into the structure of the earth’s crust, or rise to such heights above the level of the sea, as Sicily. They cover nearly one half the island, and near its centre, Castogiovanni, reach an elevation of 3,000 feet.”

The beds are regularly horizontal and several hundred feet in thickness, the limestone passes downwards into sandstone and conglomerate, below which are clay and blue marl. These are most interesting stratified beds, formed undoubtedly from materials disorged by volcanic action from the interior of the earth.

During the deposition of these beds there is undoubted evidence that the Glacial period had commenced, and that the glaciation at the Pole was steadily extending.

Now what does this glaciation mean? Simply this, that the crust of the earth no longer transmitted heat sufficient to melt the snow that fell upon it; that at that period there was no diversion, as now, of vast volumes of tidal waters of high temperature from the Equator to the Pole, and that there was a gradual but steady accumulation of snow and ice in the polar regions. This accumulation implies a corresponding evaporation and abstraction of water from the equatorial regions. The result would be a simultaneous loading of the crust at the Pole, and diminution of pressure on the parts previously covered by the sea. The natural consequence would be a squeezing-out of molten matter from the interior as above referred to, and probably the simultaneous crushing of the crust and formation of mountains, or further elevation of those previously raised.

Such results would, however, in no way arrest the process of snow-accumulation at the Pole; the higher the mass of snow became, the greater tendency would there be to extract every particle of moisture from the atmosphere, and it is difficult to conceive a limit to the process until the ocean should be dried up and all the water be collected in a frozen condition at the Pole.

I have as yet based my argument solely upon the admitted freedom of the earth’s crust to move vertically. I must now suggest the probability (as I have already more fully explained in a paper presented to the Institute) of the crust of the earth being free to move horizontally on the internal mass of matter, as well as vertically, and that, when its equilibrium was destroyed by the combined accumulation of snow at the Poles and abstraction of weight unequally from the surface towards the Equator, the crust of the earth did shift its position as already suggested—reeling to and fro—by which some of the ice was thawed; it steadied again, but eventually so far shifted its position as to launch the burden of accumulated frozen materials towards the Equator

producing thereby all the phenomena requisite for a practically universal deluge.

As the reeling or nutation recurred, land which at one time was near the Pole and stood high above the water would at another stage of the nutation be plunged below the water as it approached the Equator, the climate being arctic under the former and tropical under the latter condition; further, these alternations of depression and elevation and changes of climate would recur at intervals, until again the axis of rotation of the external crust coincided with that of the internal mass. It would be most improbable that the same spot of the crust would return to its former position at the Pole. The new position of the Pole, in the good providence of God, is such, that a wonderful balance between the accumulation of ice and its dissolution is maintained, the chief regulating element being the tidal waters, diverted by the projecting continent of America, the warmth of which moderates the climate of all countries bordering on the Atlantic, influences materially that of Spitzbergen, and slowly, it would appear, thaws the remaining old ice of the Glacial period.

This theory affords a simple explanation of the changes of climate and physical geography which are proved to have occurred during the Glacial period, but have not received satisfactory explanations; accepting this theory there remains no occasion to estimate geological periods of time by allowing $2\frac{1}{2}$ feet in a century as the rate of upheaval and depression of the surface through hundreds and thousands of feet.

No such sudden destruction by water as that which overtook man at one period of his existence could have occurred under such gradual alterations of relative level of land and water. It is necessary to accept a cataclysm as the cause of such a catastrophe, and it is my firm belief that such a cataclysm did occur.

The extraordinary physical forces in operation during the Glacial, but unknown in any preceding period, are sufficient to account for all the geological peculiarities of that era, besides the crushing-up of mountains, the voluminous discharge of molten matter from the earth's interior, the sweeping and distributing power of water of varied depths moving over submerged hill and dale, here denuding, there accumulating, which forces were common to previous geological periods; there was introduced the force exerted by ice resting and in motion as a river on the surface of the grounds, floating freely or trailing along the bed of the ocean, leaving distinctly the marks of its past action on solid rocks and distributing extensively over the continents of Europe, Asia, and America boulders, clay, gravel, and sand. It is unnecessary to enter into details of the operation of this glacial force. The like operations still continue, but not on the same grand scale. It is not philosophical to argue that all things continue as they were, and that we must take the natural operations of to-day as the measure of those which have passed away. "The common ways of river denudation" are insignificantly minute when compared with the ways of the enormous degrading, transporting, and dispersing forces to which I have referred.

Is it not probable that during the Glacial period the tropical regions of the earth were intensely hot and unsuitable for the abode of man, as though the angel with *the flaming* sword drove man from the garden of Eden there situated? again, was not the unstable condition of the earth sufficient to make Cain a fugitive and a wanderer on the earth, and that devoid of rain the ground should not yield her strength? Do we not read of Tubal Cain who instructed his fellows to work in brass and iron? Mark, brass first, then iron. And may we not direct attention to God's covenant with man after the Flood not again to destroy the earth with a flood, and explain His setting the bow in the heavens as a token of His covenant?—at which it is grievous to hear sneers from those who profess to believe in Christianity. It is probable that during the Glacial period the sky was cloudless in the temperate zone; we read that when God formed man He had not caused it to rain on the earth, but a mist went up from the earth. Is it not very probable that until after the termination of the Glacial period the rainbow had never appeared in the sky in man's time?

It seems to me impossible to estimate actual time from any facts which geology presents, but there is nothing in the geological records which should lead us to distrust the records of Scripture.

