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ORDINARY MEETING, JANUARY 17, 1881.

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

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

LIFE MEMBER :—H. S. Bosanquet, Esq., London.

MEMBERS :—F. Newth, Esq., Barnet ; Rev. E. Wells, M.A., Dunstable.

ASSOCIATES :—Rev. C. B. Brigstocke, M.A., Germany; G. W. Childs, Esq., Philadelphia ; A. E. Longhurst, Esq., M.D., London ; Rev. E. S. Radcliffe, A.B., Australia ; H. Sandford, Esq., London.

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

" Proceedings of the American Geographical Society." *From the same.*

The following paper was then read by the author :—

PLIOCENE MAN IN AMERICA. By JAMES SOUTHALL, A.M., LL.D., of Richmond, Virginia.

AMONG well-informed persons opinion has undergone a great change within the past few years with regard to the antiquity of man in Europe. We presume that few now* attach any importance to the evidences for the antiquity of the race derived by the late Sir C. Lyell, Sir J. Lubbock, and others, from the ancient stone-graves, the objects found in the Danish peat, the shell-mounds of Denmark, and the lake-dwellings of Switzerland. It has been abundantly shown that the division by the archæologists of the human period

* Dr. Southall, in his reply, explains that recent exploration has thrown much new light on the evidences cited by these authorities.—ED.

(apart from the palæolithic epoch) into the three ages of stone, bronze, and iron, has little value; and the discoveries of Dr. Schliemann at Hissarlik and Mykenæ have proved that stone was freely used for cutting implements in Greece and Asia Minor about 1,000 and even 700 years B.C. In each case this was in a *town*, and at Troy these rude implements were employed not only in association with the arts of civilisation, but under the very shadow of the Phœnician, Assyrian, and Hittite empires. It would not be strange, then, if the use of stone survived in Britain and Denmark down to, and after, the Christian era.

The evidence for the remote date of the appearance of man in Europe rests, therefore, now exclusively on the remains found in the caves and in the river-gravels in association with the bones of extinct animals. Ten years ago—indeed five years ago—on the evidence of the stalagmitic floors which covered these remains, such men as Mr. Vivian and Mr. A. R. Wallace claimed for them an antiquity of 1,000,000 and 500,000 years; and 800,000 years was suggested on other grounds by Sir Charles Lyell prior to 1872. But even here the tendency now is to reduce these figures, and in fact some bring them down as low as 20,000, and even 10,000 years.

I have myself within the past few days received from Thomas Karr Callard, Esq., a member of this society, a piece of the tusk of a mammoth, part of a specimen sent to him from Archangel, and the ivory is in so fresh a condition that it has been shaped into a checker by an ivory turner.

I spoke of 10,000 years: Dr. Winchell, Professor of Geology and Palæontology in the University of Michigan, in his recent learned work entitled *Pre-Adamites* (the object of which is to show that the black and brown races originated in "Tertiary time"), after a careful examination of the question of "the antiquity of the Stone Folk in Europe" (the Palæolithic race of Lubbock and Dawkins), comes to the conclusion that "we do not discover valid grounds for assuming him [man] removed by a distance exceeding six to ten thousand years."

Prof. Winchell has, of course, no prepossession against the theory that the implements found in the gravel of the Somme Valley are 200,000 years old: on the contrary, he argues for the existence of a sunken continent in the Indian Ocean (the Mascarene continent of M. Milne-Edwards), where, as I have intimated, he believes the black man to have appeared on the earth during the Tertiary age; and he also accepts the Pliocene Man of California. But, as a candid geologist, he feels compelled to refer the traces of man found in the river-gravels and

bone-caves of Europe to a post-glacial date not exceeding 6,000 to 10,000 years ago.

Prof. Winchell does not rest his belief in the Tertiary man of the Mascarene continent on any ascertained evidence; it is avowedly a speculation.

The evidences for Tertiary man in Europe (such as the notched bones found at St. Prest, the worked flints from Thenay, the incised bones from the *faluns* of Léognan, the incised bones described by Prof. Capellini from the Pliocene of Tuscany, &c.), he also rejects.

In his recent magnificent work on *Early Man in Britain*, Prof. Dawkins reaches the same conclusion with Prof. Winchell as to Tertiary man in Europe. The evidence on the subject he deems unsatisfactory, and with regard to Miocene man he remarks:—"There is, however, one most important consideration which renders it highly improbable that man was then living in any part of the world. No living species of land mammal has been met with in the Miocene fauna. Man, the most highly specialised of all creatures, had no place in a fauna which is conspicuous by the absence of all the mammalia now associated with him" (p. 67). And again, as to Pliocene man, he remarks:—"As the evidence stands, at present the geological record is silent as to man's appearance in Europe in the Pliocene age. It is very improbable that he will ever be found to have lived in this quarter of the world at that remote time, since of all the European mammalia then alive only one has survived to our days" (p. 93).

The latest claim for the great antiquity of man has proceeded from America, and this claim is so extraordinary, and is supported by names of such high authority in the scientific world, that it seems to deserve a serious notice. The facts are not now for the first time made public, but they are put forth in so formal a manner within the past year or two by the most eminent geologists and palæontologists in the United States (their statements having, moreover, been repeated in Europe), that the subject deserves an attention which it did not receive when the discoveries were first announced.

Dr. Foster, who was an able geologist and archæologist, referred to them in his work on *The Prehistoric Races of the United States* in 1873, but now they are vouched for by Professor Le Conte, Professor Whitney, Professor Winchell, and Professor O. C. Marsh, and the inference drawn from them is that man lived on the Pacific coast of North America in a semi-civilised condition in the Tertiary age.

The facts in question have reference to the discovery of certain vessels and implements of human workmanship at the

depth of several hundred feet from the surface, under volcanic and other deposits, in the gold-bearing gravel-beds of California.

Mr. Bancroft, in his *Native Races of the Pacific States* (vol. iv. p. 698 *et seq.*), recites a number of cases in this connexion.

We are informed that in 1858 a stone mortar holding two quarts was taken, at the depth of 300 ft. from the surface, from a mining tunnel in Table Mountain, Tuolumne County, California, lying in auriferous gravel under a thick stratum of lava. In 1862 another mortar was found at the depth of 340 ft. (104 of which were composed of lava), and 1,800 ft. from the mouth of the tunnel. At the same depth in Table Mountain, spear-heads, 6 or 8 in. long, a ladle of steatite, and a pendant or shuttle of siliceous slate, were found along with bones of the mastodon and other animals. At San Andrés, in 1864, large stone mortars were taken from a layer of cemented gravel 6 ft. thick, lying under the following strata:—coarse sedimentary volcanic material, 5 ft.; sand and gravel, 100 ft.; brownish volcanic ash, 3 ft.; cemented sand, 4 ft.; bluish volcanic sand, 15 ft. At Kincaid's Flat, 16 or 20 ft. below the surface, in clayey auriferous gravel, a stone mortar and pestle, and many other stone implements were found with bones of the elephant and mastodon. At Gold Springs Gulch, in 1863, a granite mortar and pestle, the former being 12½ in. in diameter, and weighing 30 lb., were found at the depth of 16 ft. in gravel. At Shaw's Flat, along with bones of the mastodon, a stone bead of calc-spar and a granite mortar, holding about a pint, were found at a point 300 ft. from the mouth of the tunnel. At Gold Springs Gulch, discoidal stones (corresponding with the hurling or *chungke* stone disks of the Red Indians), perforated through the centre, were found with mastodon bones, under about 25 ft. of calcareous tufa; and at the same place, a flat oval dish of granite, 18½ in. in diameter, 2 or 3 in. thick, and weighing 40 lb. "An ancient skillet," as we are told, "made of lava, hard as iron, with a spout and three legs, was washed out of a claim at Forest Hill." A similar "skillet" was found in 1861, at Coloma, at a depth of 15 ft., under an oak not less than a thousand years old. "Many stone mortars and mastodon bones," we are told, "have been found about Altaville and Murphy's." It was at Altaville that the famous Calaveras skull was found some twelve years ago. This skull was submitted to the American Association for the Advancement of Science in 1869 by Professor Whitney, the State Geologist of California. "It was found in a shaft 130 ft. deep, near Angelos, in Calaveras county. The shaft passed

through five beds of lava and volcanic tufa, and four beds of auriferous gravel. The upper bed of tufa was homogeneous and without a crack through which a human relic could have been introduced into the lower beds. The skull was given to Professor Wyman to describe, who found great difficulty in removing the cemented gravel in which it was incrusted." I quote from Dr. Foster.

In 1857, Dr. C. F. Winslow sent to the Boston Natural History Society the fragment of a human cranium, found in the "pay-dirt," in connexion with bones of the mastodon and elephant, 180 feet below the surface of Table Mountain.

Prof. Le Conte, in his *Elements of Geology*, refers in a hesitating way to these discoveries, and remarks (p. 567) that if man should undoubtedly be found in the older auriferous gravel, "it would show an immense antiquity, for, since the lava-flow, cañons have been cut by the present rivers 2,000 or 3,000 feet deep in solid slate rock."

