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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 Peploe, B.A., London.

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

"Proceedings of the Royal Society."	*From the same.*
"Proceedings of the Royal United Service Institution."	*Ditto.*
"The Defence of Virginia." By Professor Daubeny.	*Ditto.*
"Life of General (Stonewall) Jackson." By the same.	*Ditto.*
"Church History." Ditto.	*Ditto.*
"Theology." Ditto.	*Ditto.*
"Sensualistic Philosophy of the XIX. Century." Ditto.	*Ditto.*

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.

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* 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.

‡ *Palæontological 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

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* *Notes on Recent Notices of the Geology and Palæontology 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.

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* 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

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* *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

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* 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.

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100 000 according to Mr. Pengelly, or 200,000 according to the Guide.

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

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* 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

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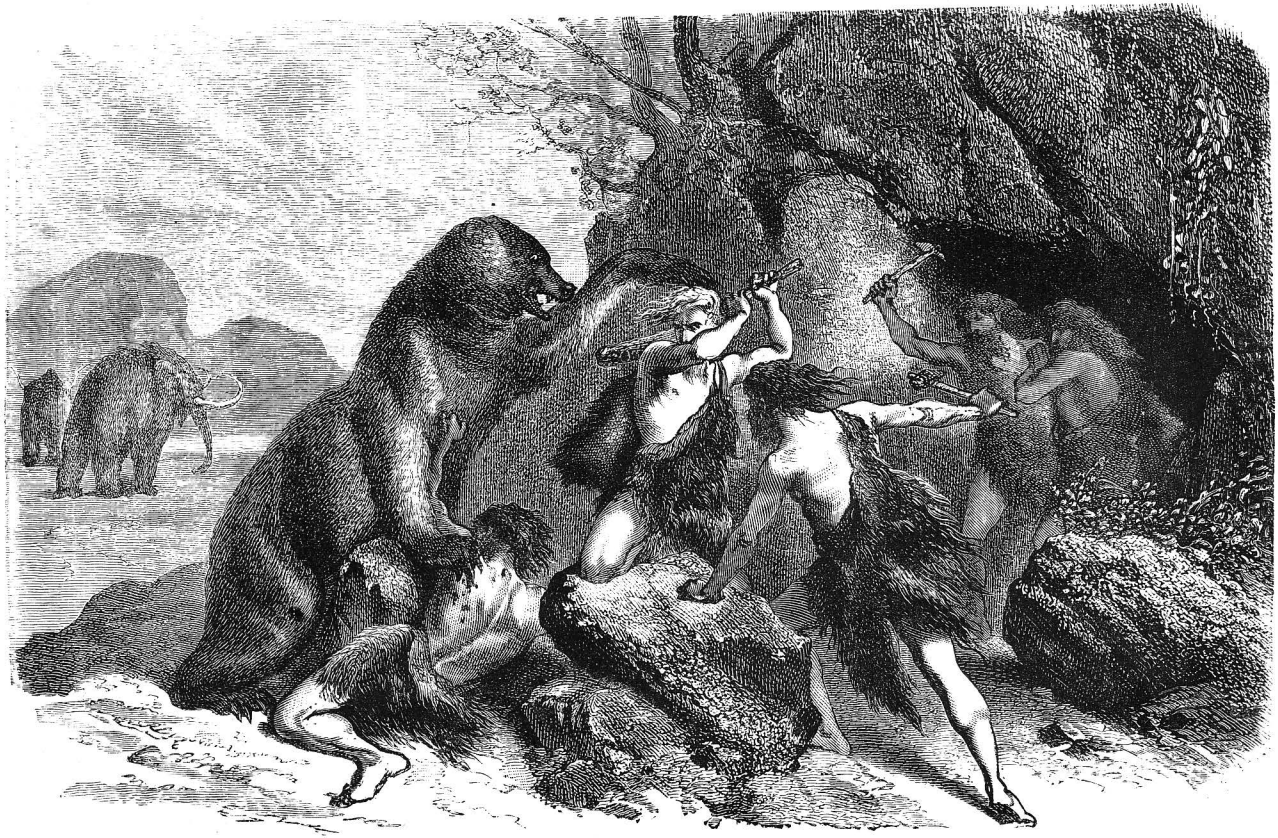
* See Appendix B.

† McEnery, p. 73.

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

"Titanibus illa,
Sed paucis fabulosa domus quibus uda ferarum
Terga dabant vestes, cruor haustus, pocula trunci,
Antra lares, dumeta thoros, cœnacula 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 laminæ 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 laminæ 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*

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* Comp. p. 15. † *Lit. K.C.*, p. 51. ‡ *Lit. K. C.*, p. 42.
§ *Geology*, p. 27. ‖ *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-

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* *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

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* *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 laminæ 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

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* *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 exuviæ 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 McEnery 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 McEnery'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.

