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JOURNAL OF  
THE TRANSACTIONS  
OF  
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OR  
Philosophical Society of Great Britain.

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

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## ORDINARY MEETING, FEB. 6, 1882.

J. E. HOWARD, ESQ., F.R.S., V.P., IN THE CHAIR.

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

MEMBER :—Miss E. Isis Pogson, Meteorological Superintendent and Assistant Government Astronomer, Madras.

ASSOCIATES :—Rev. F. Chambers, M.A., Oxon, Brighton ; Rev. Canon E. Garbett, M.A., Barcombe ; Rev. W. E. Heygate, M.A., Oxon, Isle of Wight ; J. Kitchen, Esq., London.

HON. LOC. SEC. :—Rev. W. H. Hobart, B.A., Londonderry.

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

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|---|-----------------------|
| "Proceedings of the Royal United Service Club."   | <i>From the same.</i> |
| "Proceedings of the Royal Geographical Society."  | <i>Ditto.</i>         |
| "Mikrostruktur der Steinkohle." By Prof. Reinsch. | <i>Ditto.</i>         |
| "Philosophie Organique." By Dr. Doherty, Paris.   | <i>Ditto.</i>         |

The following paper was then read by the Author :—

*BREAKS IN THE CONTINUITY OF MAMMALIAN LIFE IN CERTAIN GEOLOGICAL PERIODS FATAL TO MR. DARWIN'S HYPOTHESIS OF EVOLUTION.\** By T. K. CALLARD, Esq., F.G.S.

SIR JOHN LUBBOCK, in his Presidential Address to the British Association at York, called attention to the change that had come over the minds of naturalists since the publication in 1859 of Mr. Charles Darwin's *Origin of Species* ; and Professor Huxley, in his discourse on Palæontology, at the same meeting, says, of the hypothesis of evolution, "that the palæontological discoveries of the last decade are so completely in accordance with the requirements of this hypothesis, that if it had not existed the palæontologist would have had to invent it." What is the hypothesis of evolution ? It is, that all the higher forms of life (man included) were

\* This paper was read during the lifetime of Dr. Darwin.—ED.

evolved from some low ascidian form of mollusk through a long line of diversified forms by insensibly fine gradations.\*

2. Confining my attention to the life of mammals, it will be my object to show the high probability that at certain geological periods there were such breaks in the continuity of that order of life that fresh creations became a necessity, and, if so, as a consequence the hypothesis of evolution cannot be true.

3. Professor Huxley "would not venture to say that it is *impossible* that the multitudinous species of animals had been independently originated by an endless succession of creative acts. . . . but that it was so astoundingly *improbable* that he felt compelled to adopt the hypothesis of evolution."

4. It is 'not my intention to-night to discuss the question *theologically*, but I will content myself with saying that, admitting the existence of an Almighty and All-wise Creator, no amount or variety of creative acts is to my mind astoundingly improbable.

5. The doctrine of evolution, like that of the antiquity of man, is by many being quietly assumed, under the impression that it has been scientifically proven. But the evidence for the antiquity of man has had to be reconsidered, and that reconsideration has greatly shaken the foundations upon which the doctrine has been built; as Principal Dawson says, "The tide is decidedly turning as to the antiquity of man . . . and the Institute [the Victoria Institute] has certainly done its part in contributing to this result."† And I would just remark in passing, that in the absence of man's antiquity, evolution (so far as man is concerned) is impossible. On the hypothesis of Charles Darwin ten or twenty thousand years would be but a fraction of the time that the *minute* changes of his theory demands.

6. But to come more directly to the subject before us. The probable breaks in the continuity of mammalian life in certain geological periods. Let us first examine the Pleistocene.

7. By some geologists the Pleistocene is considered the equivalent of the Glacial period, whilst others suppose that the Glacial period formed but a part of the Pleistocene, Professor Dawkins placing it at an earlier, and Principal Dawson at a later, part; but for our purpose it will not be necessary to determine which is correct.

8. The last ten years have greatly enlarged our knowledge of the extent of the Earth's glaciation during the Ice age, so

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\* Darwin's *Descent of Man*, vol. ii. pp. 389-390.

† Vol. xv. p. 208.

much so, that when the evidence is before you it will be a reasonable question to ask whether or not the Glacial and immediate Post-Glacial conditions did not necessarily produce such a break in the continuity of mammalian life as to be fatal to Darwin's hypothesis?

9. Professor Ramsey, Director-General of the Geological Survey of the United Kingdom, says, of the British Islands in the Glacial epoch, "that they were in great part covered by glacial ice, probably as thick as that of the north of Greenland at the present day";\* that when the most extreme cold prevailed, the mountains of Scotland were covered with ice; that the glaciers flowing eastward from the Highlands met a vast body of ice coming westerly and southerly from Scandinavia, whilst the ice travelling westward from the Highlands overspread what is now the Island of Lewis and other islands of the outer Hebrides; that a thick ice-sheet from the Grampians overspread the valley of the Tay, and, crossing the Ochil Hills, invaded the valley of the Forth.

10. Professor James Geikie endorses all that Professor Ramsey says upon this subject, for, when writing upon "Changes of Climate during the Glacial Epoch," he says that "every part of Scotland, with the possible exception of a few peaks or tips of the loftiest mountains, has certainly been buried underneath snow and ice"; † and, in delivering the presidential address to the "Perthshire Society of Natural Science" in March last, he directed attention to the glacial striations detected on the Sidlaws and Ochils, which, he says, "proves that all this region [that is, Perthshire] was formerly buried underneath ice, which overflowed from the Highlands, sweeping across hills up to the height of 3,000 feet, and pressing out in a general south-east direction." ‡

11. Professor Jamieson, F.G.S., of the University of Aberdeen, found evidence of ice having deposited boulders in Scotland on summits 2,000 to 3,000 feet high; but he attributed the action not to that of glaciers, but to floating icebergs. He says that it tells the tale of all Scotland having been at that time under water: Professors Ramsey and Geikie would say under ice; but whether under water or under ice the conclusion drawn by Professor Jamieson would be equally correct. "It involves," he says, "as a consequence, that the present flora and fauna [*i.e.*, of Scotland] date from the Drift period." §

\* *Popular Encyclopædia*, article "Geology."

† *Geological Magazine*, 1872, p. 548.

‡ *Perthshire Advertiser*, March 10, 1881.

§ British Association, 1859.

A break, you will observe, in the continuity of mammalian life in Scotland.

12. England, Ireland, and Wales afford similar evidence. Professor Phillips has traced erratics from Cumberland over a large part of Yorkshire, extending to a height of 1,500 feet above the sea. At Macclesfield I examined a boulder which had travelled from the same district of Cumberland. It had crossed Westmoreland and Lancashire, a distance of nearly 150 miles, and to remove it to the People's Park in Macclesfield, from the field where the ice had left it, eighteen strong horses were required. Professor Ramsey says \* that the greater part of the low-lying land of Great Britain and Ireland was, at that time, buried in and moulded by glacial ice, till at length a slow submersion of the land took place. And it will be remembered that the Duke of Argyle, in writing to this Institute upon a paper read by Professor McKenny Hughes, of Cambridge, expressed the wish that the attention of geologists might be drawn more particularly to the admitted fact of sea-gravels at a high elevation on our Welsh and Scottish mountains. And amongst other observations made by his Grace was this, that it was his belief that a submergence under the sea, to the extent of 2,000 feet, had been one of the latest of geological changes, and that during this submergence glacial conditions prevailed over a large part of what is now Europe. The expressed wish of the Duke of Argyle was met by Professor Hughes, who, in the following year, 1880, read before this Institute a valuable paper upon "The Evidences of the later Movements of Elevation and Depression in the British Isles," and adduced evidence from Trimmer, Darbyshire, Lyell, and others, of marine deposits in Wales at heights varying from 1,370 to 1,800 feet, making it clear that the submergence was approximately what his Grace supposed. At 1,250 feet above the sea, Professor Prestwich found similar deposits at Macclesfield; and at 1,200 feet above the sea marine drift of the Glacial period rests upon the hills of Wexford. If, then, the submergence spoken of by Professor Ramsey, was to the extent referred to in the above evidence, must I not say of Wales, England, and Ireland, what Professor Jamieson said of Scotland,—“that the present flora and fauna date from the Drift period”? Are not the conditions such as to make it probable that there would be a break in the continuity of mammalian life in the British Isles?