Since these mortars were abandoned by man, according to Dr. Foster, "the physical features, as well as the climate of this region, have undergone great changes. The volcanic peaks of the Sierra have been lifted up, the glaciers have disappeared, the great cañons themselves have been excavated in the solid rock, and what were once the beds of streams now form the Table Mountain" (p. 54).

It was stated last year in the New York *Independent* that in the forthcoming edition of his *Elements* Prof. Le Conte will commit himself fully to the Pliocene age of these relics. With regard to this I have no personal knowledge, but the *Independent* spoke as if well informed on the subject.

Professor Whitney, however, has very recently made a formal report on these gravels (*Auriferous Gravels of the Sierra Nevada*, 1879), and in this he expresses the conviction that they belong to the Upper Tertiary, and that the human relics found in them are beyond question of the same period. He gives a list of the objects which have been found in the gravel, comprising (1) a mortar found in pay gravel under volcanic matter, at the depth of 150 feet (at San Andreas); (2) A stone hatchet, triangular in shape, size 4 inches around, 6 inches long, with a hole through it for a handle, found 75 feet from the surface in gravel, and under basalt, 300 feet from the mouth of the tunnel, locality Table Mountain, Tuolumne county; (3) a large number of mortars, pestles, stone dishes, with bones of elephant and mastodon at "Murphy's" Tuolumne co.; (4) mortars, weighing from 20 to 40 pounds in gravel, at the depth of 40 feet, locality Amodor co.; (5) bones of a human skeleton found in clay at a

depth of 38 feet, by Dr. H. H. Boyce, at Placerville; (6) numerous stone relics, mortars, grooved disks, &c., at various depths. We may add that bones of the camel, rhinoceros, hippopotamus, and extinct horse, or of allied forms, occur in these gravels.

In his address before the American Association for the Advancement of Science, at Saratoga, N.Y., Aug., 1879, Professor O. C. Marsh, of Yale College, President of the Association, had the following passage:—

"Important evidence has likewise been adduced of man's existence in the Tertiary, both in Europe and America. The evidence to-day is in the form of the presence of man in the Pliocene of this country. The proof offered on this point by Professor J. D. Whitney in his recent work (*Aurif. Gravels of Sierra Nevada*) is so strong, and his careful, conscientious method of investigation so well known, that his conclusions seem irresistible. Whether the Pliocene strata he has explored so fully on the Pacific coast corresponds strictly with the deposits which bear that name in Europe, may be a question requiring further consideration. At present, the known facts indicate that the American beds containing human remains and works of man, are as old as the Pliocene of Europe. The existence of man in the Tertiary period seems now fairly established."

This is pretty explicit. Man existed in America in the Tertiary period, and, what is yet more startling, it is not the savage of the Palæolithic epoch of Europe, but it is the man of the Neolithic period—the respectable barbarian of the Lake-Dwellings. We are called upon by the first scientific authorities in the United States to believe that, before the mantle of ice which destroyed the fauna of the Tertiary age was spread over Northern Europe and America, man existed in the western part of North America in such a condition of advancement (we might say, perhaps, civilisation) that he worked in the hardest stone, and fabricated out of the obdurate granite mortars and dishes of perfect form, weighing from 20 to 40 pounds, and 12 inches in diameter. He also used a vessel (described as a "skillet") made out of a lava "hard as iron," which was circular in form, and had three legs and a spout; and polished stone axes, perforated to receive a handle, and "ladles" of steatite, and various other stone implements exceedingly difficult to manufacture, as, for example, the perforated discoidal disks or quoits found at Gold Springs Gulch and elsewhere.

It is a fact, says Mr. Bancroft (who, however, equally with Prof. Whitney, believes in the vast age of these objects), that

the mortars have "in almost every instance been found by miners in their search for gold."

Another point to be remarked is that they seem always to be found in the auriferous gravels.

We know very well that Cortez found the temples and palaces of ancient Mexico resplendent with gold, and Dr. Daniel Wilson, in his charming but incautious work on *Prehistoric Man*, tells us that "the metallurgic arts were carried in some respects further by the Mexicans than the Peruvians. Silver, lead, and tin were obtained from the mines of Tasco, and copper was wrought in the mountains of Zacotollan by means of galleries and shafts opened with persevering toil where the metallic veins were imbedded in the solid rock."

A thousand years, perhaps, before Cortez landed in Mexico the Toltec civilisation flourished in Central America, in Anahuac, and on the Pacific coast, and centuries before the palaces of Montezuma glittered with the precious metals the precursors of the Aztecs had mined into the auriferous gravels of the Sierra Nevada and the Sacramento Valley. The relics which I have described were evidently left where they have been found by gold-hunters, and it is hardly credible that gold excited the cupidity of man in the Pliocene epoch.

If it were impossible to suggest an explanation of how these granite mortars and dishes got into the heart of Table Mountain, could persons having no theory to maintain accept the conclusion of Professor Marsh and Professor Whitney that the human bones and stone mortars and the geological stratum in which they are found are of the same age? If we should find a vase of gold coins in the same position, would it be reasonable to draw the conclusion that there were human beings in the Tertiary age who had some idea of finance and made use of coined money? Would it not be more sensible to seek some other explanation, and, if none were found, still to refuse to believe that gold was coined into money before the Glacial Epoch?

It seems to me that we already have the clue to the presence of these mortars and pestles in the auriferous gravels in the fact I have cited, that they seem always to be found in these gold-bearing gravels and nowhere else.

I have quoted also from Dr. Wilson to show that the primitive inhabitants were capable of boring into the bowels of the mountains to obtain gold and silver.

Mr. Bancroft, in his great work to which I have referred, testifies to the same fact. Both gold and copper, he says, were mined in Mexico from veins in the solid rock, extensive

galleries being opened for the purpose (*Native Races, Pacific States*, vol. ii. 474).

They carried their excavations, we are told, to the depth of 200 feet or more, to procure the chalchinite (or turquoise) so much prized as an ornament. Obsidian they obtained in the same way, the mines at the Cerro de las Navajas, near Monte Jacal, being described as opening three or four feet in diameter, and 110 to 140 feet in extent (horizontally), with side drifts as occasion might require.

The copper mines and the mica mines of much ruder tribes in the Northern and Eastern parts of the United States illustrate these facts.

One more statement on this subject would seem to render the violent hypothesis of Professors Whitney and Marsh wholly unnecessary.

One of these ancient shafts has been actually discovered in this very Table Mountain which figures so largely in these accounts, and where the celebrated Calaveras skull itself was discovered under such remarkable circumstances.

The discovery in question was made in 1849, long before the discussions about the existence of man in the Tertiary strata had ever been dreamed of. I quote from Schoolcraft's *Archæology*, vol. i. p. 105:—

"It was late in the month of August, in 1849, that the gold-diggers at one of the mountain diggings called Murphy's were surprised, in examining a high barren district of mountain, to find the abandoned site of an old mine.

"'It is evidently,' says a writer, 'the work of ancient times.' The shaft discovered is 210 ft. deep. Its mouth is situated on a high mountain. It was several days before preparations could be completed to descend and explore it. The bones of a human skeleton were found at the bottom. There were also found an altar for worship and other evidences of ancient labour. No evidence has been discovered to denote the era of this ancient work. There has been nothing to determine whether it is to be regarded as the remains of the explorations of the first Spanish adventurers, or of a still earlier period. The occurrence of the remains of an altar looks like the period of Indian worship."*

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* While reading these proof-sheets, my eye has fallen on the following item in an American newspaper, which seems to me pertinent to the matter in hand. It is a fresh illustration of the existence of these ancient mines. (From *The Interior*, Chicago, November 4, 1880):—"An old mine, supposed to have been worked by the ancients, was discovered last week by a prospecting party in the Sangre de Cristo range of mountains, Colorado. In

It appears to me that this is an abundant explanation of all these mortars and spear-heads which have been found at great depths in Table Mountain and elsewhere in California, and it is a matter of great astonishment to me that such men as Whitney, Marsh, and Winchell should on such evidence rashly assert that "the existence of man in the Tertiary period seems now fairly established," and that not only Le Conte, but even Dana, in the last edition of his incomparable *Manual of Geology*, should deem it worth while to incorporate such discoveries in their chapters on the antiquity of man.

I may add to what has been said that Lesquereux refers some of the fossil plants found in the gravels described to the Miocene period, so that we might fairly infer, if Marsh is correct, that the human race in California is as old as the beginning of the Pliocene—the contemporary of the three-toed *Anchitherium* and the *Hipparion* or *Protohippus*, whose saddles and bridles we may yet hope to find if the skillets, and dishes, and mortars we have been considering were manufactured at that time.

The animal remains found in the lower gravels under the basalt also belong to the Miocene age.

With regard to the Calaveras skull, Professor Whitney observes, that "it presents no signs of having belonged to an inferior race. In its breadth it agrees with the other [modern] crania from California, except those of the Diggers, but surpasses them in the other particulars in which comparisons have been made." "Man," he says, "existing at that remote time . . . . was still the same as we now find him to be in that region."