REMARKS BY THE REV. J. MAGENS MELLO, M.A., F.G.S.

THE subject brought before us by Professor Hughes is undoubtedly one of very great interest, and I venture to send a few remarks which have occurred to me in connection with it. His criticisms upon the evidence offered in support of Miocene and Pliocene man seem to be thoroughly sound, and the evidence adduced proved to be valueless. In confirmation of what he has said regarding the supposed basket-work from Dürnten, I may add that I have frequently seen upon the sea-shore such rolled fragments of wood, softened and shaped by the waves; I have noticed them in abundance at Hastings, and also at Whitby and elsewhere; and where there happens to be much clay they may often be seen embedded in it, and if matted together they would undoubtedly leave their impressions upon each other's surfaces. I believe I may state that Professor Dawkins does not accept the theory of the human origin of the Dürnten basket-work.

As to the Pre-glacial man of the Victoria Cave, it seems hardly worth while now to discuss the question whether the clay is a glacial deposit *in situ* or a *remanié*, since the bone of contention can no longer be considered human. Any evidence of man's antiquity drawn from the amount of stalagmite which may overlies bones or implements is, I think, altogether untrustworthy. So many varying circumstances affect the rate of the formation of

stalagmite, and the clue which we may have as to those circumstances in any particular case is often so indistinct and broken, that we cannot follow its indications with any confidence. We know that beds of a tufaceous character, such, for instance, as the upper so-called stalagmite of Kent's Hole, may attain many feet in thickness in a very small number of years.

The most weighty evidence as yet before us of a probably high antiquity for man in North-Western Europe appears to be that derived from the alterations in physical geography which seem to have taken place since his advent; such evidence is derived from the present height of certain terraces containing his works far above the level of existing rivers. Such alterations would appear to have taken place in the case of the Thames, the Clyde, the Somme, the Seine, and other streams. In some of the instances given, however, the river-banks bordered estuaries, and were probably affected by the tides, in which case we need not look to the slow accumulation by ordinary fluvial depositions of sediment; and it is possible that where estuarine terraces occur, both the higher and the lower terrace may have been contemporaneously formed, since a high-tide and a low-tide terrace are a common occurrence on our coasts, and the subsequent elevation of the land would account for the present position of the terraces above the level of the river. Such elevation appears to have occasionally been far from slow. Canoes, which seem to have been constructed with metallic tools, have been found 25 feet above the present high-water mark on the banks of the Clyde; and it is a well-known fact that the alteration of some of our coasts has been both great and rapid during the historical period. We have no certain clue as to the rate of changes of elevation in the Pleistocene age. Evidence drawn from inland valleys may require more careful examination, as the cutting power of rivers varies greatly in different districts according to the volume and rapidity of the stream, and also the nature of the rocks passed over; and in times when the country was more densely wooded, the rainfall may have been far in excess of the present average. That the accumulation of bones of the extinct mammalia found in conjunction with human remains in caves cannot all be assigned to the work of a flood is very clear to any one who has taken part in the exploration of such caves. I will refer only to those with which I am best acquainted, viz., the caves of Cresswell; these are, it may be observed, not more than 15 ft. above the present level of the stream. The bones found in them, with but few exceptions, bear no evidence of having been rolled along by a current of water, but, on the contrary, appear to have been left where they are now found, in many cases, by the hyænas, which devoured the carcasses of the animals; the fractured edges are frequently seen to be as sharp as if done quite recently; this could not have been the case had they been subjected to rolling in water for even a very short period. Other evidence of their being the slow accumulations of many years in the spot where they are now found is seen in the character of the beds in which they occur. The floors of the caves are not of one uniform nature, but are distinctly stratified, and contain remains to a certain extent peculiar to each.

There is also the clearest evidence of the animals having lived and bred, if not in the caves, yet in their immediate neighbourhood; the jaws of the hyenas are those of individuals of every age,—of the young, with the permanent teeth merely beginning to show through the bone, and of the veteran, with teeth ground down to stumps. The coprolites also of these animals and the bones they have gnawed abounded in some of the caves.

I think there is strong evidence that man was contemporaneous with the now extinct mammalia during a lengthened period and one marked by important physical changes; but *how* long that period was the evidence as yet is not forthcoming.

Some who have written on this subject have spoken of the remains of the sheep and goat, and also of iron, as having been found with the bones of the Pleistocene animals; but that they were contemporaneous there is, I think, no proof; the few isolated cases in which they are said to have been found together cannot be set against the great mass of evidence as to their non-contemporaneity; and the carelessness of workmen, the accidental fall from an overlying deposit, the burrowing of foxes, rabbits, or badgers, might very easily account for the few instances brought forward. There seems to be every reason to suppose that the sheep, goat, and other domestic animals made their first appearance in connection with Neolithic man.