13. Dr. Page, author of the text books on geology referring

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\* *Popular Encyclopædia*, article "Geology."

to Britain and the North of Europe at this period, says, that "the large mammalia of the earlier tertiaries disappeared and the land was submerged to the extent of several thousand feet." \*

14. We have evidence, says Mr. Charles Darwin, † of almost every conceivable kind, organic and inorganic, that "within a very recent geological period, central Europe . . . suffered under an Arctic climate, and that the ruins of a house burnt by fire do not tell their tale more plainly than do the mountains of Scotland and Wales tell their tale of glaciation," and the evidence he traces from the west of Britain to the Ural range. Crossing the English Channel, Sir Henry de la Bèche ‡ found good evidence that the north of France had been 1,000 feet at least beneath the icy sea, whilst Mr. Darwin traces the evidence of Arctic conditions to the Pyrenees. On the Jura limestone range I measured an erratic block of granite, 60 feet long, by 40 feet wide and 23 feet high. The granite is peculiar; it contains talc in the place of mica, which rock is not found *in situ* within sixty or seventy miles of this boulder. It must have been transported from the Mont Blanc range of the Alps. Sir Roderick Murchison supposed that this and other erratics on the Jura were floated when the great strath of Switzerland was under water. He thought that the granite blocks were borne on ice floats, but Sir Charles Lyell and geologists generally believe that they were carried on the breast of an enormous glacier, as some of us have seen blocks of granite being carried at the present day. I have tried on the spot to trace the course that the glacier must have taken down the Rhone valley, cross Lake Lemman, where now stands the Castle of Chillon, and then over the hills that range at the back of the lovely Vevey and across the country to the present Lake of Neufchâtel, where 800 feet above the lake lies the erratic block in question. I have been on many Alpine glaciers and been overawed with their majesty, but the largest of them is insignificant when compared with the glacier that could have carried this and other blocks of granite from the Alps to the Jura. At that time all Switzerland, except its mountains, must have been under ice, and its fauna must have for the most part perished, as the Alpine ranges would prevent a southern retreat. As we might expect, the Alps not only sent forth their glaciers northward, but also southward, covering the plains of Italy. Mr. Darwin calls attention to the altered

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\* Dr. Page, *Text Book of Geology*, p. 161.

† *Origin of Species*, sixth edition, p. 330.

‡ De la Bèche, *Geological Observer*, p. 256.

climate of Northern Italy, and to the fact that gigantic moraines of old glaciers are now clothed by the vine and maize, and Swiss geologists have found Alpine blocks far down into the plains of Lombardy. Still, travelling south and crossing the Mediterranean into Africa, there Dr. Hooker found evidence of ancient glaciers in the Atlas Mountains, and Mr. G. Mawe, who travelled with him, said of the old moraines he there met with, "they tend to confirm the opinion entertained by many geologists that the refrigeration during the Glacial period was almost universal."\* A little further south, Sir Charles Lyell is my authority for saying that "in one part of the Glacial period the desert of Sahara was under water between latitude  $30^{\circ}$  and  $20^{\circ}$  [a breadth of nearly 700 miles], so that the eastern part of the Mediterranean communicated with that part of the ocean now bounded by the west coast of Africa."† Any farther retreat of the mammalia southward on the African continent would have been effectually cut off.

15. We may have to wait for years for a full geological survey of Asia, but the evidence we have on this subject is in harmony with that of Europe and Africa. Boulder drift was found by Dr. Hooker on Mount Lebanon,‡ and its celebrated cedars growing upon ancient glacial moraines, whilst Mr. Gifford Palgrave met with vestiges of the Glacial period in the neighbourhood of the upper Euphrates. And along the range of the Himalaya, at points 900 miles apart, Mr. Darwin says that glaciers have left their marks of former low descent.

16. We will now leave the Eastern Hemisphere, and see how the evidence stands on the Western. From the report of the geological survey of Illinois, we learn that this State, extending from  $42^{\circ}$  to  $35^{\circ}$  N. lat., with an area of 55,000 square miles has its undulating prairies, everywhere covered with ice drift, leaving unmistakable evidence that flotillas of icebergs have made their way across its extended plains. This corresponds with what Professor Hitchcock said many years ago of Massachusetts. His words are: "The conclusion to which I have been irresistibly forced by an examination of this stratum in Massachusetts is, that all the diluvium which had been accumulated by various agencies has been modified by a powerful deluge sweeping from the north and north-west over every part of the State, not excepting its highest mountains."§ I need not remind you of the law by which water finds its own

\* Dawkins' *Cave Hunting*, p. 387. Quoted from *A Journey to Morocco*.

† Lyell, *Principles of Geology*, 11th edition, p. 253.

‡ Hooker, *Natural History Review*, p. 12, 1861.

§ *Geology of Massachusetts*.



level. I may not have the same detailed evidence about all the American States; but, if water flowed over the highest mountains in Massachusetts, we know that it filled all the valleys, and covered the uplands, of the other States that were at a lesser altitude than the Massachusetts mountains. Principal Dawson, of Montreal, referring to the great subsidence, says, "Lower levels of the continents were covered with ice-laden water, and the higher regions were occupied with permanent snow and glaciers; 4,000 feet or more in elevation went under water. Then there was a gradual, though intermittent, elevation. The glacial age," he remarks, "proved fatal to a large proportion of the land-life of the previous periods." "On the western side of the Rocky Mountains," Professor Archibald Geikie says, in the July number of *Macmillan's Magazine*, that "over thousands of square miles the strata remain practically unchanged from their original horizontal position; that the country has not been under the sea for a vast succession of geological periods. It has not been buried, like so much of Northern Europe, and North-eastern America, under a thick cover of ice-borne clays and gravels." The land on the west of the Rocky Mountains may not have been submerged to the extent of bringing those parts under water, but Professor A. Geikie, when descending Uintah Mountains, on reaching the valley-bottom, found abundant traces of vanished glaciers in the form of perfect crescent-shaped moraine mounds,\* and "on these were strewn huge blocks of red sandstone, borne of old on the surface of the ice from far crags on the skyline," and this far below the altitude where bushes now bear ripe fruit, which reminded the travellers of the wild gooseberries at home.

17. Darwin says, "Throughout a large part of the United States erratic boulders and scored rocks plainly reveal a former cold period."†

18. Agassiz corroborated the evidence already given of the surface of North America, as well as that of the North of Europe, being covered by the sea, after the ice that carried the erratics had melted away; to which he adds "that it was not until after this period that incontestable traces of the species of animals now living were to be found."‡

19. And, if we travel farther south to Central America, the same kind of evidence there awaits us. The late Mr. Thos. Belt,

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\* *Macmillan's Magazine*, "In Wyoming," p. 239.

† *Origin of Species*, sixth edition, p. 330.

‡ *Principles of Zoology*, p. 236.

F.G.S., in the *Quarterly Journal of Science*, October, 1874, says, "The glacial systems had reached, in the tropics, at least as far as Nicaragua, where, within thirteen degrees of the equator, I found undoubted traces of glacial action to 2,000 feet above the sea level where snow now never falls."

20. The same author, in his *Naturalist of Nicaragua*, relates a journey from San Rafael (only about eight degrees from the equator), and says that boulder clay extended the whole distance of the journey, and that ranges of hills appeared to be composed entirely of it. "I was unprepared," he says, "at the time to believe that the Glacial period could have left such memorials of its existence within the tropics, at not greater elevation above the sea than 3,000 feet."\* Equally unprepared was Mr. Alfred Russell Wallace to suppose that he had found an erratic more than 20 feet in diameter within less than *half a degree* of the equator. It was on a slight eminence, and so perched, that its being deposited there by a grounded iceberg is the only explanation that he can offer. It was not until further evidence was afforded of glacial action in the valley of the Amazons that he could be satisfied with his own explanation. (Compare "Travels on the Amazon," p. 219, with "Ice Marks in North Wales," *Quarterly Journal of Science*, January, 1867.) Mr. Alfred Wallace and M. Louis Agassiz were at the antipodes on the question of evolution, but were at one on the evidence of ice action at the equator. And Mr. Alfred Tylor, who has written upon the evidence and cause of changes in the sea-level during the Glacial period, has, in this room, expressed his belief in signs of glaciation in equatorial Africa.†

21. Nor is the evidence of the Glacial period confined to the Northern Hemisphere, for at about the same degree south of the equator that the British Isles are north, both Mr. Alfred Wallace and Mr. Charles Darwin found evidence of its former existence. At Tierra del Fuego and at Patagonia glacial drift is found at elevations of 1,400 feet, about the same height as it is found at Wexford. Mr. Charles Darwin quotes the evidence of Dr. J. Haast and Dr. Hector in proof of former glaciers at a low level in New Zealand, whilst, from facts communicated to him by the Rev. W. B. Clarke, he is satisfied that there are traces of the same conditions in the south-east of Australia; whilst Agassiz, in his travels in Brazil, and in the valley of the Amazons, traces the phenomena of glacial

\* *Naturalist in Nicaragua*, pp. 247, 248, 273, 274.