What becomes, then, of the doctrine of Evolution? If the human skull was exactly the same at the beginning of the Pliocene, or the close of the Miocene, that it is now; on the theory of evolution, how shall we explain the absence of all progress or change? and what margin of time is there for man's development from the generalised lemurs of the Eocene? There is no doubt whatever that the confirmation of Professor Whitney's opinion as to the age of this skull would be fatal to the evolution theory.

I append a few cuts of the mortars and other objects found in the gold gravels of California, and which are believed by

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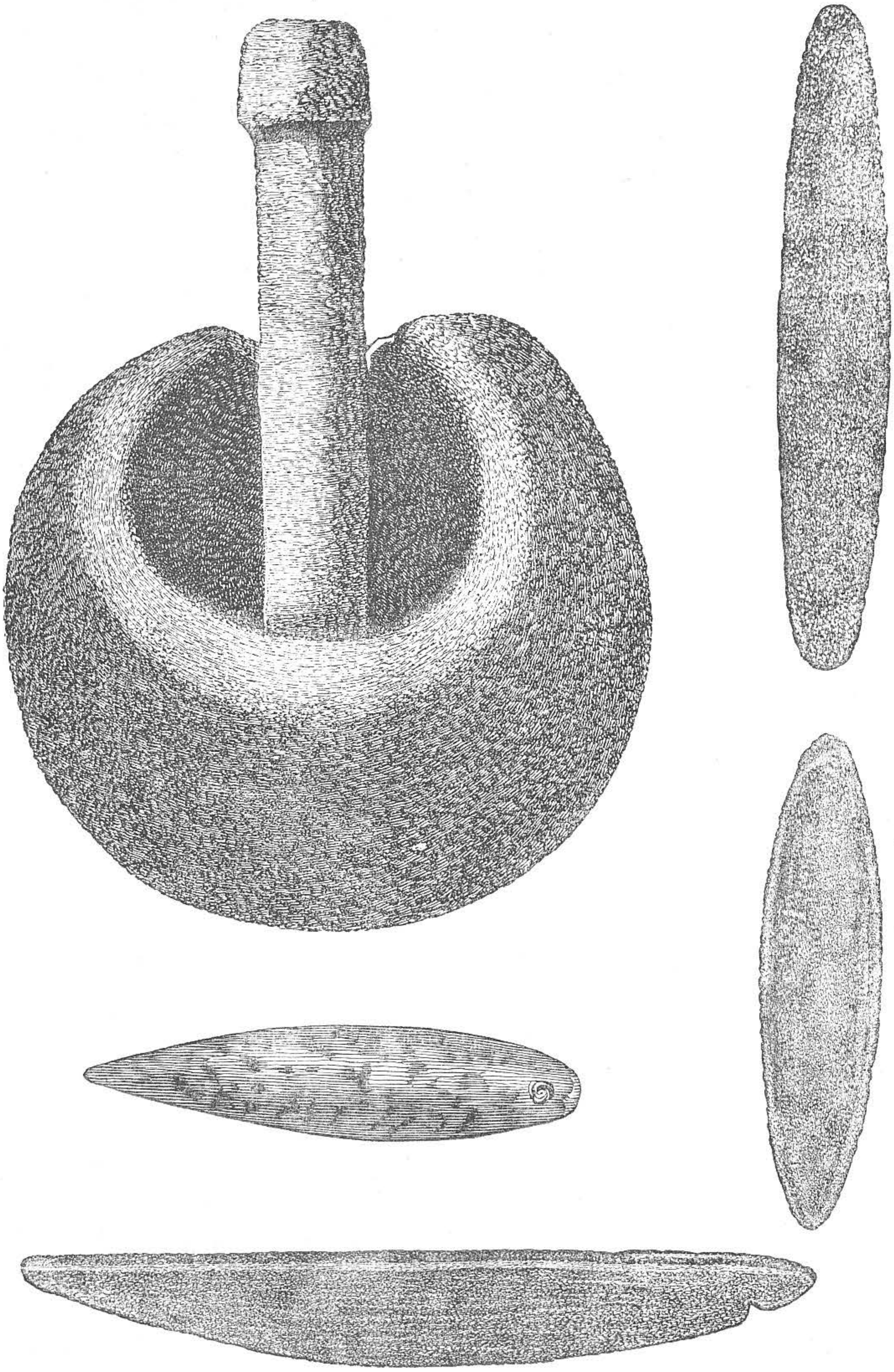
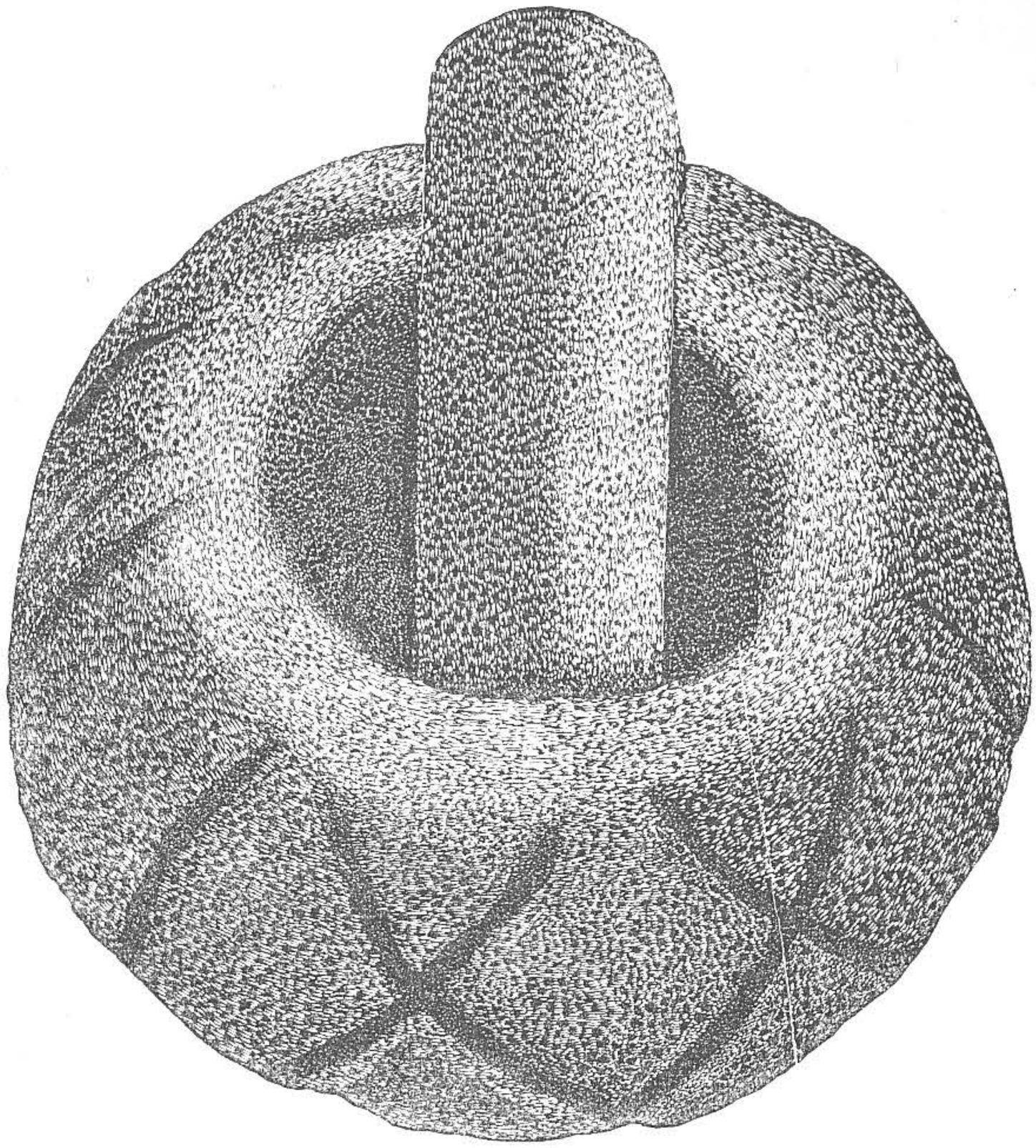
the mine are two large chambers from 10 to 20 feet high, and double that number of feet in breadth. Stones, bones, skulls, and gold were found, the value of the latter being about 900 dollars. A further investigation will be made."

Professors Whitney and Marsh to be of early Pliocene age. They are taken from Bancroft's work. I am compelled to say that I think it requires a very unsuspecting and credulous



mind to believe that these beautiful mortars were produced by man when not a single land mammal now living other than man (the one exception) had made its appearance in the palæontological procession.

Perhaps I may remark before closing this brief paper that I am not unaware that flint implements of palæolithic type have been discovered in the valley of the Delaware, in the United



States, by Dr. C. C. Abbot, which have been referred to the Glacial epoch.

With regard to these, a thorough examination and study of the gravels in question have been recently made by Mr. Henry Carvill Lewis, of the Second Geological Survey of Pennsylvania, and a paper on the subject was read by him before the Mineralogical and Geological Section of the Academy of Natural Sciences of Philadelphia, November 24th, 1879.

