the University is required. After complying with these regulations, besides giving theses on the various subjects previously studied, candidates must likewise publish an inaugural dissertation. As already stated, the curriculum required at the Portuguese medico-chirurgical schools is nearly identical with that of Coimbra; but in addition to publishing an inaugural dissertation, all aspirants for surgical diplomas must likewise propound six theses, three being on medical and three on surgical questions, wherewith the period of pupilage terminates.

Attached to the institutions named, there are students in pharmacy, and also female pupils who propose becoming midwives. The term of attendance for either class is two years, the preliminary qualification for candidates in the first category being knowledge of mathematics, philosophy, Latin, and their own language. If they are afterwards found duly qualified, a licence to act as pharmaceutists or midwives is then granted to such candidates respectively.

Analogous to several European countries, which need not be here specified, medical reform has of late years much occupied the profession throughout Portugal, especially with reference to the recently-established medico-chirurgical schools in the metropolis. Among other questions which were lately discussed in the Portuguese Parliament, one was that of augmenting the number of medical professors at these establishments. Most of the mooted propositions were, however, so strongly opposed by conservative Coimbra University authorities, who have two members in the Chamber of Deputies, that various attempts made during several years proved unsuccessful. Still, lectures on legal medicine were instituted in a late session, and reformers confidently anticipate that further improvements will be enacted by the Legislature and carried out by Government.

(To be concluded.)

Review IX.

1. *The Geological Evidences of the Antiquity of Man; with Remarks on Theories of the Origin of Species by Variation.* By Sir Charles Lyell, F.R.S. Second Edition, revised. Illustrated by Woodcuts.—*London*, 1863. pp. 528.
2. *The Antiquity of Man.* ('Edinburgh Review,' July, 1863.)
3. *Evidence as to Man's Place in Nature.* By Thomas Henry Huxley, F.R.S.—*London*, 1863. pp. 159.

Whatever drawbacks there may be to some persons in the practice of the "healing art," there can exist but very few, we should imagine, to the study of medicine as a general science. The only stumbling-blocks that we can think of are its necessitating a greater or less familiarity with the dead, and with decomposing bodies, with *foci* of

infection, and with the excreta of the human machine. With some no circumstance nor time can overcome the repulsiveness of these necessities. But most studies and professions have their unpleasant conditions, occasionally even duties of no little danger. And which of them can lay claim to the manifold attractions with which medicine, after all, allures the votaries in her train? Does not every study appear by the side of it imperfect, unsatisfying? The study of medicine alone gives a key to the mysteries surrounding us, and imparts to all a life we could not otherwise perceive. Of course, we use the term "medicine" in its wider sense—not in the simple application of its principles and experience, as the "*ars medendi*," but as that wide and all-embracing study which, beginning with physics, chemistry, and natural history, passes on to human and comparative biology, and appears finally adorned with such jewels of knowledge as the graver lore taught at the bedside of disease and death can alone impart. Herein lies the power of medicine over her disciples—viz., in her dealing with *so many*, as well as with the more recondite of nature's secrets. A man may be the profoundest lawyer, or the deepest philologist, the divinest artist, the most learned theologian; he may be the great warrior, navigator, engineer, and yet as either such simply he may walk abroad through creation and be deaf to more than half she utters. But let him have studied medicine as medicine *may* be studied, and he at once becomes free to the *arcana arcanissima* at his feet. He possesses more surely and extensively than any other man such a range and peculiarity of information as can vivify the world in a way to be vivified by no other one. So far as the pure botanist, pure chemist, pure anatomist, &c., are concerned, he cannot, of course, read such deep lessons in individual books of nature as can they. But he has this power, he can read something, often a great deal, in all of them, as well as in that, the most wondrous of all, and the most hidden to others—viz., the sybilline leaves of the body and mind in disease. Thus the man who comprehensively studies medicine becomes master of such a *passe partout*, that no other study can bestow. We have sometimes tried to think how we should have translated, or what kind of notion we should have formed of the strange acts and processes going on around us, had we not sat at the feet of the old man of Cos. Of the existence of a great number we should not have been conscious, it is true; but of those of whose presence we were aware, what should we have indeed thought? But we cannot now compass the idea of such an ignorance, having, thanks be to God, the key of knowledge in our hands.