† *Transactions of Victoria Institute*, vol. x. p. 29.

drift almost up to the equator. He says, "Now that I have seen the whole length of the Straits of Magellan, have passed through Smith's Channel, and visited Chiloe, I am prepared to maintain that the whole southern extremity of the American continent has been uniformly moulded by a continuous sheet of ice; everywhere we saw the rounded undulating forms so well known to the student of glacial phenomena as *roches moutonnés*. In Smith's Channel there is no possibility of mistaking the evidence."\*

22. Madame Agassiz, who accompanied her husband in his journey in Brazil, says that "at 3° south of the equator he, Professor Agassiz, found undoubted moraines blocking up the valleys; and the evidence of glacial action was, to him, as clear as in the valleys of Switzerland, of Scotland, and of the northern states of America."†

23. And in Central Chili Mr. Darwin found, in one of the valleys of the Andes, a mound of detritus 800 feet in height, which he was afterwards convinced was an ancient glacial moraine; he also spoke of evidence of former glaciers on the sides of the Cordillera at the very equator.‡

24. And Agassiz concluded a lecture at the Cooper's Institute, New York, shortly before his lamented decease, saying, "The ice covered the sea to such an extent that it is a question whether any open water was left at the equator then, as it is a question whether there now is open water at the pole; and, if this be so," he says, "you see at once how this intense cold must have modified the surface of the globe to the extent of excluding all life from the surface."§

25. The evidence before us is that of geologists, and of some of the highest authorities in geological science. There exists, as is seen, a difference of opinion about how much of the devastation was the work of an ice-sheet, of enormous local glaciers, or that of submergence beneath an icy sea. The evidence appears to point to all these causes being in operation in different periods of the Glacial epoch. I may also notice the growing acceptance of the hypothesis of a Pluvial period immediately following the Glacial period, during which time Mr. Alfred Tyler (the propounder of the hypothesis) calculates a rainfall of 125 times that of the present, which filled some of the valleys and rivers with a thousand times their present volume of water, and, as a consequence, deluged the lower lands,

\* Letter to Professor Pierce, copied into *Nature*, July and August, 1872.

† *A Journey in Brazil*, by Madame Agassiz, p. 456.

‡ *Origin of Species*, first edition, p. 373.

§ *New York Tribune* December 30th, 1873.

destroying land life, if, indeed, any escaped the glacial conditions. And I would here remark that it does not require the intense cold of an Arctic climate to destroy a tropical fauna. Darwin sees this in the case of the flora, and says that it is difficult to understand how the tropical productions could have escaped entire annihilation. In the fourth edition of the *Origin of Species* he says, "I had hoped to find evidence that the tropics in some part of the world had escaped the chilling effects of the Glacial period, and had afforded a safe refuge for the suffering tropical productions";\* but, up to the time of his writing the fifth edition, he looked in vain for that refuge. If the tropical flora was annihilated, there remained a poor chance of survival for the tropical fauna. Without the care of man a tropical fauna would not, at the present time, live through many winters in the valley of Chamounix, and in that valley the glaciers do not come so near to the sea level as did the glaciers in Nicaragua and at San Rafael in the Glacial period, according to the evidence of the late Thomas Belt, who had made glaciers a part of his study.

26. All the geological evidence we possess relating to that period points to conditions that would render almost inevitable a break in the continuity of mammalian life, whilst the hypothesis of Charles Darwin requires that there should be *no* break, but that the present fauna should be the continuation of the older fauna with but slight modifications in the course of descent.

27. Gradual migration of the fauna southward as the increased cold came on has been suggested as a possible escape of the land life; but this would be very partial, for the mountain barriers, owing to the accumulation of ice and snow, would be much more formidable than they are now, and this southern migration would be impossible where submergence had commenced. The low lands would go first under water, and the natural retreat of the fauna would have no reference to points of the compass, but an ascent from time to time as the waters encroached; the subsidence still going on, the hills would eventually become islands. Ultimately, the lower hills would be covered with water, and the higher ranges would bring their glaciers to sea level, when they would be floated off as icebergs. Dr. James Croll remarks that where proper observations have been made we are forced to the conclusion that the connexion between glaciation and submergence is not accidental, but the result of some fixed cause,—that they

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\* *Origin of Species*, 4th edition, pp. 448, 450.

invariably accompany each other.\* The chances of migration would then be exceedingly small.

28. By the time Mr. Darwin wrote his fifth edition of the *Origin of Species*, Dr. James Croll had made public his hypothesis of the cause of the Glacial epoch. Mr. Darwin embraced the hypothesis, which is that either the Northern or the Southern Hemisphere, having its *winter* solstice in aphelion at a period of great eccentricity, the hemisphere in that position, in consequence of the earth's greater distance from the sun, would be in a condition of glaciation. If so, the glaciation of the hemispheres would alternate during successive periods of 10,500 years. In the fourth edition, Mr. Darwin had spoken of the cold of both hemispheres being simultaneous, and then felt the difficulty of understanding how the tropical productions could have escaped annihilation. The difficulty was removed if Dr. Croll's theory were correct; but, unconnected with the present question, I have given my reasons for believing that it is not correct, and Professor Birks † in this room corroborated my views. According to the hypothesis, the Southern Hemisphere ought now to be in a state of glaciation (if the eccentricity were sufficient), for the Southern Hemisphere has at present its winter solstice in aphelion, but the eccentricity is only 3,000,000 of miles. When the Northern Hemisphere was supposed to have had its last glaciation the eccentricity was 10,500,000. The question is often asked if the Southern Hemisphere is not a nearer approach to a glacial condition than is the Northern? The answer is in the affirmative, but not because of the three millions eccentricity, but on account of its larger volume of water. The mean annual temperature of the Southern Hemisphere is lower than that of the Northern, but the mean *winter* temperature is higher by 5°. ‡ It is not winter severity, but summer coolness, that makes the south what it is; the mean summer heat does not reach 60°, whilst that of the north is above 70°; an increased eccentricity would intensify the cold in winter (if it had any effect at all) and increase the temperature in summer, and so produce a climate more like that of the present Northern Hemisphere, which is not now under glacial conditions. Mr. Joseph Murphy well remarks that "an examination of the facts of physical geography shows that the extent of glaciation depends

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\* *Climate and Time*, p. 390.

† "Modern Geogonies examined in their bearings on the Antiquity of Man," *Transactions of the Victoria Institute*, vol. xiii. p. 16.

‡ *Distribution of Heat on the Surface of the Globe*.—Professor Dove, July 28th, 1852.

on the extent of perpetual snow, and perpetual snow means summer snow."\* But increase of eccentricity would lessen summer snow in the Southern Hemisphere, and therefore produce an effect the exact contrary of what Croll's hypothesis requires, and in the absence of that hypothesis there is no reason whatever for supposing otherwise than Charles Darwin did when he wrote the fourth edition of his book. The evidence being satisfactory of the glaciation in both hemispheres, the simultaneousness of that glaciation would occur in nature's course.

29. When the Glacial period had passed away and the land was re-elevated, Page says, "A new fauna and flora suitable to the new conditions were then established in Europe," † which harmonises with what Professor Dawkins says about the mid-Pleistocene mammalia differing from the early Pleistocene group by the incoming of species hitherto unknown, and amongst these man is to be reckoned. ‡

30. Man had no existence in pre-glacial times. Every attempt to prove otherwise has signally failed. Professor McKenny Hughes, although an advocate for the doctrine of man's antiquity, in reviewing the present state of the evidence bearing upon the question, emphatically says that "the evidence for the antiquity of man has completely broken down in all cases where it has been attempted to assign him to a period more remote than the post-glacial river gravels." §

31. Was man, then, a new creation or an evolution from an old fauna? Sir John Lubbock has reminded us in his late address that evolution does not mean that a sheep might turn to a cow, or a zebra to a horse. That no one would more confidently withstand any such hypothesis than would Charles Darwin, his view being not that the one could be changed into the other, but that "both are descended from a common ancestor." In the words of Darwin, "species have descended from other species by insensibly fine gradations." ||

32. Before the Glacial epoch man was not, but when it passed away, and a new fauna appeared, man was there. If this is to be explained by evolution, when did the evolution take place? Professor Dawkins founds his argument for the non-existence of man in Europe in the Pliocene period on the fact that in all Europe he can only find one solitary species of

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\* *Spectator*, May 2, 1874.

† *Elementary Handbook of Geology*, p. 133.

‡ *Early Man in Britain*, p. 134. *Ibid.* 91, 93.

§ "The Present State of the Evidence bearing upon the Question of the Antiquity of Man," *Transactions of the Victoria Institute*, vol. xiii. p. 327.

|| *Origin of Species*, p. 171.

Pliocene mammal that is now the associate of man, and he does not find a single specimen from the Miocene.