The chief points which it seems to me require very careful examination as to their bearing upon the question of a prolonged antiquity of man, are those relating to finds of implements apparently deposited at a time when the physical geography of the country was considerably different to what it is at present; such finds, for instance, as have been recorded from the drift of Hampshire, which is now deeply cut into by numerous streams, and is also intersected by the Southampton Water. As far as now appears, those implements must have been dropped into that drift at a period antecedent to those physical changes which have so cut up the once-uniform sheet of gravel. We also require further light to be thrown upon the cases I have already alluded to, in which similar finds are recorded from high levels, in localities far removed from the sea; and most especially do we want to know something more as to the time when the separation of these islands from the Continent and from one another took place. The evidence seems very clear that man lived in this country with the Pleistocene mammalia before that separation was brought about. The abrupt line apparently existing between Palæolithic and Neolithic man is very remarkable; as far as I am aware, no signs of an overlap have been discovered. What is the meaning of that sharp demarcation, assuming it to have a real existence? And what length of interval does it imply between the disappearance of one race of man, and the animal which were his contemporaries, and the incoming of the newer race? Is it not probable that the separation of England from the Continent, with various climatal changes, may have filled up the interval? It is to such a break and to such changes that we are led to look for the explanation of the apparent sharp transition from the Pleistocene into Prehistoric and recent times

whilst as to the fact of a connection having existed at no distant period (speaking of time geologically) between the continent of Europe and these islands there is abundant evidence, not the least striking part of which is that which shows a gradual diminution as we pass westwards and northwards of plants and animals of existing species, which are common both to Great Britain and the North-Western regions of Europe. It can only be reasonably accounted for by the supposition that the connection was severed before the species had time to spread generally.

REMARKS BY S. R. PATTISON, ESQ., F.G.S.

PROFESSOR HUGHES is so cautious, that his testimony concerning disputed facts has all the strength of an admission. We may, therefore, accept as conclusive, 1st, his denial of any evidence of the existence of man in Pre-glacial times; 2nd, his statement of the untrustworthiness of stalagmite as a measure of duration; and 3rd, his affirmance of the absence of any measure of Post-glacial time in geology. Into the field thus cleared of positive scientific facts hypothesis enters, and seeks to govern by analogies. Here we do not consider the Professor as equally skilful, or even equally cautious. Unlike his distinguished predecessor at Cambridge, Sedgwick (*clarum et venerabile nomen*), he repudiates *cataclysm* in the past, and relies on causes in present operation, and apparently on present rates of action. He argues that all the events indicated have been brought about by minute changes; that this has been the case with the cutting back of the rivers forming the valleys of the Thames* and the Somme, with the change in the groups of mammalia, and the variation in the local freshwater fauna. Therefore, he says, that the time which has elapsed since the deposition of the flint implements is "enormously long," a "vast time," a "great lapse;" implying that it is far longer than is assigned by the ordinary Mosaic chronology. But the power of these analogies depends entirely on the circumstances of the two cases being equal. Surely Professor Hughes cannot hold that this is the case. We affirm, on the contrary, that the elevation of the inland cliffs and of the coast, the traces of violent land movements, the tokens of alternate immense rushes of water and ice with periods of repose and tranquil sediment, the excavation of materials by side-cutting and their rolling and re-sorting, are phenomena which, in the extent indicated, do not now occur, and can never have occurred from causes now in action at the present or any other conceivable rate of uniform progress. If this be so, or if it may be so,

* A Member, writing from Cirencester, states that he has not observed evidence of the "cutting back" higher up the stream of the Thames.

then the whole analogy is destroyed. Having displaced existing causes, or rather existing *rates* of action, we are then free to assert that the irregular work of Post-glacial forces may have been accomplished, say within 10,000 years, for aught that geology can show to the contrary. In fact, that science does not, as yet, displace the common chronology of our Bible, which, as we well know, admits of very considerable extension. We are at liberty, therefore, so far as geology is concerned, to accept the reasonings of Dr. Southall, Dr. Andrews, Dr. Dawson, Mr. Callard, and others, on the recent origin of man, the close and crown of animated nature, according to the commonly-received interpretation of the Scripture.

REMARKS BY JAMES C. SOUTHALL, M.A., LL.D.

(Richmond, Virginia).

I CERTAINLY concur in what Professor Hughes says as to the breaking-down of the evidence for the existence of Miocene, Pliocene, and Glacial man. It is hardly worthy of serious consideration, and I think the bringing forward of insufficiently considered facts of this sort for the purpose of establishing the antiquity of man brings discredit on the cause of science. If the antiquity of man is to be proved, we must have more careful and judicious investigators. The Miocene man of the Dardanelles, the chipped flints from Thenay, the perforated sharks' teeth of the Crag, the sharpened sticks from Dürnten, the human fibula from the Victoria Cave, have been severally patronized by very distinguished scientific names, and should serve to admonish us of the necessity for that "caution—caution—caution," which Mr. John Evans has been compelled to recommend.

The remarks of Professor Hughes with regard to the evidence bearing on the antiquity of Quaternary man are so vague, that it is difficult, while dissenting from his conclusions, to criticise what he has said.

If, I understand him, he rests the antiquity of Quaternary man on the fact that the palæolithic implements of the river gravels antedate the excavation of the river valleys by the present streams. He argues that the time required for the Somme River to excavate its valley is the measure of the age of the upper gravels, and the implements found in them.

He asserts that there are ancient terraces along the banks of this river, and that these terraces mark the former position of the stream, as it cut its way back from the sea up to the present "rapids," which are now, he says, "far back towards Central France."

At the mouth of the Somme the gravels fringe the coast at an elevation of 100 feet above the sea. If I understand Professor Hughes, the cataract or the rapids must have originally existed at the sea, and the rapids have slowly retreated into "Central France."

He apparently regards the volume of water as being the same then as now.