All embracing as our department of knowledge is—various as are the formative sciences upon which it is based—there is undoubtedly a great difference as regards the nature and amount of help which the latter afford us in arriving at our culminating or practical effort—the alleviation of sickness and of disease. Some of these collateral branches can offer us but little, others are vital in the extreme. The former must be resigned in the propylœum; the latter accompany us into the adytum of the Æsculapian fane. But having left the latter,

our novitiate passed, and having stepped out into the world with a little time to look about us ere we take our settled place, how many of us are there not who, remembering the charms of some of those fair handmaids of knowledge we left upon the temple steps ere we passed beneath its dome, return to them, single one out, and fly with her, and dwell with her for ever! He who was to have become the physician, the practitioner of the healing art, becomes instead botanist, chemist, or naturalist, &c., as the case may be. To such as remain true to their vows, becoming members of the profession of medicine in its strictest sense, the progress of these collateral branches of knowledge they were once grounded in, generally continues to be matter of considerable interest. The merest practitioner cannot hear of their novelties without some recognition of them; whilst to the more intellectual of the medical circle, a chief delight is to give such attention to them as the urgencies of active practice may permit. Little, in the majority of cases, no doubt, this is, and it would be often less were it not for such literary and scientific jackals like ourselves, whose duty it is to hunt out the lion's provender, and lay it before him, so that as little as possible of the monarch's time be uselessly spent. And this office we are now about to perform, believing that the intellectual banquet we shall provide will be worthy of attention. We cannot say it will be food for babes, but rather meat for strong men; yet, with all, there will be found a piquancy about it. And, so far, it is in accordance with the fashion of the time, for *sensation* is the order of the day. "Spiritualism" has to struggle for its own; it is pushed almost from its seat by the Aurora Floyds and Lady Audleys of feminine literature. In theology, there are 'Essays and Reviews,' Colenso's 'Enquiry,' and 'La Vie de Jesus' by Renan. Chemistry dazzles us with spectrum analysis. Astronomy startles us about the sun.* Engineers present us with a main-drainage scheme; Social Science with "woman's work;" Zoology with the gorilla; the theatres with ghosts; medicine with the renewal of life;

* "I have still to advert to Mr. Naysmith's remarkable discovery that the bright surface of the sun is composed of an aggregation of apparently solid forms shaped like willow-leaves or some well-known forms of Diatomaceæ, and interlacing one another in every direction. The forms are so regular in size and shape as to have led to a suggestion from one of our profoundest philosophers of their being organisms possibly even partaking of the nature of life, but at all events closely connected with the heating and vivifying influences of the sun. These mysterious objects, which since Mr. Naysmith discovered them have been seen by other observers as well, are computed to be each not less than 1000 miles in length and about 100 miles in breadth. The enormous caverns in the sun's photosphere, to which we apply the diminutive term 'spots,' exhibit the extremities of these leaf-like bodies pointing inwards and fringing the sides of the cavern far down into the abyss. Sometimes they form a sort of rope or bridge across the cavern, and appear to adhere to one another by lateral attraction. I can imagine nothing more deserving of the scrutiny of observers than these extraordinary forms."—(The President's Address to the British Association for the Advancement of Science, September, 1863.) This apparent conversion of the sun into a cluster of glowworms or fireflies will no doubt be received with a degree of hesitation, considering that astronomers have at the same time announced that they have likewise just found that they have hitherto been wrong as regards the solar parallax. This they propose to increase so as to bring the earth closer to the sun by four million of miles, and to diminish the distances and dimensions of all the planets! (Hind, Stone, Hanson.)

and last, though not least, comes the geologist, with the 'Antiquity of Man.'

From the comprehensive character of the study of medicine, we become privileged to say that certain of the branches of knowledge by which the latter question is unravelled and tested fairly belong to the list of the collaterals of our own department. Since this question is a highly-interesting one, we intend availing ourselves of this privilege, and of devoting a few pages to a succinct account of it. The argument now *sub judice* may be expressed thus in a few words.