33. Man, says the evolutionist, was derived from some anthropoid ape. Did that ape struggle through the Ice period? If man was derived from the ape, the theory requires that at a certain point of time the ape should be so near to man, or the man to the ape, that it would have been impossible to say whether the mammal under consideration was man or ape. Darwin stakes his theory upon this. He says,—“If it could be demonstrated that any complete organ existed, which could not possibly have been formed by *minute successive slight modifications*, my theory would absolutely break down”;\* and Professor Dawkins endorsed what Charles Darwin says, in these words, that “between his [man’s] appearance in the Pleistocene age and the present day the time is too small to have produced appreciable *physical* or intellectual change.”† Immense time is asked for because of the *minuteness* of each successive change. Dryopithicus is claimed to be the most advanced of the ape kind (some of his bones may be seen in the new Natural History Museum); but Dryopithicus became extinct in the Miocene age, leaving the whole of the Pliocene to separate him from man; besides which, Professor Dawkins disclaims for the higher apes of the European Miocene and Pliocene period “any tendency to assume human characters”; he also admits “the first appearance of man as a man and not as a man-like brute.”‡ Dr. Virchow goes so far as to say,§ “We must really acknowledge that there is a complete absence of any fossil type of a lower stage in the development of man.”

34. One of the two oldest skulls known to us, the Engis skull, shows no inferiority to an average modern skull.

35. When, then, did the ape become a man by *minute successive slight modifications*, upon the correctness of which Charles Darwin stakes his theory of evolution. Was it in the Glacial period? I see no other time left for the change. How long, then, did the Glacial period last? Professor Boyd Dawkins, believing in the geological antiquity of man, would not place his first appearance on the earth as man at less than 200,000 years; and, if that is not long enough to produce any appreciable physical change, how long would it take to evolve man from an ape? Why, vastly longer than the Glacial epoch lasted, even upon Dr. Croll’s hypothesis, for the eccentricity which was supposed necessary to produce a Glacial epoch had come

\* *Origin of Species*, p. 239.

† *Cave Hunting*, p. 425.

‡ *Cave Hunting*, p. 425.

§ *Leisure Hour*, 1878, p. 334.

and gone in less than 200,000 years. If that period is not long enough to produce an appreciable change, 160,000 years added to it (which is Croll's estimate for the Glacial epoch) certainly would not convert an ape into a man. I am inclined, then, to say that Charles Darwin's theory has absolutely broken down. Broken down from want of time.

36. To the question, by what successive steps did man rise to the culture of a flint-chipping savage? The candid admission of Professor Boyd Dawkins is, that on this point there is no *evidence*. We can merely guess.\*

37. I have adduced much evidence respecting the Glacial period, and that evidence points to a necessary break in the continuity of life, and it will require more than a guess to take the place of that evidence. I do not profess to have proved the break to demonstration, but I think I have succeeded in showing it to a very high amount of probability, and, if a break, then man was created, not evolved.

38. Those who hold to the hypothesis of evolution would require to bring evidence of more than a few survivals from a pre-glacial period to account for a new fauna of *many* species in post-glacial times. Every species now living should have had its representative in pre-glacial times, seeing that there was not time during the Glacial period, nor since, to produce the change required by the hypothesis. Every form now living not so represented must have been a creation of post-glacial times.

39. I am now anxious to see what is the evidence on the other side, as it is vital to the hypothesis of evolution that there should be no *break*, and no post-glacial creation. Professor Huxley's pedigree of the horse is generally referred to as the most conclusive (it was mentioned in the President's address). The idea afloat is that Professor Huxley has proved the doctrine of evolution, so far as the horse is concerned, and the inference is drawn that what is true of the horse is, in all probability, true of all other animal forms.

40. Professor Huxley claims to have traced the horse back to the hipparion, hipparion to anchitherium, and anchitherium to orhippus. The pedigree is traced principally by the feet, the assumption being that all the various forms of the mammalian foot have been derived from animals with five-toed feet.

41. The bear and the horse (Professor Huxley's own illustrations)† are both mammals, and both constructed on the same

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\* *Cave Hunting*, p. 426.

† Lecture by Professor Huxley, London Institute, 1876, reported in the *English Mechanic*.



general plan, but with significant differences. The bear has two bones in the arm of each front leg, the radius and the ulna, and in each hind leg two distinct bones, the tibia and fibula; whilst the horse has these two bones coalesced in both front and hind legs. But the principal difference lies in the number of their toes. The bear has five toes on each foot; the horse has but one, with two small splint bones, which are named rudimental toes. The bear's middle toe answers to the horse's one toe or hoof. On the theory of development by natural selection and survival of the fittest, the two mammals in question are held to have descended from a common ancestry. The horse, being the differentiated animal, has to be traced back to an ancestor with the two bones in each leg and the possessor of five toes.

42. Professor Huxley has found, in an older stratum than the present, the hipparion with the two bones in each front leg, and with three toes (although only one reaches the ground); and in a still older stratum the anchitherium, with three toes, all of which reach the ground, all serviceable toes; and, still lower down, orhippus, with four toes on the front feet, and three on the hind feet. Upon this evidence Professor Huxley said "that he thought the chain of ascertained facts verified so far the doctrine of evolution, and justified him in saying 'he would not in future take the trouble to discuss that doctrine on *à priori* grounds.'"

43. In the judgment of Professor Huxley the evidence is demonstrative. He has said so, and entitles the third lecture of the "American Addresses" "The Demonstrative Evidence of Evolution"; and to the audience in Chickering Hall, New York, he said that evolution was as thoroughly proved as the Copernican theory.

44. If the doctrine of evolution is true, then the interesting facts brought under our notice by Professor Huxley are certainly in harmony with that doctrine; but it does not, therefore, follow that these facts in themselves prove the truth of the doctrine.

45. We are necessarily without a particle of collateral evidence that these divers-toed mammals descended from each other in the line indicated. This has to be assumed on the ground of their resembling construction and their following each other in order of strata,—Eocene, Miocene, Pliocene, Pleistocene.

46. But with a certain resemblance in construction there were also very marked differences. They differed from each other, not in the number of their toes only; hipparion differed from the present horse both in limbs and teeth; and anchitherium differed from hipparion as much as hipparion differed from the

present horse. It sounds almost like a slip; but Professor Huxley is reported to have said of the equines of the genus anchitherium found in the Miocene beds in Germany, France, and Greece, that they "differ *essentially* from the modern horse;" whilst orohippus was an animal about the size of a fox.

47. The probability of the correctness of Professor Huxley's pedigree of the horse would have been the greater if all the different types from orohippus to the living horse had been found on the same continent; but it was not so. Anchitherium is as far back as European deposits would carry Professor Huxley. For orohippus we have to go to the Rocky Mountains of America. It was there in the Eocene beds that Professor Marsh found orohippus, the assumed ancestor of the living horse. The old world, which had hitherto been considered the early home of the horse, knows nothing about the four-toed orohippus. This has led Professor Marsh to claim America as the original home of the horse, and Professor Huxley yields the claim.

48. But neither in America is the pedigree complete; for, whatever were the fossil forms, no living horse of any kind was there found. The existing horse of America was introduced from Europe.

49. Without wishing to depreciate the value of Professor Huxley's horse, I cannot help thinking that its pedigree would not be accepted at Tattersall's.

50. Again, the pedigree is incomplete on Dr. Huxley's own showing; for the bear has five toes on each foot, but we have not yet found the five-toed horse. Orohippus could only boast of fourteen toes altogether; but twenty toes are wanted to make the case complete.

51. Orohippus has since been discovered by Professor Marsh in a still lower horizon than orohippus; and, whatever may be the indications, it certainly has but the same number of perfect toes as orohippus, and Charles Darwin would not consider six toes short as a slight modification in the course of descent. His theory would require a vast number more gradual modifications before the common ancestor of the bear and the horse is reached. I submit that the pedigree is not complete; and, if it were, is it the evolution of the horse? The pedigree begins with what is assumed to be a horse, and ends with a horse. We must trace the horse back to an ancestor that is not a horse, before we are on the threshold of evolution. The pedigree of Professor Huxley's horse, if correct, is only tracing the varieties of the horse kind.

52. And this brings me to the Second break in the continuity of mammalian life.

53. Professor Marsh says that the native horses of America were all extinct, and that at a very early period. The presumed palæolithic man in America had no horses.

TERTIARY.	PLEISTOCENE.	POST GLACIAL GRAVELS. ..... GLACIAL BEDS.
	PLIOCENE.	
	MIOCENE.	
	EOCENE.	
		CHALK. .....
	CRETACEOUS.	UPPER GREENSAND. ..... GAULT. ..... LOWER GREENSAND.
		PURBECK BEDS. .....
	OOOLITE.	STONESFIELD SLATE. ..... RHAETIC BEDS.
	LIAS.	
		TRIAS.

54. Professor Marsh does not mention the glacial conditions as the cause of that extinction. He calls the extinction a mystery. To Principal Dawson it was no mystery; for you will remember that he said the land went under water 4,000 feet in depth, and that the glacial age proved fatal to a large proportion of the land-life. If so, does not that solve the mystery?

55. But, if the horse did survive that period, we come now to a still greater difficulty, a difficulty which is shared by all the great mammalian pachyderms of the Eocene period.