It appears from this examination that the Trenton gravels in which the alleged implements were found are the latest of four gravel beds in the valley of the Delaware. The formations of this region are divided into five clays and four gravels, which, beginning at the oldest, succeed each other as follows: 1. Jurasso-cretaceous plastic clay; 2. Tertiary clays (Brandon period); 3. Bryn Mawr gravel (Upper Tertiary); 4. Branchtown clay; 5. Glassboro gravel (Pliocene); 6. Philadelphia

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NOTE.—The blocks of the illustrations have been kindly lent by Messrs. Trübner & Co.

red gravel (Champlain or Palæolithic epoch); 7. Philadelphia brick-clay (same date); 8. Trenton gravel (equivalent to the Reindeer period of Lartet).

Mr. Lewis remarks:—

"It is thought that the hypothesis of a second and more local glacier, long subsequent in age to the first great glacier, will explain all the facts observed. The Trenton gravel cannot be assigned to the First Glacial period except by assuming that there have been no river gravels deposited since that time,—an assumption that can hardly be maintained. Some European archæologists have held that the *Palæolithic era*, the era of the river gravels, is antecedent to the *Reindeer period*, the period of the Cave-men. No such distinction has been observed on the Delaware. The period of the Trenton gravel flood, whether contemporaneous with a glacier or not, is the period of the last geological deposits here known; the recent mud-flats being alone excepted" (p. 13).

With regard to the age of the Trenton gravel, he says:—

"The same reasoning that showed that the modern river channel might have been excavated in hundreds rather than in thousands of years, will indicate that no great length of time is necessary to produce all the surface features of the Trenton gravel. While the writer may venture to express the opinion that there is no reason geologically for carrying the age of this gravel and the antiquity of man on the Delaware farther back than a very few thousand years at the most, he is fully aware that any close approximation can safely be arrived at only by extended comparison with other river gravels and by a much more complete series of observations than has yet been possible" (p. 15).

If Mr. Lewis is correct in his reading of the sequence of the geological phenomena in the Delaware valley, and in his conclusion that the gravels in this region are of different epochs, it corroborates a conjecture made by me elsewhere with regard to the European river gravels, and I shall not be surprised if a more careful study of the European beds shall show that the gravels in which the so-called palæolithic implements have been found are the newest and latest in a series of beds running back into pre-glacial times.

Mr. S. R. Pattison, F. G. S. (having read the paper in the author's unavoidable absence, then added):—I will not detain the meeting more than a few minutes by my remarks; but I wish to state that since this paper was written — in fact, within the last few days — there has been a very important addition made by Professor Whitney to the materials that are here put forward. That addition is so important that I feel justified in at once bringing it under the notice of the Institute. It occurs in the second part of his "Report." In this he carefully goes over his surveys—the whole of the area of the Pacific slopes, from the plains of California to the summit of the Rocky Mountains—and he adds to his conclusions those of another of the State geologists who worked with him. Professor Whitney contends that the auriferous gravels from the Pacific slopes of the Rocky Mountains (gravels which are now worked for gold, and which have been so worked very extensively) represent the whole tertiary period. He thinks he has found out this, and in laying it before the world brings the following evidence in support of his conclusion. He says that series of gravels, from the very highest point where gravel is found—which he terms the "high gravel series"—down to the lowest, all form one series. He finds that they were deposited before there is any evidence of the action of ice having taken place; and he makes the gravel period comprise the whole period of the tertiary deposits—the eocene, the miocene, and the pliocene. He states that, in fact, these gravels are all mastodon gravels. He also says that there is no distinction between the gravels of the different levels; and, therefore, draws the conclusion that the remains of man found in the gravels on the Pacific slopes indicate the existence of man all through the tertiary epoch. He says the course of the streams was the same at the commencement as now; and accounts for the gravel as having been made by the streams, the "slow and ordinary working of the streams," interrupted by grand paroxysmal action during which large quantities had been dropped and spread over a large area. In the lower parts of these gravels, in the "pay dirt," gold is found in large quantities, and some gold in the upper parts also; and because the remains of man have been found at various places in both these gravels he attributes the remains that have been found to the same period as the gravels, *i.e.*, the tertiary period. I have myself had an opportunity during the last autumn of visiting the eastern slope of the Rocky Mountains, and of examining these gravels with the haste which a casual traveller can only regret to be obliged to use in his investigations. But I will just mention two facts of observation which I made as to Professor Whitney's discoveries, and which I mention with very great submission, because he has been almost all his life at the work. In the first place, on going over the prairies to the Rocky Mountains, you rise

6,000 feet, and you have under you, nearly all the way, tertiary formations pretty evenly spread over the whole district. These tertiary formations are a little tilted when you come to the Rocky Mountains. Over these formations there is spread, for hundreds and thousands of miles, a layer of gravel, and above the gravel a layer of brick earth, both together constituting the gravel period. From the Missouri up to the Rocky Mountains, and up and down the river Missouri for thousands of miles, you tread upon deep gravel—at least deep brick-earth and gravel, lying upon the tertiary. Now, it is almost unaccountable that the gravel on the Rocky Mountains should be like some ill-assorted couple,—May and December,—that there should be one epoch on the one side and another on the other; that it should be extremely old on the one side, and but reasonably old on the other. It is quite out of the question to conceive that that is the case. That is the first thing that strikes one; and the other is, that in following up the abundant gold gravel deposits in that magnificent country I can perceive nothing, except in the enormous scale of things, different from that which abounds in Switzerland and in our own country. You have a gravel which is laid out over the district, becoming fine as it is at a distance from the mountains, and becoming coarse as it is near the mountains, and which is laid out as running water will lay out gravel; and this process is evidently going on now, the course of streams being constantly changed by the operations of the gold-diggers. But underneath that gravel, which is mastodon gravel, no doubt, and which contains the implements of which we have heard, I found a tumultuous mass of boulder gravels, which, if we had seen them in this country or in Europe, we should have attributed to the action of ice. Not only did we find these gravels, but we found very numerous basins and terraces cut out, giving proof of the enormous power of water in a paroxysmal manner, operating far more suddenly than anything we have instance of now; so that we have presented to us the same state of phenomena as we have in Europe, and I do not know any reason for calling the one tertiary and the other post-glacial. Then as to the excavations for mines. There are old excavations for mines spotted over nearly the whole of this district, which clearly indicates that the early inhabitants derived their gold from diggings, as the Cornish people did their tin from the streams. They found it in the same gravel at the bottom of the mud. In Cornwall, in the same situation, we find deer-horns and the remains of man; and at first you would say, "Well, man must have lived at that epoch, upon that floor, when that tin was deposited; but, beyond a doubt, these were the remains of the men who were the workers of the tin," but they are all transported or transposed remains, from a more modern surface. And so, the extraordinary jumble that you get in the Rocky Mountains, by reason of the enormous rush of the streams down those gulches and cañons, really accounts for everything with regard to the position of these things; for, if the implements had been here this year, they would have been there the next, and somewhere else the following

year, carried by the force of these streams. This is a fact that strikes one on visiting these places, and it seems to me to dispose of the evidence for extreme antiquity which is proposed by Professor Whitney. One really is almost afraid to advance anything against the State geologist of California; but my own view is that simply of an observer, and when I observe the tertiary strata, which he says are contemporaneous with the gravel on one side, are on the other side covered by the gravel, I think there must be a mistake; and when I observe the displacements which have been taking place in these drift deposits in the search for gold, I think he must have been mistaken also in supposing that any chronology can be established from them.

The CHAIRMAN.—My duty is, first of all, to return our thanks to Dr. Southall for his admirable paper, and then to Mr. Pattison, not only for the able manner in which he has read it, but also for the interesting remarks which he has added. Before the discussion commences, some "communications" have to be laid before you: Principal Dawson's is taken first, as the others refer to it.

The following communication from Principal and Vice-Chancellor J. W. Dawson, C.M.G., LL.D., F.R.S., of McGill University, Montreal, was then read:—

"*December 30th*, 1880.

In answer to your communication accompanying Dr. Southall's paper on Pliocene Man, I have much pleasure in stating that I concur in general in the conclusions of the paper, several of which I have indeed already argued for in previous publications.

There should, I think, now be no doubt as to the modern and even historic character of the remains of man usually known in Europe as 'Neolithic.' Their nature and mode of occurrence are in no respect different from those of the historic aborigines of America, no material physical or faunal changes have occurred since their time, and the identity of the Neolithic men with tribes still extant in Europe, as the Basques and Lapps, has been again and again insisted on. I regard the whole of these remains as coming within the dates of the historic empires of the East, and as being historically post-diluvian, and geologically recent.