The Somme River at Amiens is, I believe, some 50 or 60 feet wide, the river valley being a mile or a mile and a half wide. The length of the river from its head (some 12 miles N.E. of St. Quentin) is 124 miles. The fall from the source to the mouth is 220 feet, or 1.77 foot per mile,—about the flow of the Thames at Oxford.

When the excavation, however (according to Professor Hughes' theory), commenced, the river at its mouth at St. Valéry ran 140 feet higher than its present level at that point, for the plateau there is 140 feet above the sea. The fall at that time in the Somme from its source to its mouth was only 80 feet, or about 8 inches per mile; that is to say, the Somme river at that time had about one-third of the present flow of the Thames above Oxford, and about one-half of the flow of the Thames below Oxford.

The stream, spread at the time over the almost level plateau, must have had a depth of less than an inch.

The course of the river above Amiens to its source, 80 miles, is a winding one, which tended still farther to weaken the force of the current.

I do not comprehend how Professor Hughes deems it possible for such a stream to excavate a valley a mile or a mile and a half wide, and 150 to 200 feet deep. If it be true that man witnessed the commencement of such a work of excavation, he is old indeed; the time since his appearance on earth is, in fact, almost incomputable. Professor Hughes indeed points out the fact that there has been no change in the valley in two thousand years, and we may confidently believe that the present stream will not materially augment the excavation in twenty thousand more.

The upper gravel bed exhibits multitudes of chalk pebbles larger than a man's head, and some few far-travelled boulders of sandstone weighing a ton.

The shallow stream we have spoken of (less than an inch in depth), moving by a circuitous course, with a fall of eight inches per mile, is supposed to have swept the chalk out of the valley, to have moved and rolled these pebbles and boulders, and to have laid down gravel-beds sometimes 20 feet thick.

It is perfectly evident, on the contrary, from the phenomena as exhibited in the European river valleys, as well as in those of the United States, that these gravels (as well as the loess, 20 to 100 feet thick in the United States), were deposited by mighty floods, which filled the valleys across their whole breadth from hill to hill.

I have studied these gravels with some attention at Richmond, Virginia, where they cover the country to the right and left of the James River for miles. Richmond is, at the head of tide, 110 miles from the sea. The gravels here are not confined to the valley, but are spread beyond the limits of the valley, 150 feet above the present stream, over the level country north and south of the river. They were not deposited exclusively in the trough

of a valley, but between Richmond and the sea they extend indefinitely over the whole plain on either side of the river. This is not all; they extend over the entire tide-water area of the State, from the Potomac to the Roanoke (in North Carolina). They cover this whole region like a sheet 150 miles from north to south and 100 miles east and west. They begin with this fanlike expansion at the head of tide, and continue to the sea. After going a few miles above Richmond the gravels are only found near the river, and it is the same above Fredericksburg, on the Rappahannock. In North Carolina the same phenomena are reproduced; the gravels brought down the rivers, after they reach tidewater, spread in one continuous sheet across the State. I have no doubt it is the same in South Carolina. Now this contradicts at once the theory of an excavation, as connected with the deposition of the gravels. A similar appearance seems to be presented in what Sir Charles Lyell calls the tabular mass of drift on the Hampshire coast, in England.

The gravels which I have described in Virginia were brought down, as ascertained by their mineralogical character, from the mountains. They are not found on the banks of streams which do not issue from the mountains as, for example, the Appomattox. They are found high up on the bluffs of the rivers which take their rise in the Blue Ridge and the Alleghanies, and when they reached the head of tide they were by some agency dispersed over the whole face of the country to the right and left, until they reached the sea.

I think it possible that below Richmond, and similar points, the rush of fresh water in the rivers was met by the waves of the sea, which rolled inward at the same time, in consequence of a depression of the coast. The fresh water and the salt water met, and at the point of junction the gravels were spread far and wide over the present low country of Virginia.* I offer this as a mere conjecture; the subject is full of difficulty.

It was possibly the same in the valley of the Somme. The gravels occur on the French coast, as I have stated, 100 feet above the sea-level. When they were left there, the river ran 100 feet higher, and the sea stood 100 feet higher.

As the coast subsided and the sea rose to that level, the river sent down a flood of fresh water to meet the incoming waves. There are evidences both of the freshwater flood and of the movements of the coast-lines.†

As to the manner in which the Somme Valley was formed, I do not deem it incumbent to explain it. The valley was there when the gravels were spread over it; it was there at the close of the Glacial epoch. The "terraces," if such there be, were there also.

* This gravel becomes finer as we go below Richmond.

† The 100 feet gravel-bed on the coast shows this, and marine remains have been found at Abbeville, 25 feet above the present bed of the stream.

Professor Hughes seems to rest his whole argument on the fact of the existence of these terraces. But it is positively asserted by those who have made the most careful examinations, that there are no terraces in the case. This is the statement of Mr. Alfred Tylor, F.G.S. It is positively asserted by Professor Andrews, of Chicago. And in a paper read before the "Geologists' Association" (see Proceedings, vol. iv. No. 5), by Mr. James Parker, F.G.S., &c., on the Somme Valley, the same declaration is made.

"I need not notice at length," says Mr. Parker, "the terraced character which is given to the banks in the section [of Sir C. Lyell], and which, of course, goes far to help the hypothesis of river action. Mr. Tylor, in a series of carefully-measured sections, has shown that these terraces do not exist in any part which he has explored. I can add my testimony to the fact that no continuous horizontal terraces exist in any part I have explored also (and I may say I have traversed quite three-fourths of the course of the Somme); certainly not of the character as shown in the section" (p. 19).