56. Professor Marsh, in his "Introduction and Succession of Vertebrate Life in America" (an address delivered before the American Association for the Advancement of Science, August,

1877) says that, "In the lowest tertiary beds in the country a rich mammalian fauna suddenly makes its appearance." The lowest tertiary beds are the Eocene. It was the Eocene and the lowest of the Eocene beds that yielded the remains of the fourteen-toed orhippus and eohippus. If, then, this rich mammalian fauna, which suddenly appeared, and orhippus and eohippus were not fresh creations, but evolutions, where do we look for their line of ancestors? (See Chart on previous page.)

57. The next stratum that we come to is the enormously thick cretaceous, consisting of the chalk, the upper green sand, the gault, and the lower green sand. I think I may say without the fear of contradiction that throughout the length, and breadth, and depth of the rocks of the Cretaceous age, no land mammals of any kind have ever been found in any part of the world.

58. Professor Marsh makes a similar statement, and says, "that this is especially to be regretted, as it is evidently to the Cretaceous that we must look for the fossil representations of any of our present groups of mammals as well as for indications of their more ancient lineage." But, however it may be regretted, there is the fact before us. Deposits of enormous thickness which had taken thousands upon thousands of years to form, have never yielded to the geologist a single tooth or bone of any kind of mammal; where, then, are we to look for the common ancestor of the bear and the horse, and for the ancestors of the rich fauna of the Eocene? Through the whole series of descending rocks (after passing the Cretaceous) down to the Laurentian, the only mammalian forms known to the palæontologist are those in the Rhætic beds of Somerset (represented by a single tooth), in the Stonesfield slates of Oxfordshire, and the Purbeck beds of Swanage. These are the only forms known in the Old World, the largest is about the size of a full-grown rat.

59. But it is to the New World that we are directed for the earliest ancestor of the horse. And it was of the New World that Professor Marsh was speaking when he said, "that a rich mammalian fauna suddenly made its appearance." What about the pre-Eocene Mammalia of America? I will again quote Professor Marsh, who says that "a single small marsupial from the Trias is the only mammal found in all the American rocks below the Eocene."

60. Dr. Darwin's hypothesis demands a long line of diversified forms, evolved by minute successive slight modifications. From the Trias to the Eocene no mammal of any kind is found in the New World nor in the Old World from the Eocene to

the Purbeck beds. To say that these multitudinous diversified successive forms may have existed, although not one of them has yet been found, is simply conjecture, and must not rank as science. Evolution is an hypothesis founded too much upon conjecture. Professor Huxley speaks about the demonstrative evidence of evolution. There is no demonstrative evidence of evolution. It is a necessary postulate of the doctrine of evolution, that from the highest animal down to the lowest speck of protoplasmic matter in which life can be manifested there must be a series of gradations leading from one end to the other.\* We come to the Cretaceous, and no part of such series can be shown. So far as the present evidence goes, there is a break in the continuity of mammalian life in the Cretaceous period.

61. I have also attempted to show that there was a break in the continuity of mammalian life in the Glacial epoch, which occurred in the Pleistocene period. Now either of these breaks proves fatal to Dr. Darwin's hypothesis of evolution.

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The CHAIRMAN (J. E. Howard, Esq., F.R.S.).—I am sure I may offer Mr. Callard the best thanks of this meeting. I regard his paper as a most valuable contribution to our knowledge. My own acquaintance with geology, however, is too limited to discuss the whole question of breaks in the continuity of mammalian life, though I believe Mr. Callard to be correct in his statements.

In a portion of the Festiniog district, specially known to me, the rocks above Cwmorthin present very markedly the features described by Mr. Callard. Above 1,300 feet from the sea-level the crags of Moel Wynn rise sharp and distinct with slaty cleavage—below that level commence almost suddenly the *roches moutonnées*, indicating submergence under an icy sea, rather than a glacier, if I read them aright. A little lower is a fine specimen of an ice-carried boulder, perched fantastically and as if artificially placed upon a rock. Mr. Callard might have considerably strengthened his argument as to South America, by referring to D'Orbigny's *Voyage dans l'Amérique Méridionale*, which happens to be in my possession, and from which extracts will be found in my appendix to *The Caves of South Devon*. This geologist, whose work on South America is second only to Humboldt's, shows that the immense deposit of the Pampas, occupying nearly 24,000 square leagues of surface, was "in some sort deposited in a very short time, as the result of a great terrestrial commotion." This immense deposit presents for seven degrees and a half in breadth the same features, the same peculiar red clay, and the remains of the same creatures, all swept to destruction. This flood reached to a height of 4,000 mètres (13,000 feet and more) above

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\* Dr. Huxley's *American Addresses*, Lecture 2, p. 46.

the level of the sea. D'Orbigny ridicules Darwin, who attributes these effects (or perhaps I should say *that portion* of them which fell under his observation) to a *River*. The deposits of bones, I am informed, are most curious—especially in Columbia, where one place is called *Los Gigantes*, from their abundance. This was out of Humboldt's course, and has not since been explored by any scientific traveller that I am aware of. I do not think that any remains have been found showing that man was a denizen of the earth at the time when this occurred; but it is otherwise in Guyana, where Dr. Maurel, a member of the Anthropological Society of Paris, has found well-formed stone implements beneath a layer of auriferous clay, showing, as he considers, “*que l'homme existait à la Guyane française au moment où un mouvement des eaux a couvert sa surface.*”

How do the evolutionists meet all these facts opposed to their theory? Simply by silence. The tactics of the evolutionist sect are remarkable. Whatever they cannot answer they studiously ignore; and, whatever assertions they may choose to make, they expect their credulous readers to accept as true. The Editor of the *Journal of Science* has found himself at last compelled to notice a translation of M. A. de Quatrefages on the “*Human Species*,” which has reached a second edition. I hope that neither M. Quatrefages nor any of the foreign members of the Victoria Institute will take this so-called “*Analysis*” as a specimen either of the candour or good feeling of our insular “*scientists.*” I forbear to stigmatise the whole as it deserves, but notice one expression. This reviewer asks (p. 748), “*Does not the balance of facts observed point so uniformly against the fixity and reality of species that the day for useful discussion is well-nigh over?*” This very characteristic suggestion merits attention. *Discussion* is indeed *useless* with men of a certain class! He depreciates M. Quatrefages, whose eminence as a naturalist has been, I think, universally admitted in France, and asks: “*Is he not aware that Darwin has been, and still is, one of the most patient and persevering observers and experimentators (sic) the world has ever witnessed?*” Probably he is, and *also* cognisant, as are French naturalists generally, that the patience of his observation does not prove that his judgment is accurate. They think that in Darwin we have an acute observer, but an illogical thinker.

The Honorary Secretary (Captain F. Petrie) then read the following communication from S. R. Pattison, Esq., Member of Council of the Geological Society:—

6th February, 1882.

I quite agree with Mr. Callard's condemnation of Mr. Darwin's hypothesis of evolution, but not on the grounds indicated in the paper. There was no break in mammalian life at the Glacial epoch. The Horse, Hippopotamus, Boar, Red deer, Rein-deer, Elk, Roebuck, Ox, Bison, Musk Ox, Bear, Lion, Mammoth, Hyena, and a host of small animals existing before it, survived until after, and most of them until the present day, in identical species. Nor can it be shown that the glacial work was strictly contemporaneous over the whole earth, so that there may not have been a total extinction of species by cold, and the above biological facts show that there was not.

With par. 58 I entirely agree, and submit that it is quite sufficient to

sustain the conclusion, viz., that it is fatal to evolution as interpreted by Mr. Darwin. The supposed progenitors of the horse were clearly separate and distinct beings, not lineally connected with predecessors or successors of any other form. We have no instance whatever of descent from species to species by "insensibly fine gradations"; but we have everywhere proof of creation by plan and method, dimly shadowed forth in nature's mirror—a divine evolution, hitherto, as to its *modus operandi*, entirely beyond our present ken.

Also the following communication from the Rev. J. Magnus Mello, M.A., F.G.S. :—

*The Rectory, Brampton St. Thomas, Chesterfield, Feb. 4th.*

I have read Mr. Callard's paper, which you were good enough to send me, with considerable interest, and I venture to make a few remarks upon it.

Everything turns upon one point, that is, the simultaneous and universal prevalence of the Glacial period over the entire globe. Could that be once firmly established, then it would indeed be fatal to the doctrine of evolution, at any rate, as regards the higher forms of animal and vegetable life. This is the great question which we are all anxious to have answered, not that I dread the consequences which some suppose are involved in accepting evolution, if the doctrine is true. I have faith to believe that natural and revealed truth will ever prove to be one; but before accepting evolution as absolutely proven, however fascinating the theory may be, and however good a working hypothesis it is, we are right in requiring, not guesses nor plausibilities, but absolute demonstration, as far as it is possible to have it. That there are almost innumerable facts in the natural world, which, if they do not actually prove, yet very strongly support many of the statements of the evolutionists, is undoubtedly the opinion of a very large number of the ablest naturalists, and such evidence as that brought forward in Gaudry's *Enchainements du Monde Animal* and the strange "convergence of all sciences, from physics to chemistry and physiology, towards some doctrine of evolution and development," are facts too striking to be passed over without the most serious consideration. But the theory is as yet far from being so proven as some would make out. Before it can be pronounced true there are many difficulties to be got rid of, apart from such supposed ones now discussed, which as yet seem almost insuperable. The true attitude of science is to accumulate her facts and wait patiently for the clue which will unravel the web of mystery by which we are surrounded.