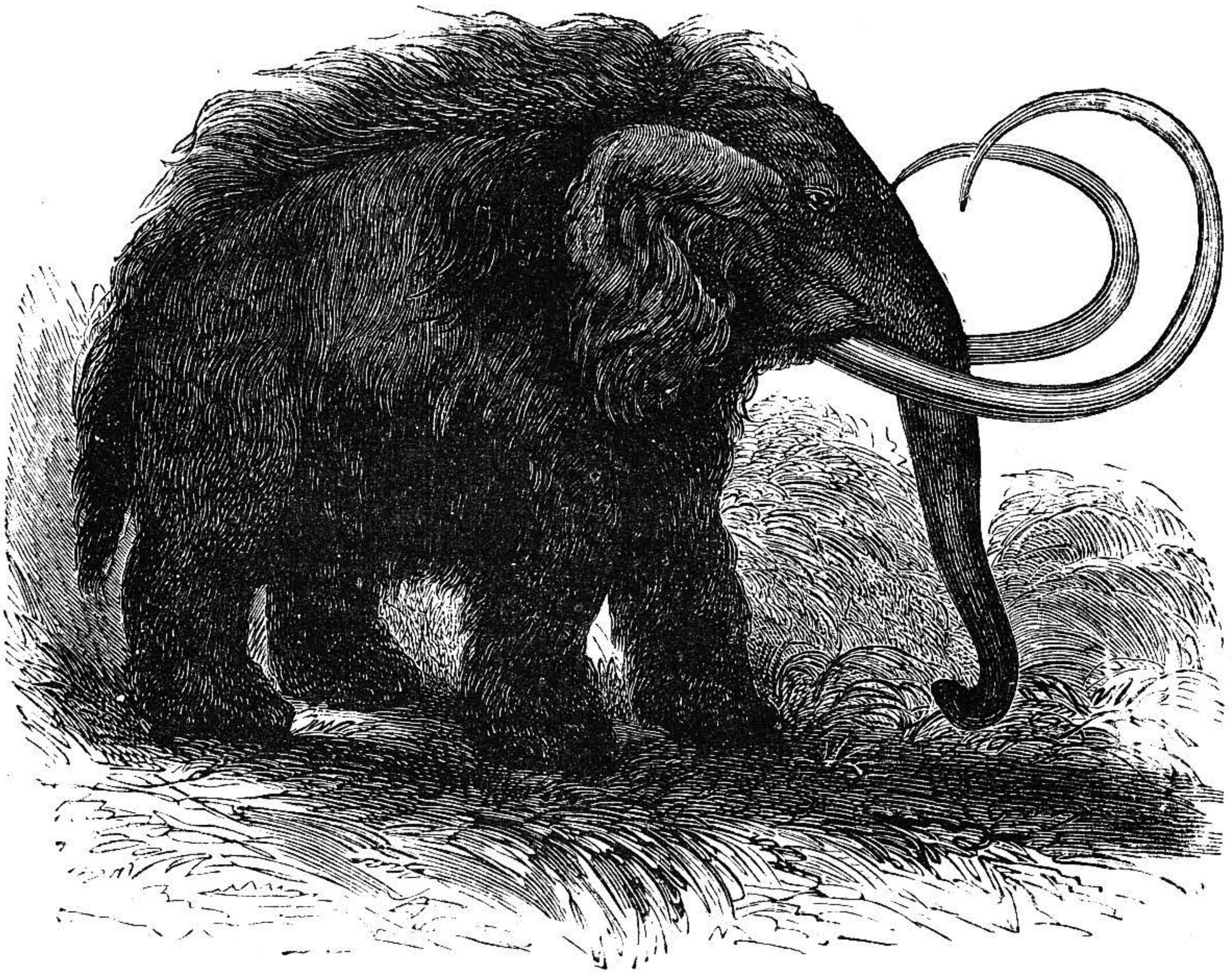
The Mammoth, *Elephas primigenius* (Blumenbach), was, as we have seen, contemporary with man. I have in a previous paper shown a very well-designed representation of this creature, sketched on ivory from a living specimen.