As to the so-called 'Palæolithic,' or, as I have preferred to call them, *Palæocosmic* men, those of the older cave and gravel deposits; while I can see no good reason for the view recently advocated by Dawkins, that the race of the gravels is older than that of the caves, I agree with him that both are in all probability post-glacial, and referable either to the close of the Pleistocene or the beginning of the modern period. For reasons which I have stated in a recent review of Dawkins's valuable work on 'Early Man in Britain,' I prefer the latter classification, and have stated the arrangement adopted by me, in various papers and other publications as follows:—'On

the one hand, while the whole Tertiary or Kainozoic, up to the present day, is one great geological period, characterised by a continuous though gradually changing fauna and series of physical conditions, and there is, consequently, no good basis for setting apart, as some geologists do, a Quaternary as distinct from the Tertiary period, on the other hand there is a distinct physical break between the Pleistocene and the Modern in the great glacial age. This in its arctic climate and enormous submergence of the land, though it did not exterminate the fauna of the Northern Hemisphere, greatly reduced it, and at the close of this age many new forms came in. For this reason the division should be made, not where Dawkins makes it, but at or about the end of his 'Mid-Pleistocene.' The natural division would thus be :—

I. PLEISTOCENE, including—

(*a*) *Early Pleistocene*, or First Continental period. Land very extensive, moderate climate.

(*b*) *Later Pleistocene*, or glacial, including Dawkins's 'Mid Pleistocene.' In this there was a great prevalence of cold and glacial conditions, and a great submergence of the northern land.

II. MODERN, or period of Man and Modern Mammals, including—

(*a*) *Post-glacial*, or Second Continental period, in which the land was again very extensive, and Palæocosmic man was contemporary with some great mammals, as the mammoth, now extinct, and the area of land in the Northern Hemisphere was greater than at present. This represents the Late Pleistocene of Dawkins. It was terminated by a great and very general subsidence accompanied by the disappearance of Palæocosmic man and some large mammalia, which may be identical with the historical deluge.

(*b*) *Recent*, when the continents attained their present levels, existing races of men colonised Europe, and living species of mammals. This includes both the Prehistoric and Historic periods.

On geological grounds the above should clearly be our arrangement, though, of course, there need be no objection to such other subdivisions of the Recent Period into local Historic and Pre-Historic ages as historians and antiquaries may find desirable for their purposes. On this classification *the earliest certain indications of the presence of man in Europe, Asia, or America, so far as yet known, belong to the Modern period alone.* That man may have existed previously no one need deny, but no one can positively affirm on any ground of actual fact.'

It will be observed that a consideration of the distribution of the post-glacial gravels, the character and extent of the post-glacial denudation, and the faunal changes between the post-glacial and the recent periods, lead me to infer that a submergence of the land occurred at the close of the post-glacial period, and that it is not improbable that this submergence may have

been that otherwise known as the historical deluge. Further, since it is impossible to suppose that the great submergence of the land of the Northern Hemisphere, to an extent known to have exceeded 4,000 feet, before the post-glacial age, nor that second submergence, which followed it, can have proceeded at the slow rate of modern changes of level, it seems necessary to admit an abrupt or paroxysmal character for these great changes of the relative levels of land and water in the later Tertiary time, and thus to modify very much the estimates of the absolute antiquity sometimes assigned to post-glacial, or Palæocosmic man, who, as I have elsewhere argued, becomes, on the views above stated, the representative of the historical Antediluvians.

The evidence adduced by Prof. Whitney and others for the Pliocene age of human remains found in the gold gravels of California, I have never held to be valid, and have regretted that able geologists should have committed themselves to so startling and otherwise improbable conclusions on grounds apparently so insufficient. I have studied with care the facts detailed by Prof. Whitney in his recent memoir on the Auriferous Gravels of California, and have stated at length my objections to his conclusions in the appendix to my book, entitled "Fossil Men" (pp. 344 to 347). These objections may be summarised as follows:—(1) None of the specimens can certainly be affirmed to have been found *in situ* in the undisturbed gravel. (2) The fossil fauna and flora of the deposits consist, so far as known, of extinct species, with the exception of man and of a modern snail found in association with the Calaveras skull. (3) The human remains found belong to a somewhat advanced race of modern type. (4) The manner in which Prof. Whitney accounts for the deposition of the Calaveras skull on the supposition that it is contemporaneous with the gravel, is fanciful and improbable. (5) The so-called "fossilised" condition of the skull proves nothing. That it afforded on analysis 62 per cent. of calcium carbonate, merely shows that, after decay of the animal matter, its pores became infiltrated with that mineral, a change not requiring a long time.

I have also much pleasure, in this connexion, in referring to the interesting paper recently communicated to the Academy of Natural Sciences, Philadelphia, by Mr. H. C. Lewis, of the Geological Survey of Pennsylvania, in which, for the first time, the age of the 'Trenton gravel,' which has afforded the rude flint implements described by Dr. C. C. Abbott, is accurately determined. As Dr. Abbott's discoveries have been extensively quoted, both in America and Europe, as evidence of pre-glacial or interglacial man, it is satisfactory now to be assured that the gravels in which these interesting relics occur are altogether post-glacial, and are really modern fluviatile deposits. This age I had already assigned to them, in the appendix to "Fossil Men," on analogical grounds, but it has been fully proved by the observations of Mr. Lewis.

The above remarks are necessarily condensed, and refer to conclusions which I have elsewhere supported at greater length, in publications, the

greater part of which have, I think, been placed in the Library of the Institute. We are much indebted to Dr. Southall for his previous labours on this subject, and also for the facts and reasonings contained in his present paper.*

To Capt. F. PETRIE,
Hon. Sec., Victoria Institute."

The following from his Grace the Duke of Argyll, K.G., was then read :—

"*January* 17*th*, 1881.

SIR,—I had intended to attend this evening on the occasion of Mr. Southall's paper being discussed, but the severity of the weather and a cold prevent me from doing so.

The human implements which seem to have been found in the auriferous gravels of California can hardly be supposed to be contemporary with the deposition of those gravels, unless they are found under conditions which make it certain that they could not have been introduced at a later epoch.

I regard such an assumed contemporaneousness as in the highest degree improbable, considering the change which we know to have passed over the mammalian fauna since the probable epoch of those gravels; and generally, I agree entirely in the view taken in this paper, and in the letter from Principal Dawson, of Montreal.—I am, dear Sir, ARGYLL.

Capt. F. Petrie."

The following from Professor W. Boyd Dawkins, F.R.S., was then read :—

"*Owens College, Victoria University, Manchester,*
14*th January*, 1881.

I regret that my engagements forbid my hearing Dr. Southall's interesting and impartial paper, and of expressing my entire agreement with his views as to Professor Whitney's 'Pliocene Man,' of California. In the Lowell lectures in Boston, last October, I pointed out that the auriferous gravels of California offered no evidence on the question, because none of the human remains have been proved to be contemporaneous with them. The human remains belong to the class of relics left behind in California, Arizona, and New Mexico by the ancestors of the present native tribes, and imply a rude civilisation of the same kind. They have, in my opinion, either been embedded in the gravel by the action of streams, or of slips from the mountain sides in modern times, or are the result of interments, or of the mining operations which Dr. Southall describes, carried on by the native tribes in modern times and not in the Pliocene age. With regard to the Calaveras skull, I feel inclined to the view of Mr. Bret Harte rather than to that of Professor Whitney. There is, in my opinion, no satisfactory evidence in the New or Old Worlds of the existence of man in the incalculably remote Pliocene age.—I am, dear Sir, yours truly,

W. BOYD DAWKINS."

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* In another communication, Dr. Dawson, F.R.S., commenting upon the whole question, remarks :—"I think the tide is decidedly turning as to the antiquity of man, as well as with reference to the origin of species, and the Institute has certainly done its part in contributing to this result."

The following from Professor T. McK. Hughes, F.G.S. (Woodwardian Professor of Geology at Cambridge), was then read :—

"*The Palace of St. Asaph, North Wales, January* 10*th*, 1881.

I am much obliged to you for sending me the interesting paper of Dr. Southall on Pliocene Man in America. His explanation seems reasonable and well supported. It is the old story of the toad in the rock. It was true, I dare say, that men had found a toad in a hole in solid rock to which apparently there was no access except along the line they had newly broken. But they did not consider that in their quarrying they had destroyed all evidence of the fissure along which the toad crept, and in fact that they would not notice such a thing until the question had been raised 'How did the toad get there'?

I think Dr. Southall shows that it was highly probable that, in all the cases recorded of mortars, &c., being found in the old auriferous deposits, the discoverers had only cut into ancient disused and perhaps collapsed mining levels. I am sorry that the author has gone out of his way in his first paragraph to sneer at the cautious Lyell and the clear-headed Lubbock. I confess I do attach great importance to the evidence they bring forward on the points referred to by the author; though, of course, I do not think that any term of years can be assigned either to the earlier or later human periods of which they were writing.—Yours, very truly,

THOMAS MCK. HUGHES."

The following from Mr. N. Whitley, C.E., was then read :—

"*Penarth, Truro, January* 12*th*, 1881.

The conclusion arrived at by Dr. Southall that the stone mortars and dishes found in the gold-bearing gravels of California are the relics of ancient mining operations is supported by the analogous case of somewhat similar bowls and dishes having been found in the tin-bearing gravels of Cornwall.

The ancient tin trade of Cornwall can be traced back with a considerable degree of certainty to a Phœnician origin, and the earliest operations appear to have been the extracting of the 'stream tin' by open excavations from the lowest stratum of the valley gravels. This tin-bearing bed resting immediately on the oldest rocks of the county, was usually from two to four feet in thickness, and was covered by ordinary river gravel for a depth varying from four feet in the upland valleys, to sixty feet at their mouths. In addition to a plentiful supply of detrital tin-ore, small quantities of gold have been found mixed with the tin-ore.