Was the Glacial period simultaneous and universal? The answer to this question will not be found, as far as I can see, in the facts to which Mr. Callard calls attention, viz., that traces of former glaciation may now be discovered over enormous tracts in both hemispheres, and in both the old and new worlds. That such traces exist no geologist will deny; but were all these areas under ice or sea at the same time, and did the intense cold *universally* prevail over every continent at one period? The question must be answered rather by the astronomer or the physicist, I think, than the geologist; the mere fact that once the greater part, or even the whole of Northern Europe, was clothed in an icy mantle, which would utterly destroy all terrestrial life, will not serve to discredit the evolutionist, unless it can be absolutely proved that the other parts of the continent were either themselves equally glaciated at the same time, or else so cut off from the ice-covered regions that migration would be an impossibility. If the physicist can tell us that we must certainly believe that the entire globe was involved at one and the same time in glacial conditions, then nothing more

need be said. There *must* have been new creations, and evolution, so far as its continuity through all time is concerned, is non-existent; but till we are thus met we must hold our judgment in suspense. Mr. Callard apparently tells us that the question *is* settled—that Professor Birks has corroborated the view that the cold of both hemispheres was simultaneous. What say the leading physicists to this? If it is still open to question, then there are other facts we have to take into consideration, which *seem*, at any rate, to show that all terrestrial existence may not have been so absolutely broken off by the Glacial period. There were some species of animals living before the great cold set in which were still found living when it had passed away; or may we not say even during its continuance, for it has been shown that the Glacial period itself had its breaks, and in the inter-glacial deposits the remains of a fauna and flora are found. Amongst the animals which lived both before and after were the Hippopotamus, an animal as old as the Pleiocene age, and another—the formidable Carnivore (*Machairodus latidens*), also of the Pleiocene species, was apparently living after the culmination of the Glacial period. *Elephas antiquus* (the Mammoth), and Rhinoceros (*Megarhinus*) lived both before and after the refrigeration, and what is thus true of these animals is true also of many others. *A priori*, it seems hardly likely that there should have been a new creation of identical species; the theory of migration seems more probable. The most remarkable break in continuity would appear to be rather between the epoch of palæolithic and that of neolithic man, when the existing fauna made their first appearance in Europe; but even then there were survivals from that of the pleistocene, or, if not survivals, then new creations of identical species. Thus an allowed break in the continuity of life may have occurred in any given area, but yet that area may have been repopulated, not by new creations, but by the gradual immigration of species, some of which previously occupied it, whilst others which had not as yet appeared there, but may have been their contemporaries in more distant countries—probably to the south and east—pushed their way forward to the north as the climate permitted. This appears to me to be more probable than to suppose a new creation of species for each district after the passing away of the great cold of the Glacial times; and I think, too, that the present distribution of both the testacea and the flora of North-western Europe points in the same direction. Therefore, for the establishment of Mr. Callard's views, we must ask for a general admission on the part of those scientific authorities who have the means of verifying the facts, that the glaciation must have been both simultaneous and universal. This admission I do not think we have at present.

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The following communication from the Rev. E. Duke, M.A., F.G.S., was also received:—

*Lake House, Salisbury, Feb. 3, 1882.*

Mr. Callard has treated his subject clearly and satisfactorily. His line of argument is one good proof, among many others, of the unsoundness of the evolution theory. The truth, I am convinced, is that, though the Creator has worked in all ages *after the manner of evolution*, and the successive species of animal and vegetable life have been created, not evolved or transmuted.

The *resemblance* to evolution is close enough to afford scientific men who hold these views an apparent ground for their ingenious theory, and too close to enable ordinary readers to see readily how to refute them. Hence a paper like Mr. Callard's is very valuable.



The CHAIRMAN.—I wish the writer of the second communication had given proofs of some of his statements.

Mr. W. GRIFFITH.—Mr. Callard, in his most interesting paper, has led us a journey from Switzerland to Italy,—from the Alps to the Jura; thence into Africa and across the Great Desert; from thence to the plains of America and the Rocky Mountains; and, further on again, to the mountain ranges of the great Asiatic continent. He has certainly established one great fact most completely, namely, that in all these regions there has been a Glacial epoch, during which glaciers of vast size existed and undoubtedly exercised a corresponding influence on vegetable and animal life. He has also brought forward another question, as to which the evidence is of a different description. I certainly agree to some extent with the conclusion arrived at by Mr. Callard and Mr. Pattison, the writer of the first letter read. But, at the same time, I also agree with Mr. Mello, that the evidence of the effects of the Glacial period is not altogether so satisfactory as we could wish. It is necessary for the theory founded on the Glacial epoch that that period should have been both universal and simultaneous, in order to produce a break in the continuity of life; for if one portion of the earth was still warmed by the heat of the sun, while the other portion was under the action of the terrible glacial sea which Mr. Callard has described, it would follow that, in that portion which received the sun's warmth, both the flora and fauna, the vegetable and animal life, might continue to exist. I could not help thinking, as Mr. Callard led us on the voyage he was taking round the globe, of a journey I once made myself, from the plains of Northern Italy to the Alps he has so eloquently described. While on the plains of Northern Italy, I was among an almost tropical vegetation, the Indian corn was growing to a height of several feet; in fact, it completely overtopped the tallest man, while the luxuriance of all the other vegetation was remarkable. Only a few miles further north, in the valley of Aosta, this vegetation had all disappeared, and a few miles beyond that, when we reached the pass surmounted by the great St. Bernard Hospice, summer and spring had gone, and we were nearing the confines of winter, and approaching the everlasting glaciers of Mont Blanc; but even at that great height the Alpine flora still existed, though, of course, as we mounted higher among the perpetual snow towards the very summit, the flora disappeared, in a manner corresponding with that of the glacial flora already described. Thus, then, we have at the present period in Europe huge glaciers among the higher mountain ranges, and within less than a hundred miles we get into a sub-tropical region where the Indian corn waves in the richest luxuriance on the plains. I have, therefore, come to the conclusion that it is not established that the glacial periods were simultaneous and universal and, if either of these two conditions be wanting, the break of continuity contended for by the author of this paper is not established, because there may have been, as in the case I have referred to, spots where the deleterious influence produced by glacial action did not exist. At the same time I

think that the great eloquence employed, and the strong arguments and large number of facts adduced by Mr. Callard are hardly required for the purpose of upsetting the Darwinian theory, which, after all, is little more than an hypothesis. Professor Huxley has said, as stated in the paper, "that the palæontological discoveries of the last decade are so completely in accordance with the requirements of this hypothesis, that if it had not existed the palæontologists would have had to invent it." I cannot compliment Mr. Huxley on the clearness of his language. When I read the passage I hardly knew what he meant by saying "that if it had not existed the palæontologists would have had to invent it." If what had not existed? Evolution or the hypothesis? Which of the two would the palæontologist have had to invent? Looking at it grammatically, it is loosely expressed; looking at it logically, the consequences do not follow. Putting the most favourable construction upon it, and supposing the Professor to mean that if evolution had not existed, as a matter of fact, the palæontologist would have had to invent it,—and I think you will agree with me that that is the best construction we can place upon it,—what does it come to? If it did not exist, it must have been invented. What is invention? We discover a fact or truth; we invent a theory. Truth exists independently of man; an invention is the act of man. To conclude, I would say that the burden of proof rests on those who advance this new theory. They certainly have not established it by evidence. It is imaginative, fanciful, and speculative, the result of defective induction, illogical ratiocination. It is unsupported by, or rather it is contradicted by, the evidence; and it rests for its success on bold and unwarranted assertion. Such an assertion was that made in a lecture delivered in America,—that it is demonstratively proved "as strongly as the Copernican theory." I only hope the orator had a very "soft" audience to whom he could address such arguments, and I can only suppose that he knew very little about the Copernican theory. If he had known that the astronomer-general observes the stars and calculates their positions, and two years in advance publishes the results of these calculations in the *Nautical Almanack* which is used by navigators in their voyages round the globe, and that all the vessels engaged in these long voyages are dependent on the Copernican theory, I think he might have shown a little more modesty in the assertion he made that the theory he has propounded is as strong as that of Copernicus.