As to the *rate* of excavation of its bed by a river, I wish to remark that that depends on the character of the material through which the stream passes, on the volume and velocity of the water, and on the movements of elevation or depression of the coast-lines. Now, let us suppose that when the sea and the Somme River at St. Valéry stood 100 feet higher, suddenly, from some cause, the level of the sea should fall, or, which is the same thing, that the land should rise. In this case, through a mud bottom, or through gravel and sand, the river would cut a deeper channel back in a very brief time.

Professor Hughes refers also to the change in the fauna which has taken place since the palæolithic times. I have discussed this elsewhere. I will only remark here, that it is now admitted that the reindeer was found in Central Europe at the beginning of our era, and that the lion was found in Thessaly about the same date. The Irish elk lived also to historic times. In America the remains of the mastodon are found habitually under circumstances implying the existence of the animal only a few thousand years ago. All are familiar with the discoveries in connection with the mammoth and rhinoceros tichoriinus in Siberia.

I think the excavation theory advocated by Professor Hughes is not held on the Continent, nor in America. Professor Dana, certainly one of the greatest of living geologists, and who holds to the antiquity of man, remarks in his *Manual of Geology* (p. 553), speaking of what he calls the Post-glacial flood: "The fact that such a flood, vast beyond conception, was the final event in the history of the glacier, is manifest in the peculiar stratification of the flood-made deposits, and in the spread of the stratified Drift southward along the Mississippi Valley to the Gulf, as first made known by Hilgard. Only under the rapid contribution of immense amounts of sand and gravel, and of water from so unlimited a source, could such deposits have accumulated." M. Dupont, in his "Report on the Belgian Caves"; M. Belgrand, in his work on "The Paris Basin"; Professor J. W.

Dawson, and many others, take the same view. Whatever else may be true, there is no doubt about the flood.*

There are ancient beaches on the great lakes of North America, showing that the water formerly stood in these basins at a much higher level. The beaches are Post-glacial in date. Has the water in these lakes excavated these basins?

REMARKS BY N. WHITLEY, ESQ., C.E.

I CONSIDER the paper of Professor Hughes to be of especial value and importance at the present time, in clearing the study of the evidence of the early advent of man of a number of doubtful cases which have for many years surrounded this subject with a haze of uncertainty, and which required a considerable amount of research and labour to clear away. This has now been done, and for which our warmest thanks and grateful acknowledgments are due to the learned Professor.

The result being, as the evidence at present stands, that in all cases where it has been attempted to assign to man a period more remote than that of the Post-glacial river gravels the evidence has completely broken down, and that man is neither Pre-glacial, nor Inter-glacial, but Post-glacial.

Professor Hughes is further of opinion that the earliest traces of man are to be found in the old "river gravels" of the Somme, and in similar deposits, consisting of numerous stone implements of human workmanship. Around the point of the genuineness of these supposed implements, therefore, the interest of the controversy now centres.

It is important further to notice that no other relics of man are mentioned by him as being found in these gravels except the so-called implements; and that in these beds the bones of the extinct animals have been found in great abundance, but not a single bone of man, or any other relic indicative of his presence has been discovered associated with them.

It is a matter of regret that the author has considered it unnecessary to produce any evidence that these fractured flints are really of human workmanship, as this is in fact, now the issue of the whole contention; but on this vital point we are referred in a foot-note to Dr. Evans' *Ancient Stone Implements of Great Britain*.

Turning to Dr. Evans' elaborate work, I find no proof whatever given

* Below Richmond, far down the river, the Jurassic is exposed in the river-bluffs, overlaid by the Tertiary and Quaternary deposits. In this Jurassic is a heavy bed of rolled gravel, composed of the same up-country rocks as the Quaternary bed; which shows that these great floods of fresh water were not confined to the Quaternary period. There were a river and a river-valley here in the Jurassic (or Triassic?) period.

that these flints are man-made implements : at considerable length Dr. Evans discusses the "characteristics of their authenticity" (p. 575); but this only relates to the indications by which they can be distinguished from modern "spurious imitations," which is a very different matter from that of their being genuine human implements. The so-called "Implements" of the gravel beds of the Somme are undoubtedly *authentic*, in that they are really found in the gravel-beds, and may be known from new-made forgeries ; but it does not therefore follow that they are *genuine* as implements made by man. (See *Trench on Words*, p. 197.—On the "confusion often made between genuine and authentic." 2d. ed.) And, in fact, Dr. Evans in this place does not appear to draw such a conclusion.

Both Sir Charles Lyell* and Sir John Lubbock† have considered it necessary for them to prove that the "flint implements" are of human workmanship, but they do not support this proposition by any direct evidence ; they do, however, convincingly prove by the vitreous gloss and dendritic markings on its surface that the split flint is not a modern forgery; and then they jump to the conclusion that it is a genuine implement. This is obviously a mistake of the question.

Mr. Prestwich alone has fairly grappled with this subject; and I have given his arguments in full and my reply, at page 45 of my *Flint Implements from Drift*.

On the other hand, there is a considerable amount of sound rebutting evidence to show that these split flints are not man-made tools, of which I will only now adduce two arguments :—

1st. These flints are usually found at the lower part of the stratum of angular flint-gravel, where the fractured surfaces of the whole mass are stained the same colour, show the same kind of fracture, and exhibit the same vitreous gloss and dendritic markings as the supposed implements. *And the most symmetrical implement is found to pass by imperceptible gradations through other forms of fractured flint into the rough angular gravel by which it is surrounded*; the fracture of which is confessedly the result of natural causes.