No relics of man's frame or of his implements have been found in the tin-bearing stratum, but low down in the overlying gravel some few human skulls have been found; and almost at as low a level a bronze crucifix was found in the gravel and is now in the museum at Truro.

From the imperfect manner of working adopted by the ancient 'streamers' it has been found remunerative to work some of the gravel beds over the second time; and thus relics of the implements of the 'old men' (as they are called) have been found; consisting of shovels and pickaxes formed wholly of oak timber, and others of a more advanced type, of wood tipped with iron, also many stone bowls, mortars, and dishes, mostly of granite, and varying much in size, form, and workmanship.

In 1879 I obtained a fragment of a very symmetrical bowl from a small valley in the parish of Zennor: it was made of granite, and when complete measured twelve inches in diameter at the outside of the top, and would hold about two-thirds of a gallon. Three others, all of hard stone, have

lately been found by my son at places near the tin-bearing valley of the Fal, of larger size, rougher form, and may more correctly be termed mortars.

The late Mr. Bryant, of Trebetherick, near Padstow, collected a considerable number of such granite mortars; of these he kindly, some years back, sent me a photograph.

Such bowls, or mortars, might have been used to pound up the coarser materials in order to separate the crystals of tin from the matrix; the smaller dishes for washing out the minute particles of tin-ore from the earthy matter with which they are mixed; or perhaps, with a greater degree of certainty, to determine by measurement the proportion of tin-ore due as '*toll*' to the landowner. This might be a tenth part or otherwise as agreed on; the agent who collected it was called '*the Toller*,' and the agreement would have described it as the tenth *dish*.

Putting all these circumstances together, I think it is an analogous case to that described by Dr. Southall, and tends to support the conclusion to which he arrives in his paper—that the stone mortars found in the gravel beds of California are the relics of ancient mining operations.

NICHOLAS WHITLEY."

Rev. J. M. MELLO, F.G.S.—I had hoped that some one would have relieved me from the necessity of getting up to address you on this occasion, as I am not very well up to the work of extemporary speech; at the same time I may say that I have much pleasure in being present and taking part in the discussion of the paper we have had read this evening. I have read the paper with some care, but unfortunately I have not been able to obtain access to the original documents; for, really, in order to pronounce a definite opinion upon the subject, one ought to be able to say that one has examined all the evidence that has been adduced, and I am not able to say that, as I do not know what evidence the American geologists have brought forward to show that the remains they have found are contemporaneous with these gravels. To my mind, however, everything is against that assumption. I agree with Dr. Southall and the Duke of Argyll in what they have brought forward, and which, I believe, has proved, as far as it can be proved by argument, that the remains which have been found are certainly not of the pliocene age. We may argue on *à priori* grounds that it is almost impossible—of course, we have no right to say that it is absolutely impossible—but it is almost impossible that man could have existed in those days. I most thoroughly agree with the arguments of Professor Dawkins, that it is not likely, when no genera of mammals exactly similar to those of the present day are known to have existed, that man himself could have been in existence, and I do not think we have any right to look for man before we find these mammals making their appearance on the earth. Another argument, which is also an *à priori* argument, is that, as far as we can learn, geological history in America does not seem to be in such an advanced condition as it is in Europe. Professor Dana has made some remarks to this effect, showing that we Europeans are in advance of the New World, as well as other parts of the Globe—for instance, Australia. Australia has its marsupials at the present day, and, as far as its other fauna are concerned, it is said to be still in the tertiary period. In North America we get a grand

development of herbivorous mammals, and we do not find in that part of the world the great diversity of mammalian life which is found in the Old World. But, supposing man did exist in those ages in the highly-cultivated condition referred to, who preceded him? There must have been men of a lower grade, according to the view which many hold as to the development of man, and his remains ought to be found in beds yet earlier than these which are supposed to be tertiary; so that in order to find the earliest man of all we should have to push our researches back to the oolitic period. We know that although the North American Indians, not only at the present time, but for a considerable number of centuries, have been in a semi-civilised condition, their civilisation has been of a very low order—that is to say, they have made either no very great use of metals or none at all. But, although this is the case, it has been pointed out in Dr. Southall's paper and elsewhere, that there was a time—and that not so very long ago—when the North American Indians were in a far more civilised state than they are in at the present day. We find scattered over the greater part of North America great tumuli and mounds, and we have in these mounds apparent relics of civilisation among the Indian tribes of a far higher character than that which now prevails. It is also, I believe, a fact that, although we now find the greater part of America to be new forest land and waste, there was a period when the greater part of this forest district was to a certain extent cultivated; the mounds erected by the mound-builders, and by those who constructed those old tumuli, were in all probability the sites of cities and towns; and we know for certain that there was a very considerable use made by those earlier tribes of certain metals, although the use of them seems to have died out. We know that copper was used, and probably lead and silver—copper, and occasionally silver, being found in the tumuli, while mines have been found near Lake Superior in which copper used to be worked. This shows that there is no reason why we should not look for the existence of men having a tolerable civilisation who were able to mine to a considerable depth in certain parts of America, at a period not so far removed from that of those mound-builders and, probably, contemporaneous with them. But I do not see any decided proof that the men whose remains are found in these gravels were by any means contemporaneous with the gravels themselves. If you find remains, unless those remains are found by competent observers, it is almost impossible to say for certain that the things found are contemporaneous with the gravels and have not been introduced since, because in the very nature of the section of a gravel-pit it is impossible to see any decided lines. In almost all cases it is impossible for those gravels to give any proofs of the existence of contemporaneity between the remains found and the gravels themselves. Suppose a mining level had been driven into those old gravels of the Rocky Mountain district, and supposing the mining level had fallen in, which I think, in many cases, would have undoubtedly taken place, then no trace whatever would be left of the existence of the level so driven. If there had been timber props put

up in the level they would, under the influence of moisture, soon have decayed, so that there would be no proofs whatever of there having been a level there; and, in subsequent mining operations, miners might come across these old levels, and, finding the implements that had been left there, regard them as contemporaneous with the gravel itself, and so jump at once to a conclusion as to a fact which has had no existence. I think the suggestion of Dr. Southall's a most likely one, namely—that all these implements and other things found in the gravels were introduced by the old miners in old mining galleries, and all the circumstances seem to point in that direction. With regard to the Calaveras skull, we should not expect to find any recognisable disturbance in the overlying bed, supposing the object had been introduced by a gallery or level in the way I have described. The overlying bed would have been, of course, untouched. With regard to Dr. Dawson's communication, I think it an interesting one, and I agree with most that is in it. There is not much difference between his views and those of Professor Dawkins, except that one draws the line at one period and the other at another. I should like to know what argument Professor Dawson can adduce to show that the submergences of land he speaks of were not slow submergences. He says, without giving any proof, that it is impossible to show that. Of course, I do not say that it may not be so; but I should like to know what proof he can give of it; because all the geological changes, as far as we can follow them, have been slow changes. I think I have now said nearly all I need put before you, for I do not feel able to add very much to the arguments that have been adduced by others. I hope some other gentleman will now take up the subject.

Mr. T. K. Callard, F.G.S.—I should like to make a few remarks in the same direction as those of the last speaker. On pages 6 and 7* of the paper we find it stated that the mortars have "in almost every instance been found by miners in their search for gold"; this is important. Again, it is said that the relics seem always to have been found in the auriferous gravel, and I should like to add that they are just such as we should have expected the ancient miners to have used. Now, if it be established that ancient miners have been there, all difficulty with regard to these relics is removed. In addition to the evidence before us, Mr. Bancroft says that the new Alamaden quicksilver mines are said to have been worked by the natives for the purpose of obtaining vermilion long before the coming of the Spanish. I would also call attention to the skillet spoken of on page 4,—"An ancient skillet, as we are told, made of lava as hard as iron, with a spout and three legs, was washed out of a claim at Forest Hill"; and on page 6 it is said, "He,"—that is, Pliocene man—"used a vessel described as a skillet, made of lava, hard as iron, which was circular in form, and had three legs and a spout."

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* See numerals at the foot of each page.