MR. E. CHARLESWORTH, F.G.S. (a visitor).—I was extremely gratified at receiving, two or three days ago, from Captain Petrie, a copy of the paper that has been read this evening. I read it with the greatest pleasure and interest, and to-night have the still further advantage of listening to its rehearsal by the author himself. But the conclusion at which I arrived on reading the paper was this,—that while it conveys, in a most instructive manner and with a high order of ability, a great deal of what can be advanced in opposition to the theory of evolution, yet, taking the paper as a whole, it fails to carry conviction to my mind. I will now proceed to tell you in what I think the weak feature of the paper consists, and it is this :

that the author has rested too much on mere negative evidence in the conclusions he has drawn with regard to one of the most remarkable problems of natural science which has ever been brought before the intellectual world. Negative evidence, I admit, may be carried to a point in which it may be said to have almost the same weight as positive evidence; but, I would ask, is this the case with the negative evidence upon which the opponents of the doctrine of evolution rest? I answer, most assuredly not. It is impracticable at this late hour of the evening to attempt to go through all the various points and interesting string of facts and reasoning we find in Mr. Callard's paper. I will, therefore, simply call attention to one matter, which I think he relies upon as his sheet anchor in his opposition to the doctrine of evolution. It is this: that, in order to establish that doctrine, it must be proved that there has been a continuous series of life forms, carried onwards by numberless insensible gradations, from a low to a high type, through all the various phases of animal life which we find represented on or in the crust of the earth; and that this series of multitudinous forms shall have had no break. Now coming to what the author has said, with regard to the alleged break in the Cretaceous period, I would ask your attention to this passage:—"I come to the Cretaceous, and no part of such series can be shown. So far as the present evidence goes, there is a break in the continuity of mammalian life in the Cretaceous period." Here, in referring to mammalian life, I must ask you to bear in mind that the doctrine of evolution does not restrict itself to mammalian life. It includes the whole range of animal life; but to-night we are dealing with mammalian life. Now the Cretaceous system of rocks forms a very large portion of the whole series of fossil-bearing strata. It extends from England over thousands of square miles in Europe, and again we have it in North America; and it is true that in all parts of the world, wherever this system of rocks has been explored, we have found no trace of land mammalian life. Consequently Mr. Callard has come to the conclusion, and I am not surprised at it, that there was no mammalian life in that period. But this conclusion, I say, is wholly and entirely illogical, and can be at once refuted and extinguished by any one who has had anything like a large practical experience in the exploration of fossiliferous strata. I will give you chapter and verse, by citing a perfectly parallel case, to prove how utterly worthless—I am sure Mr. Callard will forgive me for using so strong a term—is the conclusion he bases on this apparent break in the continuity of past mammalian life. There is, in East Anglia, a geological formation which is locally known under the name "crag"; with regard to which I may say, that when William Smith founded the science of Geology, some fifty or sixty years ago, he, and other geologists, adopted the local name "crag" as a geological term. Of course, when Geology began to rank as a science, geologists had to construct a terminology denoting the different strata. When they could find a name that was in common use, they took it. "Chalk" is a case in point, for that name has become incorporated in all systems of stratigraphica

Geology. Nobody could tell what the origin of the name "crag" was, but that local name had long been applied in Norfolk and Suffolk to beds of sand filled more or less with beautiful fossil shells. One hundred years ago collections from these fossils-beds were commenced. Dale, in his work on the Antiquities of Harwich, was the first to give us particulars of the fossils found in the crag; and this formation has ever since been a favourite field for all who interest themselves in fossil remains. It may safely be said that there has been, and is still, an enormous amount of research carried on in the East Anglian crag. Well, forty years ago, the conclusion geologists had arrived at was that this Suffolk crag was rich beyond all description in the remains of shell and fish life generally, but that there was no trace in it of mammalian life. By mammalian life, I would explain that I refer to the class of animals commonly coming under the designation of animals which suckle their young, whether quadrupeds, bats, or whales—all such animals are mammalian. Here let me call attention to the fact that this was negative evidence. I will now proceed to show how a mere accident utterly revolutionised and upset this negative evidence, and gave us a complete picture of a vast amount of mammalian life previously unsuspected. A clergyman, the Rev. J. S. Henslow, went one day to Felixstowe, and, while geologising among the crag and cliffs, came on certain dark-coloured stones, which he sent to London in order to have them analysed. It turned out that these stones, previously looked upon as worthless, contained a most valuable material—phosphate of lime. This led to these stones being collected in enormous numbers, by turning over and sifting the crag to get at them. Now, although during half a century scores of indefatigable geologists had been searching among the crag, and finding shells, corals, and fish teeth, but no trace of mammalian existence, no sooner did the navvies commence sifting, than out came abundant evidence of crag mammalian life, including mastodons, rhinoceroses, beavers, tapirs, deer, and various other animals belonging to the mammalian class. All this was owing to the mere accident of Mr. Henslow finding the stones I have mentioned. Now, supposing we were to discover in the interior of an unexplored part of some vast continent a lake previously unknown, and that some one going across in a canoe were to cast a net and draw it up, and, obtaining nothing, were to say, "I have caught no fish;" what would you think of his logic if he were thereupon to add, "There are no fish in this lake, for I have thrown my net, and drawn it up, and find it empty." But that would be just as reliable evidence as you have got from the cretaceous rocks—in fact, it would be a parallel case to your saying, "There are no remains of mammalian life in the cretaceous rocks, because the chalk quarries we dig and the wells we sink give us none." This is a point which I would ask Mr. Callard to think well over. But, in saying this, I would add that, supposing there should be some day evidence forthcoming of land mammalian life in the cretaceous rocks, such evidence might not in any way support the theory of evolution. I should like to go on, but I fear I have detained you too long already. may, however,

say that I look on the evolution theory as one of those grand problems which are of the very greatest use in leading to further acquisitions of human knowledge. Every now and then some great question is brought forward, respecting which the highest authorities—men whom we regard as our teachers—are equally divided in opinion. It is so with the alleged evidence of life in the vast series of Canadian rocks called Laurentian—forming strata older than anything in this country. Those Laurentian rocks spread over a vast extent and through an immense depth—rocks enclosing a peculiar structure, which Dr. Carpenter and many others of the highest practical knowledge say most positively is a life structure, a structure to which has been given the name *Eozoon*; but there are other high authorities who say that *Eozoon* is a mineral structure, and not of organic formation. Here, then, on both sides we have men of eminence working, on the one hand to show that the Laurentian rocks give us life structure, and on the other to show that they do not; each engaged in a kind of rivalry which, even if it does not succeed in deciding the problem, is sure to bring forth facts of the highest interest in other directions. Therefore, I hope it will not for a moment be thought that these discussions are at all useless because the men to whom we should look to guide us are divided in opinion. On the contrary, there is every reason why we should discuss these questions, and my own feeling on the matter now before us is, that while the theory of evolution gets us out of one series of difficulties, it lands us, on the other hand, in a fresh series. I am patiently waiting, and hoping for the time to arrive when that doctrine will either be entirely repudiated or completely accepted. I wish now to call Mr. Callard's attention to one or two slips in his paper. The first on which a correction is needed is one of special interest to myself. Mr. Callard tells us that the mammals found in the Stonesfield oolitic slates are no bigger than rats. It so happens that I was the discoverer of the most important of all the known mammals in the strata, and I gave it the name "*stereognathus*," or "solid-jaw." Now this animal was a great deal larger than a rat; I think it must have been as big as a cat, but at any rate it was as large as a hedgehog. It will not do in matters of such importance as these Stonesfield mammals, which geologists all the world over read of with great interest, to make even a small slip. Then, again, with regard to what the author says about the cretaceous rocks; I think Mr. Callard must make a correction, because, although no remains of land mammalian life have been discovered in the cretaceous series, there is strong evidence in the publications of the Geological Society, of which Mr. Callard is a Fellow, of a marine mammalian animal having been found in the cretaceous rocks. I forget the name given to it, but three or four of the neck vertebræ are figured in the Journal of the Society. I can only now conclude by saying that the author has handled the subject in a most pleasant and able manner, though I cannot say that he has made me an anti-evolutionist.