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 Behemoth 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



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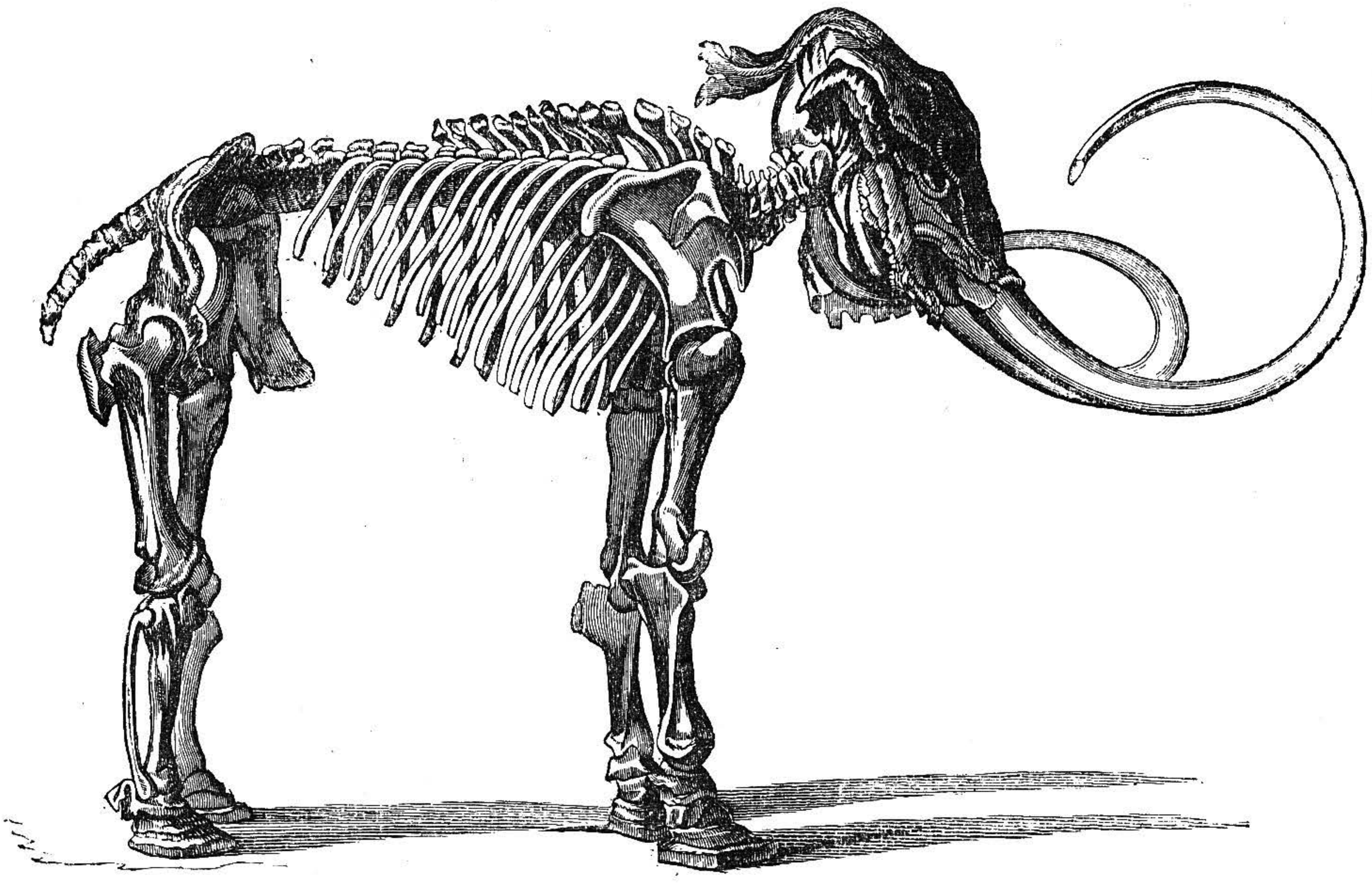
* The Seventy translators, not understanding this, have rendered *Behemoth* by θηρία in ver. 10, followed by the singular αὐτοῦ in ver. 11.

*** 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*

* יִגַּשׁ חַרְבּוֹ 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 Shalmanezer 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,

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* 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

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* *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?

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* 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.