In the Museum of Practical Geology in Jermyn Street there are a large number of rough flint "implements" side by side with naturally-fractured flints of approximate forms; the object being to show that the simpler forms referred to fortuitous fracture may have suggested the type of the "undoubtedly artificial implements." But by an inspection of the labels the attempt to refer some to one class and some to the other confessedly breaks down. Thus in series D, six specimens in succession are described as,—

- " 42. Seems entirely natural.
- 43. Seems also entirely natural—perhaps used.
- 44. Apparently being dressed into form.

* *Antiquity of Man*. First ed., p. 112.

† *Pre-historic Times*, p. 276.

- 44 a. Natural or partly dressed.
 44 b. Natural or partly dressed.
 45. Appears dressed."

Specimen No. 10 probably approached the nearest to the Somme type, but even this flint is described as "natural, but perhaps chipped at the edge."*

These flints were collected and described by a first-class "expert," having the "experienced eye," which Lyell says is necessary to distinguish the false from the true implement; and yet in this case the present Woodwardian Professor of Geology at Cambridge could not distinguish from his point of view the work of man from that of nature, the gradation of form and fracture being so imperceptible.

2nd. I have inspected most of the gravel-beds whence these "implements" have been obtained, both in England and on the Continent, and also the accessible museums in which they have been placed; and I have never found one single "Drift implement" showing the same indubitable evidence of use by man, as is stamped on the true stone tools of the Neolithic age.

Even the degraded Bushman of South Africa, who has no house or home, no animals but a few wretched half-wild dogs, and no clothing but rough skins, makes a stone implement, with a *hole* in it for a handle, to dig out roots from the soil. And these undoubted implements are now found over a large area, conclusively indicating a former extension of the Bushmen who used them over that which they now occupy.†

Wherever man, even the most degraded savage, has been, he has left multi-form and indubitable relics of his presence, but the supposed Palæolithic man of the Drift gravel-beds has left no evidence of his former existence but rough stone implements, and these unlike any genuine implements known to have been used by man, and so uncouth in form that it is doubtful to what use they could have been applied; and with these, says Sir Charles Lyell, are a vast variety of very rude implements, some of which can only be recognised by an experienced eye as bearing marks of human workmanship (*Antiq. of Man*, p. 118, 1st ed.); and we now further find others which so blend with the natural forms of the angular flint gravel, that the most accomplished expert cannot determine the difference between the work of nature and the work of man.

Considering judicially the weight which should be attached to the whole of the evidence for and against the "implement" theory of these flints, from the ancient valley gravels, it appears to me more reasonable to reject the supposed existence of the so-called Palæolithic man,—than to believe that these fractured flints are of human workmanship.

* "On Flint Implements." By T. McK. Hughes, M.A. The "Geological Repertory." *Proc. Soc. Ant. Lond. Africa*. By Keith Johnston. P. 441.

PROFESSOR HUGHES' REPLY TO THE FOREGOING
COMMUNICATIONS.

It gives me great satisfaction to meet with the approval of so skilled and careful an observer as the Duke of Argyll, and I quite agree with his Grace in believing that, whether we are investigating the evidence for the antiquity of man, or the sequence of events which we include in what is known as the Glacial period, the most important inquiry is,—what was the extent, horizontal and vertical, of the last great movement of depression in the British Isles? It marks the close of *our* Glacial period, and seems to precede the commencement of *our* human period. It was probably the sea of that submergence that lifted off the last of the ice. We do not expect to find traces of man's sojourn here when the whole was covered by ice, nor was he likely to have left much indication of his visits when the greater part was covered by water. I did not go into this question, because I have not within my own knowledge any evidence of remains of man having been found in the marine deposits of that age.

With regard to Prof. Birks' observations, I may remark that, as I cannot regard the astronomical combinations referred to as even the principal cause of the prevalence of Alpine conditions in our area at any period, I, of course, cannot accept them as a measure of the age of the Glacial period. I think, on referring to my paper, it will be seen that I do not lay much stress on the contemporaneousness of man with certain extinct mammals, except so far as we can infer that such palæontological changes seem to take place slowly, and to be dependent on terrestrial movements, which also, we believe, take place gradually. To the growth of stalagmite as a measure of time I attach no importance, and have made full allowance for local changes of level, which would accelerate the rate of waste. I appeal to river terraces, not to any doubtful deposits which may be due to cataclysmic action. What it comes to is this,—that there is at present no certainty about the age of the old river-terraces in which we find the remains of man; but apply what test we will, we have always the same result, that, according to observed rates of change, the time must have been very long, unless we assume that every case that has been examined is an exceptional one, in which there has been an exceptional and local acceleration of all the operations of nature.

I must ask Mr. Brass to read the former paper by myself, referred to in p. 10, and I think he will see that I am far from assuming that no recent changes of level have taken place affecting the flow of rivers and the rate of waste in valleys. It is the recognition of this and other similar facts that makes me believe that in the present state of our knowledge it is impossible to assign a term of years to the period during which the rivers have been at work.

Whether a valley has been in the main cut out by an ordinary river or by

some exceptional flood, is a question about which a field geologist can generally form a good opinion.

Prof. Huxley's remarks, quoted in a footnote on p. 342, refer to the effect which such changes might have on the rate of denudation, but do not call in question the fact that the valley has in the main been scooped out by the river.