Mr. D. HOWARD, V.P.<sup>Inst<sup>Chem.</sup></sup> (who had taken the Chair in the place of Mr. J. E. Howard, F.R.S.).—Before calling upon Mr. Callard to reply, I wish to say

that I think, while on the one hand we ought not to overstate, we should on the other be very careful not to understate the value of negative evidence. There can be no doubt that it is of great value as a defence ; and, when the doctrine of evolution is put forward, the more pugnacious it is, the more fair is it that the negative argument should be used against it. The paper we have heard, whether we accept altogether its deductions or not, is one well worthy of careful consideration. I think the onus of proof lies so entirely with the evolutionists, that the line of argument adopted in the paper is a very fair one. It is for the evolutionist to prove how the Glacial period is to be got over, and it also lies with him to prove why it is that we do not find a sort of sliding scale of fossils. We find, as it were, a certain number of milestones, and we assume there is a roadway lying between them. If we are sure they *are* milestones, I grant the inference. We find the remains of various creatures, which Professor Huxley took it for granted were the progenitors of the horse ; but I think it is rather for him to show why we do not find the intermediate links. If you dig about London, you will come upon the remains of the former inhabitants from the time of the Romans, but with no distinct breaks between, so that you may assume London to have been continuously inhabited ; but if I found merely Roman and Tudor coins, and none other, it would not be fair to assume that there had been a continuous inhabitation of London between the two periods represented by those coins. If, then, we are to adopt the continuous hypothesis of evolution, using the term in the sense that all living phenomena are to be explained by a continuous process of evolution, without cessation, and with no assistance from without, I say we have a right to require that these breaks shall be explained. It certainly does not necessarily involve a denial of creation by Divine Power to believe that some form of evolution played a part in it, but I confess that I should like to have strong proof of the evolution theory before accepting it. Well, then, I say before we adopt the doctrine of evolution, which Mr. Callard is opposing,—the doctrine which assumes a continuous succession of evolutionary changes by a process of natural selection,—we may fairly ask for some explanation of these very inconvenient breaks. A proposition in Euclid would be very difficult to understand if we only had some of the syllogisms before us, and we had to find out the others. I do not say the deficiencies would show that there was no argument ; but I think we ought to suspend our judgment till we found out the missing links somehow.

MR. CALLARD.—I have been much interested by the way in which my paper has been received. I did not expect that the doctrine of a complete break during the Glacial period would be at once accepted. I know that a good deal might be said about it ; but think, if I have an opportunity at another time of saying a little more upon the subject, I shall be able to prove to you that the glaciation of the northern and southern hemispheres was simultaneous. We have not time to go into that proof to-night ; but I would ask, what leads you to suppose there was a glacial condition on one hemisphere and not on the other ? Until Dr. Croll's hypothesis

came before the world no one ever thought of such a thing. Darwin, when he wrote the fourth edition of his "Origin of Species," saw no way out of this glacial difficulty; and he is entirely indebted to Dr. Croll, who came forward just in time to help him.\* Dr. Croll's hypothesis is that the eccentricity of the earth's orbit will give a certain period of glaciation for each hemisphere. Is it so? The eccentricity at the time assigned to the last Glacial epoch was ten and a half millions of miles; that does not mean that the earth was ten and a half millions of miles further from the sun than it would have been in a circular orbit, but five and a quarter millions of miles further at one part of its orbit and five and a quarter millions of miles nearer to the sun at the other part of its orbit. I fancy that any mere common-sense person, looking at this, would require a little further explanation before he could see how this alteration could produce the Glacial period. Dr. Croll said that this would not do alone, it would only be the hemisphere that has its winter solstice at a time of great eccentricity that would be so glaciated. It is a question whether the distance from the sun would have made any difference at all; but, if it be granted that it would, the northern hemisphere, which was supposed to have had its winter solstice at the greatest distance from the sun, would, when it came to the other side of its orbit, get its summer when nearest to the sun, so that, if an increased cold is obtained in the winter when in aphelion, it has, on the other hand, an increased heat at the time it is in perihelion: how this could produce the Glacial epoch I am at a loss to see. Mr. Croll says, there would be a cool atmosphere in summer from the melting of the snow and ice, and, on account of this, the earth would pass through a hot summer without feeling the heat. But this is merely begging the question. We have not got the snow and ice, to begin with; we know that it is not one winter's cold that would produce the Glacial period, and that what winter would do in one part of the earth's orbit the summer would undo in the other.† The difference in climate referred to by Mr. Griffiths, within one hundred miles, was occasioned by difference of altitude; and the Indian corn to which he alludes, Mr. Darwin says, has its roots in ancient glacial moraine. Mr. Mello's letter refers to there being evidence of certain of the fauna living from the pliocene to the present time. I expected that question would be raised, and no one could deal with it better than our friend, Mr. Charlesworth. He is a thorough geologist, and I remember how in this room he dealt with the pliocene badger, which was supposed to have been one of those animals which existed in the fauna of both strata—the pliocene and the pleistocene. Mr. Charlesworth, however, showed that the badger had merely worked his way into a pliocene quarry. What really is the evidence of pliocene forms now living? Does the evidence come from the

\* "It formerly appeared to me that we could not avoid the conclusion that the temperature of the *whole world* had been *simultaneously* lowered during the Glacial period."—*Origin of Species*, fifth edition.

† See *The Geological Evidences of the Antiquity of Man re-considered*. T. K. Callard, pp. 16-26.

ossiferous caverns ?\* If so, we know that evidence from this source is very uncertain. Professor Dawkins says, with regard to these caverns, that it is impossible to tell with certainty their precise relation to the Glacial period. If it is impossible to tell this, we must be left in doubt about glacial survivals. And I do say that those who hold to the hypothesis of evolution would require to bring evidence of more than a few forms living through the Glacial period to account for a new fauna. Every species now living should have had living representatives in the pre-glacial period, seeing that there was not time during the Glacial epoch—for which 160,000 years is claimed—for evolution, according to the views I am dealing with, to produce the multifarious changes required by the hypothesis. If these changes have not been produced during the post-glacial times, and if they could not have been produced during the Glacial period, then all the animals we see around us—the dog, the horse, and all the other multitudinous forms of animal life—must have had representatives in the pre-glacial period. If, therefore, I should have two or three forms pointed out in which my deficiency in palæontological knowledge causes me uncertainty about their stratigraphical position, Mr. Charlesworth will, perhaps, be able to remove the difficulty, as he did in the case of the pliocene badger. But to come to the question of negative evidence: I say that there is no evidence of there having been mammals (land mammals) in the cretaceous period. Mr. Charlesworth says that this is but negative evidence—mammals may yet be found; and, in drawing a parallel with his own experience in the Suffolk crag, those present who are not geologists might understand Mr. Charlesworth to mean that Suffolk crag is cretaceous. If, in the Geological Society, I were to venture, in Mr. Charlesworth's presence, to say that there had been mammalian life in the Laurentian rocks, I think he would stare at me. But why should I not say so? He would say, "We have never found any." I reply, "No, but perhaps we may in the future." Would not Mr. Charlesworth say, "You

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\* In the lower deposit, at the entrance to Victoria Cave, Settle, there was found the remains of a fauna beneath glacial clay. It was the same deposit in which the supposed fibula of man was discovered, and which led to the supposition that pre-glacial man lived in Yorkshire. The argument that claimed man as pre-glacial would equally apply to all the fauna in that deposit. Amongst this fauna were eight out of the fourteen forms said by Mr. Pattison to be pre-glacial, and two out of the four forms so claimed by Mr. Mello. As the evidence at first stood, all the forms in that deposit would be correctly claimed as pre-glacial. In 1876 I visited the cavern, and (for the reasons assigned in a paper read before the Victoria Institute), I satisfied myself that the glacial clay covering the animal remains was *remanié*,—a re-deposit at a later date. Both Professor Dawkins and Professor McKenny Hughes expressed the same conviction at the conference held in 1877 to consider the present state of the question of the Antiquity of Man. Great care is needed in receiving evidence from pleistocene fauna respecting their pre- or post-glacial position. Dr. David Page, in his *Text Book of Geology*, points out the difficulty of fixing with certainty the limit of the pleistocene system.—T. K.



must not talk about these mammals having existed in that period till we have seen some evidence of it?" Well, I say precisely the same thing to him about the cretaceous system. If you are prepared to put Darwin's theory of evolution on the shelf until you have found the mammals, I am content.

The meeting was then adjourned.\*

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\* Since the meeting took place, Dr. Darwin has passed away; and it may be permitted to quote the following from a periodical entitled the *Champion of the Faith* :—

"It is with the sincerest sorrow that we write the words, 'Darwin is dead.' We can ill afford to lose so earnest a student of nature, so gentle a spirit, or so honest a man. We all owe him a debt, the greatness of which we can scarcely realise. He has revealed to us the habits of countless creatures, whose apparent insignificance caused them long to be overlooked, his almost last legacy having made even worms objects of admiring interest. . . . We cannot accept his creed, or agree with his inferences in the matter of evolution, as we consider them illogical; but, though they should all hereafter be proved erroneous, that would not detract in the slightest degree from his fame as a naturalist. It would only show that his acumen as a logician was not equal to his insight as an observer. . . . Atheist he assuredly was not; he could not even be ranked amongst Agnostics, for again and again he speaks of the 'Creator,' and the 'Creator breathing life into one or two primitive forms,' as also of the 'ennobling belief in God.' It would be wise if some of those who call themselves his followers tried to copy his earnestness and his modesty; but as disciples frequently travesty the teaching, and ignore the spirit of their masters, so do many Darwinians manifest an *odium scientificum* that Darwin would have severely condemned. Anger in controversy is an absurdity. Facts will live though all the world should combine to howl them down. Fictions will die though all the world combine to try and keep them alive. Whatever has been true in Darwin's life work will live; whatever has been mistaken will die, and we are persuaded that no man would more rejoice at the death than Darwin."