This identical skillet, a writer quoted by Bancroft says will be sent to a state fair in America as a specimen of crockery used in the mines several thousand years ago. If there were mines, as I said before, the difficulty is gone. The finding of relics in a Pliocene stratum no more proves that man was Pliocene than the finding of a pickaxe in a coal-mine would prove that man belonged to the carboniferous period. Reference is made on page 2 to my having sent to the author a piece of the tusk of a mammoth, part of a specimen sent to me from Archangel, in which the ivory is in so fresh a condition that it has been shaped into a chequer by an ivory-turner, which indicates—I do not say proves—that the extinct mammal has not been so long extinct as is generally supposed. I have brought a chessman here that has been turned out of a mammoth tusk, and it has such an appearance of freshness that neither the eye nor the tongue can detect any indication that the animal to which it belonged lived 200,000 years ago; and the finding of certain implements along with the mastodon, mentioned in this paper, would not to my mind convey the idea of any considerable antiquity. On page 3 reference is made to the views of Professor Dawkins, who has given, from a zoological point of view, his reasons for believing that man did not exist in the Miocene period. The first appearance of man, according to Professor Dawkins, is in the Pleistocene. But whilst Professor Dawkins does not hold that man lived in the Miocene period, yet he does hold to the antiquity of man; and it is a very considerable antiquity that he would claim for man, the proof of which rests on the finding of assumed stone implements. At Erith, now, these implements are not to my mind at all convincing. I have a figure of one here. It must be remembered that chipped flints were found in the Miocene period, flints so chipped that good authorities believe them to have been chipped by the human hand. If flints chipped so as to resemble human implements are found in the Miocene strata, and man was not there at that period, then the finding of chipped flints must no longer be regarded (without some collateral evidence) as sufficient proof of the existence of man at the period to which they relate. Professor Gaudry, I presume, saw this difficulty; neither he nor Professor Dawkins believe in the existence of man in the Miocene period; but yet there was the fact before them that chipped flints had been found; and if somebody must have chipped them, and no man existed to have done it, it must have been done, suggests Professor Gaudry, by some anthropomorphic ape. Professor Dawkins thinks that this is highly probable. I think it is very improbable, and I would on this point ask the question, if an ape chipped these flints in the Miocene period, why may not an ape have chipped the flint, the drawing of which you have before you? And if he could have done this, then I say the finding of the Erith flint does not prove that man existed at the time that it was chipped. Professor Dawkins seems to have anticipated this remark, for he suggests that the ancient ape might have been much in advance of the existing ape: he admits that the ape of the present day could not have done it. And this leads me to another point.

Professor Dawkins appeals to those who believe in the doctrine of evolution, and thinks that they will see the force of his remarks on the non-existence of man in the Miocene period. I do not believe in evolution, but see the force of his remarks. Still, this point arises. How does this fit with the doctrine of the "survival of the fittest," if there were such apes once; according to the evolution theory, they had no right to go out of existence prior to the appearance of man. It is contrary to all rule that they should have done so; they ought to exist now if the principle of evolution be right, and we ought at the present moment to have the highest type of ape along with man. But I do not feel that we are shut up to either conclusion. We have had evidence that flints have been naturally fractured, so as to resemble implements made by man. If we have *some* evidence of this and *no* evidence of apes having chipped flints, I think it is more in accord with the principle of arguing from the known to the unknown to suppose that the Miocene flints were chipped by nature and not artificially, and I would say, by way of caution, if the Miocene implements were naturally fractured flints, would it not be befitting of us to be exceedingly careful how we receive these chipped flints of the Quaternary period when there is no collateral evidence to show that they were the work of man?

The Hon. Secretary said,—Mr. E. Hepple Hall, F.R.G.S., who has not been able to stay, has given me permission to mention that he accompanied Professor Whitney in his explorations over the Rocky Mountains, but that, so far from his opinion being the same as Dr. Whitney's, he must confess to being obliged to agree with Professor Dawson and Professor Hughes.

Mr. E. Charlesworth, F.G.S.* (a visitor), said he had from an early period of his life taken up with great interest the study of natural history, and as a branch of natural history that of geology. In his early days geology was comparatively a new science, and it was then that a number of persons who had time and ability were turning their attention to it. He was much interested in what was going on, and now for a period of something more than half a century had been, more or less, personally in communication with all the great lights in the geological world. If the meeting would allow him, he would tell them the conclusion to which he had come was that geological science,—what might be termed the grand truths of the science,—were completely established, just as were the truths of astronomical science, but when you got beyond that, when

* Mr. Charlesworth is well known as a painstaking geologist. He attended the meeting as a visitor. His intimate relations with such men as Professor Owen, and others amongst those scientific worthies of whom all Englishmen are justly proud, are well known. The freedom with which he alludes to their errors—and all are liable to err—shows how strong can be the language of a fellow-worker in regard to a colleague's mistakes, even when under no circumstance can the most hypercritical antagonist say that such language indicates disloyalty to Science.—Ed.

you got to matters of minor detail, the conclusions often arrived at demanded the most serious sifting before they were generally adopted; and while he was quite prepared to find that man did exist in the Pliocene period or did go even lower yet, having had very considerable opportunity of looking into this matter, he had come to the conclusion that there was no evidence worth a straw, to give man a place in the Pliocene system of the earth's history. The history of geological science was, more or less, a history of extraordinary blunders, and these blunders not committed by men who were tyros just beginning to work at one department of geology, but by men who stood at the very highest pinnacle of knowledge of the science. He would not have attempted to address the meeting to-night had others present taken the question up, but perhaps the Chairman would stop him if he detained them at too great length. He was trying to show that little dependence was to be placed upon the opinion of men of the highest eminence who came forward and said they had found, under such and such a surrounding, such and such an object, and it must certainly justify such and such a conclusion. Suppose some great man of the geological world came and told one a thing of that sort, the popular idea would at once be, "Oh, we must believe that." Forty years ago Professor Owen brought out his important work on the history of British fossil meat-giving animals, and in it he mentioned that there was in the York Museum the skull of a badger, agreeing in all respects with the badger of the present day, and that this skull had been found in an undoubted Pliocene formation in Suffolk,—that was, in the famous deposit known as the Suffolk Crag. Well, he had read that work of Professor Owen's with the greatest possible delight and instruction, but he happened to know something about the Suffolk Crag, and something about the badger, and he thought he should like to see that Pliocene badger's skull. Well, a short time after that, Professor Phillips was translated from the York Museum to succeed Dr. Buckland at Oxford, and they then wanted a successor to Professor Phillips. He accordingly said that he was willing to take the office, and, on appointment, went down to York, and, of course, over the Museum. The very first thing he rummaged for was that Pliocene badger's skull, which, on examination, proved not to have the slightest claim to be Pliocene. It was nothing more than an ordinary badger's skull. The fact was, that one or two hundred years ago living badgers were very abundant in the neighbourhood, which contained numerous crags and old quarries, not being worked, and the sides of which had fallen in and become overgrown with bushes. These crags and quarries were charming places for the badgers to burrow in. This badger had taken up its abode in one of these quarries, and died in its hole; and then, twenty or thirty years after, the Pliocene quarry was worked again, and the workmen, of course, came across that badger's skull, and they, finding it buried in the crag, turned it out and said, "Here is a fossil." He ought to tell the meeting how he knew that this was not a fossil at all. All the bones found in this Suffolk red crag were

most beautifully mineralised. A geologist could swear to them when he saw them in any part of the world, but Professor Phillips being a Yorkshireman, and not being, like himself, thoroughly acquainted with this Pliocene deposit, when this skull was put into his hands, and he was told that it had been taken from the Pliocene, he, as a matter of course, thought there could be no doubt about it. Professor Owen then got hold of it, and published it as a genuine crag fossil. Now, there was a name that he dared to say was familiar to many of the members of the Institute—that was the Rev. W. B. Clarke, of Sydney in Australia, who had done so much with regard to the gold-discoveries in that country. In one of his (the speaker's) early papers on this Suffolk crag, he had mentioned that no mammalian remains had ever been found. Mr. Clarke at once rushed into print to say that Mr. Charlesworth had made a most extraordinary blunder, and said that from one of these quarries near Hoxne he had a collection of bones. He (the speaker) was very much amused when he saw that, because he knew the quarry very well, and he knew that, like all other quarries in Suffolk, there were two deposits—there was a bed of sand and gravel, 15 feet or 16 feet deep, and then the older formation underneath, which was Pliocene. Therefore the question was, had these bones come from the sands above, or from the lower part? and he immediately replied to Mr. Clarke's paper and said, "Will Mr. Clarke be so good as to tell us if he took those bones out of the quarry himself? and, if so, if he took them out of the sands or from the bottom of the quarry?" In reply Mr. Clarke said that it had never occurred to him that there were two formations. He would like to go into the other department. They would understand that what he had been saying all related to what might be called the physical surrounding under which these things were said to be found, but let him say something about the objects themselves. He could go on all the evening, giving them the history of mistakes in regard to these, and these mistakes only showed how extremely necessary it was to thoroughly sift the statements made to you before you receive them. They must not think that what he was going to say was intended to disparage what Professor Owen had done, but the misfortune was, that every now and then, when a case of the kind occurred, a man thought that, because he had a great name, he was bound to tell you what a thing was when he saw it. At Manchester, Professor Owen read a paper on "An Anaplotherium," found in the Cliffs at Cromer, in Norfolk. He (the speaker) had not seen the beast, but he had seen a picture of it, and he doubted its being an Anaplotherium. That was one of the extinct animals that Cuvier described as found in the neighbourhood of Paris. As soon as the British Association was over at Manchester, he (the speaker) went to Norwich to see the animal, which he found had been purchased by subscription for the Norwich Museum, and was just being mounted; asking permission to examine it closely, he did so, and what did they think it was? A roebuck. He thereupon wrote a letter to the *Athenæum* and to the *Literary Gazette*, describing what he had seen, and that he had found it to be a roebuck; but Professor Owen would not have it, and