Of course many mistakes have been made, as might have been expected, where so many people with very various previous experience of such phenomena have been examining the gravels and loams for evidence of the existence of man during the period of their deposition. What we have to ask is, are there *any* well-authenticated cases?—and I think we must admit that there are.

Prof. Boyd Dawkins' note, referring as it does to several cases which I have not had an opportunity of examining, usefully supplements and supports the arguments I have adduced.

Mr. Harrison will find recorded plenty of instances of the large mammalia in northern regions being caught by river floods, or in the ice, and perishing in herds. Although this may occur only now and then, it is part of the ordinary operations of nature there. When I said they went out one by one, I was not referring to individuals, but to species (races and groups). To follow the theories propounded by Mr. Harrison would lead me too far from the points I proposed to deal with in my paper.

Mr. Mello raises some interesting questions, which I fear cannot at present be answered, among them the reason of the gap between the Palæolithic and Neolithic periods. There are some things which lead one to infer that the Palæolithic type, though it went back very far, also came down to Neolithic times; as, for instance, the occurrence of so many Palæolithic forms among the misfits of Grime's graves near Brandon, in Suffolk, and the Palæolithic implements scattered over the surface at La Ganterie, near Dinan, in Brittany.

Mr. Pattison would find among the causes now in operation full explanations of floods and debacles sufficient to fill many a valley with coarse *débris*. When a flood dammed for a time some of the upper waters of the Rhone, and then they broke loose upon the valley, filling it, as I myself saw, with rocks and stone; when a thunder-storm had burst upon a small hill-side in Westmoreland, and I saw the greater part of a field covered in two hours with gravel 10 feet deep,—all this was but the common way of rain and river denudation. But we know that kind of *débris* when we see it, and it is not in that kind of gravel that the implements I referred to were found, still less in a gravel showing any evidence of having been transported by great rushes of water due to violent earth-movements.

I regret that the Member writing from Cirencester has been unable to find evidence in that district to satisfy him as to the mode of formation of the Thames and other similar valleys, but I doubt not that the views I have put forward on this point will on further inquiry be more generally admitted.

The vagueness referred to by Dr. Southall arises, I think, from this, that I assume as proved certain views in physical geography with which he does not agree, and, therefore, the figures on which he relies cannot be applied to the statement of observations as given by me. For instance, I hold that broad valleys are formed by the rivers winding from side to side along the flatter parts, but that a river never runs in a shallow stream evenly covering the whole of the bottom of a valley. Again, I never knew a river with a uniform fall along its whole length, and believe that a slope of much less than a foot per mile along the flatter parts, with a fall of 6 or 10 feet at the rapids, would cut back a valley, though there might be no denudation going on, except at the rapids. The general principle upon which I lay so much stress, that a river cuts back at the rapids, and that the denudation of valleys is chiefly due to that kind of action, has received ample illustration this year. I have known the rapids cut back in some of our Welsh rivers many yards in the recent heavy floods. Nor can I follow Dr. Southall in his explanation of the formation of loess and gravels. The loess, or brick-earth, may be seen after floods have spread over the lowlands; as, for instance commonly in the rivers which run into the Humber, Wash, and Thames estuary, and is only the mud which has settled down from the flood-water when it has been allowed to stand and the sediment to settle. This is a well-known phenomenon, and is directed and turned to account in the process of warping. But the gravel requires water running at a high velocity to transport it, and cannot be spread at one and the same time over the whole valley.

Mr. Whitley confines his remarks to the question whether the objects appealed to in evidence are really the work of man or not, and refers to a collection I made many years ago to illustrate the probability that man, first adopting common natural forms, then modifying these, had the fashion of his tools suggested by nature. Mr. Whitley objects to receive my evidence that a finished weapon is the work of man, because I have stated that I have found specimens which I thought were natural forms, but which had received a blow or two which made them more likely to be useful, and because I would not venture to say whether those blows were accidental or given designedly by man. If I see a stone chisel-dressed all over, and recognize it as the work of man, because I have seen man make such things, but have not known them produced by nature, and I see also a weathered fragment under a crag broken by frost and fall, and I say I have no doubt that it has been broken by natural causes, is my evidence about these of no value because I refuse to say whether another piece which I find by a road is altogether natural or roughly-hewn by man?

APPENDIX.

Mr. JAMES PARKER, F.G.S., in a paper upon "The Valley of the Somme," read before the Ashmolean Society at Oxford, said that :—