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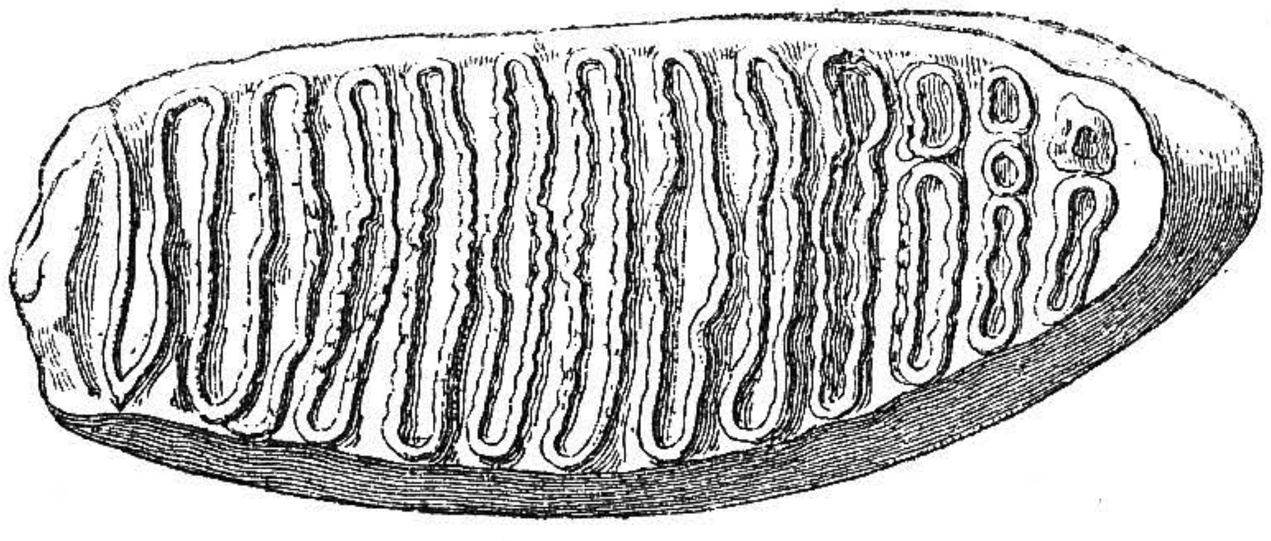
* D'Orbigny, tome iii. pp. 80, 254, 273, &c. † See Hebrew.

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

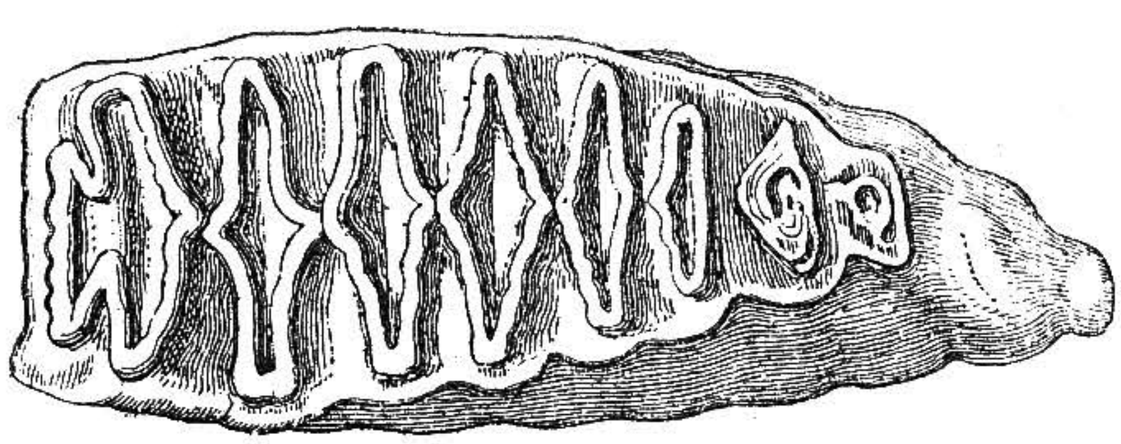
It may be inquired how it is possible that the term *Behemoth* could be applied to any creature that may seem to have perished from off the earth so many centuries before the book of Job can be supposed to have been written. My reply to this is, in the first place, that many of the associated animals, 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 Eschcholtz Bay to the shores of the Gulf of Mexico. Making due allowance for the interference of the

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* "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.

† See Appendix E.

‡ Falconer, vol. ii. p. 289.

§ 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

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* 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

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* *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 serials 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!

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* 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 envellopait 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 temoin 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 *fluviatile 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 carcases 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 *saumâtres* 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, pourquoi, 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 *fluviatile 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 fluviatiles 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 coincidence 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 fluviatile 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

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* "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 rameneront 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?—

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* *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.
"Etudes 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 Devonshire." By W. Pengelly, F.R.S. Teignmouth, 1874.
"The Antiquity of Man in the South-west of England." By W. Pengelly, 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, Devonshire," 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 Devonshire." 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."

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* 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, 1*st 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

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"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

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* 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 faras 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 1½ 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.