the fight went on for six months, and then he was obliged to admit that it was a roebuck. He (the speaker) fully agreed with the general results at which Dr. Southall and Mr. Dawkins had arrived. There was one feature in the history of Pliocene upon which he would like to say something, and it was this. In the Suffolk Pliocene crag there had been discovered, during the past forty years, countless millions of sharks' teeth. In his young days, he used to go and look in the Suffolk Crag quarries for fossils, and he was in the habit of finding any number of shells; but his greatest prizes were the sharks' teeth. When Professor Henslow, who was very fond of geology, was presented, in the year 1842, to a living in Suffolk, he came to the conclusion that certain stones in the Pliocene crag contained phosphates of lime, and he maintained that the stones, if ground up, might be used for manure. The result was that all that part of Suffolk where the Pliocene crags existed was found to be extremely wealthy, for all the farmers dug up these stones and utilised them for manure. One of the results of this was that, whereas in his (the speaker's) early days, he would occasionally find a shark's tooth among the shells, the men engaged in shifting the stones found them by thousands. He bought up about 20,000 of them, and, on turning them over was surprised to find that some had a hole drilled through them. Some might be familiar with the dreadful weapons made by the South Sea Islanders. These weapons were made thus;—a piece of wood was cut into the shape of a dagger, and a groove was made down each side of it; into this groove the teeth were placed, and, in order to keep them in position, a hole was drilled through each of them, and a strong piece of binding put through the holes, the result being a most dangerous weapon. Well, the moment he found the drilled hole in his sharks' teeth he thought,—"Why, surely primitive man was here. Here we have really Pliocene man." He went through all his sharks' teeth, and altogether he thought he found eight with the hole drilled through them. He sent them to Professor Owen, who wrote a report stating that he really believed the drilling was human work. There was not a shadow of a doubt that these teeth were really of Pliocene age. The workman who sold them knew nothing about the hole, and did not know that the teeth were of any extra value when pierced in this way. Now came the question: were these holes, which exactly agreed with the holes in the South Sea Island teeth, human work or the work of some animal,—some mollusk or a worm which had the power of drilling hard substances? This was a matter of the greatest possible interest. If it was human work, then man was undoubtedly of Pliocene date. But was it human work or not? They all knew there were certain shell-fish which had that wonderful power of tunnelling their way into the hardest rock. One took a stone and threw it into the sea, and a year or two afterwards found that it was tunnelled through and through. He was not now speaking of the ship-worm, but a worm that drilled through the hardest rock, and that, a creature no harder than an oyster and with its early shells as thin as a piece of paper. Had those shell-fish tunnelled into the

sharks' teeth? The difficulty was, that when the shell-fish went into the stone it went there to live, and did not drive its way through; like a rabbit, it made a burrow. In the case of these teeth, whatever had made the hole had gone in at one end and out at the other. He had brought with him an ordinary tumbler containing about 100 of them. The sharks' teeth of the present day were about an inch and a quarter in length.

The CHAIRMAN.—With regard to what Mr. Charlesworth has said about caution, I do not think I can do better than read a part of the Address of Mr. John Evans, F.R.S., before the Conference on the question of the Antiquity of Man, of which he was President; it was held in May, 1877. He says, after alluding to several recent discoveries in France, Spain, and Switzerland, "Each successive discovery, or presumed discovery, must be received in a cautious but candid spirit, and, looking to the many sources of doubt and error which attached to isolated discoveries, our watchword must for the present be,—'Caution, caution, caution!'"

The meeting was then adjourned.

DR. SOUTHALL'S REPLY.

I do not desire to add anything to what I have said, except to notice a remark of Professor Hughes, that he "is sorry that the author has gone out of his way . . . to sneer at the cautious Lyell and the clear-headed Lubbock." I had said in the beginning of my paper, as an introduction to what followed, that "I presumed that few now attach any importance to the evidences for the antiquity of the race derived by the late Sir C. Lyell, Sir J. Lubbock, and others, from the ancient stone graves, the objects found in the Danish peat, the shell-mounds of Denmark, and the lake dwellings of Switzerland."

Sir Charles Lyell suggests, in his *Antiquity of Man*, an antiquity of several thousand years for the mound-builders of the Ohio valley. Sir John Lubbock suggests "three thousand" years, intimating that it may be perhaps far more.

Sir John Lubbock devotes a large space to the tumuli and stone graves. He indicates his opinion of the remote antiquity of some of them by referring them to the stone age, and, speaking of the circle of Abury, he cites Stukeley as of the opinion that it was founded in 1859 B.C. I have no doubt, however, that he regarded that as far below the truth.

Both of these writers, while abstaining from very specific figures, imply a very high antiquity for the stone implements found in the lower layers of the French and Danish peat. Both of them refer to the fact that the vegetation of Denmark has changed several times since the Stone age in that country, and they both cite the calculations of M. Boucher de Perthes with regard to the time required for the formation of the peat of the Somme valley, whose estimate involved the lapse of some 30,000 years.

As to the lake-dwellings, they both imply in all that they write of them, that those of the Stone age go back some thousands of years before our era, —perhaps some 4,000 to 7,000 years,—but they are cautious about committing themselves absolutely.

As to the Danish shell-mounds, Lyell brings forward various considerations to show that they are "very old"; he suggests that they may be 16,000 years old. Sir John Lubbock makes them older than the Neolithic Age; he calls them "Pre-Neolithic."

Now, in the light of the investigations which have been made since the works of Sir C. Lyell and Sir J. Lubbock appeared, all this appears very extravagant, and we cannot help feeling that it is not fair to the public to be drawn into such wild and unwarranted opinions by our most eminent scientific men. It was in this spirit that I felt called upon in the foregoing paper, which I have had the honour to lay before this Society, to protest against the manner in which the human relics found in the auriferous gravels of California have been treated by distinguished American geologists. The names that I have given as endorsing or countenancing the opinion that the mortars and skillets found in these California gravels were manufactured by men with highly-developed skulls, in the Tertiary period of the geologists, are the highest among the scientific men of America. We are just authoritatively told that "the existence of man in the Tertiary period seems now fairly established." It is absolutely impossible that science shall command the respect to which it is entitled if it proceeds in this incautious spirit. It is a serious matter to be told that man was living in the Tertiary period, and the declaration ought not to be made lightly.

I regret that I should have been construed to have sneered at Sir C. Lyell or Sir J. Lubbock, because I entertain for both of them the very highest admiration.

I intended to point to them as warnings in these discussions about the antiquity of our race; as teaching us by the errors into which they have fallen the necessity of more caution on this subject. Why, both Sir C. Lyell and Sir J. Lubbock mention, in their argument for the antiquity of man, the skeleton of the Red Indian found by Dr. Dowler in the delta of the Mississippi, "beneath four buried forests of cypress-trees superimposed one upon the other," and estimated by Dr. Dowler to be 57,000 years old. They also cite the human bones found in the coral rock of Florida, said by Agassiz to be 10,000 years old; also the *os innominatum* of a man found with the bones of the mastodon in the Mississippi valley, near Natchez; also the cone of the Tinière, in Switzerland; also the pottery found by Dr. Horner in the mud of the Nile, at the depth of 60 feet. Sir C. Lyell also brings forward certain antique boats found in the plain of the Clyde, 20 feet above high-water mark, which he regards as extremely ancient, but one of which had a hole in its bottom stopped by a piece of cork, which must have come from Spain or Portugal. Sir C. Lyell also brings forward the case of a raised beach at Cagliari, in Sardinia, where fragments of antique pottery

were found associated with marine shells of living species, at the height of from 70 to 98 metres above the sea. He concludes that this pottery is 12,000 years old, "even if we simply confine our estimate to the upheaval above the sea-level, without allowing for the original depth of water in which the mollusca lived." Sir Charles was mistaken in this, as in the other instances cited. In 1878 M. François Orsoni ascertained that what Sir C. Lyell took to be a raised beach at Cagliari is, in fact, the site of a kjökkenmödding of the Neolithic age.

ORDINARY MEETING, FEBRUARY 7, 1881.

THE REV. PREBENDARY CURREY, D.D., MASTER OF THE CHARTERHOUSE, IN THE CHAIR.

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

MEMBERS:—J. Caudwell, Esq., London; Rev. C. Elliott, D.D., Chicago, U.S.A.; Rev. R. Taylor, New South Wales.

ASSOCIATES:—Rev. H. East, New Zealand; Rev. H. G. Grey, Oxford; W. Griffith, Esq., London; Rev. S. M. Jackson, United States; Kyneton Rural Deanery (Rev. J. E. Herring, R.D.), Australia; F. I. Waring, Esq., M.Inst.C.E., Ceylon.

Also the presentation of the following work for the library:—

"Journal of the Royal United Service Institution." *From the same.*

A lecture, entitled, "The Advancement of Science confirms the Inspiration of the Scriptures" (illustrated by diagrams), was then read by S. Kinns, Esq., Ph.D., F.R.A.S. A discussion ensued, in which the Right Hon. the Earl Fortescue, Mr. T. K. Callard, F.G.S., Mr. D. Howard, F.G.S., and the Rev. T. M. Gorman took part. The author having replied,

The meeting was then adjourned.