"It was not a part of his task then to explain the phenomena of the Somme valley ; but with that map before him he felt called on to say a few words as to the operations which he thought it suggested. He might add that the view he took was based not only on the data then before them, but upon the study of the levels of the Ordnance Survey in a much more minute degree than was represented by the figures on his diagram, and beyond this by many a tramp over the hills in question, sometimes in geological excursions, more often archæological. The great parallel lines of rivers, the furrows as it were stretching in a direction similar to that of the sloping chalk, suggested that the river valleys belonged to the operations consequent on the upheaval of the great mass of chalk from its ocean bed. He compared the result with what any one might see on any argillaceous shore, where the base was impervious and yet soft. The descending tide left channels and furrows, by which the surface was drained, but afterwards modified in character by evaporation and exposure to atmospheric influence. The great chalk expanse of a hundred miles was enormous in comparison to the few yards of a tidal shore, and so were the valleys of 100 and 200 feet depth to the little drifts of 2 or 3 inches. But this was not all. If it were argued that the effect was not proportionately sufficient, it might also be reasonably replied that the emergence of this vast chalk-bed from the ocean was probably not of that passive character which belonged to a tide receding from the shore ; but it might well have been the result of active elevation of the chalk, and such elevation could scarcely have been unaccompanied by fissures and inequalities which, as a rule, would lie, as regards their greater intensity, in lines at right angles to the main axis of elevation. That was just what those valleys did, and the minor fissures represented by the smaller ravines lay again in a general sense at right-angles to them, as might be seen by a glance at the Ordnance map before them, on which the valleys were slightly tinted. The general aspect of the Somme valley and its tributary ravines pointed distinctly to operations connected with the rising from the ocean-bed. Whether that took place in tertiary or post-tertiary times, whether once or more than once, were not questions with which he had now to deal. All he would lay stress on was that those rivers and valleys, and among them the Somme river and Somme valley, did not owe their origin to the slow excavation of river action, and therefore the assumption of that action, as a measure of time in connection with phenomena which the valley presented, was an absolute error."

Mr. Parker's paper, referred to at page 331, will be found quoted at length in Volume VIII. of the *Transactions of the Victoria Institute*.

NOTES.

THE following extract from the notes to the preface of Vol. xii. of the *Journal of Transactions* of the Victoria Institute seems fitly placed at the conclusion of the present volume :—

1. Age of the EARTH :—Chief Justice Daly, LL.D., President (for 1878) of the American Geographical Society, referring to this subject and a careful collocation thereon of the views of Astronomers, Geologists, and Physical Geographers, said, it was found that there was “a wide diversity of opinion between them upon the question of time—a diversity so irreconcilable as to show that our knowledge is not yet sufficiently advanced to admit of any reliable theory as to the age of the Earth.”

2. With regard to the bearing of recent Geological discovery upon the statements of Scripture, more than one paper and discussion referring thereto appear in Volume xiii. The following opinions will not be without their interest to many :—

“We need not, in accepting the Bible narrative of man’s creation, repudiate one fact accurately deduced from modern scientific research.”—*The late Radcliffe Observer* (R. Main, 1878). *Relig. Hist. of Man*, p. 5. (See also Preface, *Trans.*, vol. xi.)

“Nothing can exceed in truth and grandeur these words (*Gen. i.*) of the inspired historian, * * the most keen-eyed hypercriticism could see nothing to object to.”—*Ibid.*, in *Aids to Faith*. (See also *Trans.*, vol. xi. p. 431.)

“With regard to Physical Science, I think we have seen that its real advances are in favour of Religious Faith.”—*Ibid.*, *Trans.*, vol. x., p. 174.

“The language of Scripture neither is, nor can be, * * contrary to the language of Science.”—Professor Challis, M.A., F.R.S., F.R.A.S., Plumian Professor of Astronomy at Cambridge. *Trans.*, vol. ix. p. 140.

“The Bible abounds in illustrative references to natural objects and phenomena, * * these are remarkable for their precise truth to nature.”—Principal Dawson, LL.D., F.R.S. *Trans.*, vol. ix. p. 173.

“The great discoveries as to the physical constitution and probable origin of the universe, the doctrine of the correlation and conservation of forces, * * these, and many other aspects of the later progress of Science, must tend to bring it back into greater harmony with revealed Religion.”—*Ibid.*, in *Origin of the World*. (See also Preface, *Trans.*, vol. xi.)

“There has never been produced in my own mind * * the slightest impression that we (he, and those who studied under him) were considering facts and laws in any way opposed to Christian Faith, to the inferences of Natural Theology, or the deductions from Scripture.”—The late Professor Phillips, F.R.S., speaking of his duties as Professor of Geology at Oxford. *Aids to Faith*. (See also *Trans.*, vol. xi. p. 432.)

“We all admit that the book of Nature and the book of Revelation come alike from God, and that, consequently, there can be no real discrepancy between the two, if rightly interpreted.”—Professor G. G. Stokes, M.A., F.R.S., &c., Secretary of the Royal Society. (See Preface, *Trans.*, vol. v.)

See also the very important paper read by Professor Stokes, F.R.S., before the Church Congress in 1879.

ORDINARY MEETING, MAY 5, 1879.

THE REV. G. CURREY, D.D., MASTER OF THE CHARTERHOUSE,
IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

HON. LOCAL SECRETARY :—Rev. H. Finlay, M.D., Limasol, Cyprus.

ASSOCIATES :—A. J. Arnold, Esq., London ; P. Stewart Macliver, Esq.,
Weston-super-Mare.

Also the presentation of the following Works for the Library :—

“Proceedings of the Royal Society.”	<i>From the same.</i>
“Proceedings of the Royal Geographical Society.”	<i>Ditto.</i>
“Proceedings of the Royal United Service Institution.”	<i>Ditto.</i>
“Charing-Cross Magazine.”	<i>From T. Greenwell, Esq.</i>

A lecture on the “State of the World at the Advent (or commencement of the Christian Era”), was then given by Professor W. Lee, D.D., of Glasgow University. A discussion ensued, in which the following took part :—The Chairman, D. Howard, Esq., F.C.S. ; the Reverends W. Berry, M.A., R. W. Ground, F. N. Oxenham, M.A., and T. M. Gorman, M.A. ; the author having replied,

The meeting was then adjourned.