Does the first appearance of man upon the earth date back from incalculable ages, or not longer than a few (six) thousand years? But little more than half a century back, it was the general belief that the globe itself was not older than six thousand years, and that it, along with all living things upon its surface, was formed and fashioned in that period of time which we now reckon as a week. To doubt this was held at any rate to be equivalent to a disbelief in the fundamental doctrines of revealed religion. But men increased in knowledge, and it was found that such a literal chronology of the Mosaic writings as they had hitherto been endowed with was not God's gift, but man's, and that the space of time, both when the earth was originated and during which it was in process of formation, could be carried back and magnified to uncountable ages, without any disrespect to the intentionally vague information which the Infinite had vouchsafed concerning them. To satisfy, however, the "weaker brethren," it became necessary to distinctly indicate a method by which such a reconciliation could take place; and consequently several theories were propounded to bring about the harmony of geology and Genesis. These it is not our purpose, of course, to discuss; but it is not irrelevant to our present position to state that, whilst we hold it impossible that we shall ever be able to establish such a parallelism between the great characteristics of the Mosaic days and the palæontologic remains of geologic epochs as shall satisfy acuter intellects, yet that for all the purposes of the Christian apologist, we agree with those* who think the hypothesis usually associated with the name of Chalmers, and afterwards illustrated in the earlier writings of Hugh Miller, amply sufficient.

Dr. Chalmers, so early as 1804, had arrived at the conviction that

"The writings of Moses do not fix the antiquity of the globe. If they fix anything, it is only the antiquity of the species. In the article on Christianity, this general assertion appears in a more distinct and intelligible form. When it is asked, 'Does Moses ever say that there was not an interval of many ages betwixt the first act of creation described in the first verse of the book of Genesis, and said to have been performed at the beginning, and those more detailed operations the account of which commences at the second verse? . . . Or does he ever make us to understand that the genealogies of man went any farther than to fix the antiquity of the species, and of consequence that they left the antiquity of the globe a free subject for the speculations of philosophers? . . . . It is not said when the *beginning* was. We know the general

* See an article entitled "Genesis and Science," in North British Review for November, 1857.

impression to be that it was on the earlier part of the first day, and that the first act of creation formed part of the same day's work with the formation of light. We ask our readers to turn to that chapter, and to read the first five verses of it. Is there any forcing in the supposition that the first verse describes the primary act of creation, and leaves it at liberty to place it as far back as we may? that the first half of the second verse describes the state of the earth (which may already have existed for ages, and been the theatre of geological revolutions) at the point of time anterior to the detailed operations of this chapter, and that the motion of the Spirit of God described in the second clause of the second verse was the commencement of these operations?"*

In the 'First Impressions of England and its People,' by Mr. Hugh Miller, the above theory was further illustrated, though it was afterwards abandoned by the writer, in his 'Testimony of the Rocks.' From the former work we make the following extracts:

"Between the creation of the matter of which the earth is composed, as enunciated in the first verse, and the earth's void and chaotic state as described in the second, a *thousand* creations might have intervened. As may be demonstrated from even the writings of Moses himself, the continuity of a narrative furnishes no evidence whatever that the facts which it records were continuous. Take, for instance, the following passage: 'There went out a man of the house of Levi, and took to his wife a daughter of Levi. And the woman conceived and bare a son, and when she saw that he was a goodly child, she hid him three months. And when she could no longer hide him, she took for him an ark of bulrushes, and daubed it with slime and with pitch, and put the child therein, and she laid it in the flags by the river's brink.' The narrative here is quite as continuous as in the first three verses of Genesis. In the order of the relation, the marriage of the parents is as directly followed in the one case by the birth of a son as the creation of matter is followed in the other by the first beginnings of the existing state of things. . . . . We know, however, from succeeding portions of Scripture, that the father and mother of this child *had* several other children born to them in the period that intervened between their marriage and his birth. . . . . Had it been as necessary for the purpose of revelation that reference should have been made to the intervening creations in the one case as to the intervening births in the other, we doubtless would have heard of them too. . . . . it was not necessary at all. . . . . The ferns and lepidodendra of the coal measures are as little connected with the truths which influence our spiritual state as the vegetable productions of Mercury or of Pallas; the birds and reptiles of the oolite, as the unknown animals that inhabit the plains or disport in the rivers of Saturn or Uranus. And so revelation is as silent on the periods and orders of systems and formations as on the relative positions of the earth and sun, or the places and magnitudes of the planets."†

Though acquiescence has now for some time been accorded to the belief that geology demonstrates the earth was not created only six thousand years ago, and that Revelation does not apodictically affirm it was so, any alteration of opinion with regard to the origin of man has not been generally admitted. He, it has been strenuously maintained, is a recent visitor. A few writers, it is true, have asserted the contrary, affirming that geology proved a more ancient origin of man, and that Revelation did not gainsay it. Even the orthodox and cautious author of the 'Researches into the Physical History of Mankind,'

* Memoirs of the Life and Writings of Thomas Chalmers, D.D., &c., vi. pp. 386, 387.

† Op. cit., third edition, pp. 321, 323.

Dr. Prichard, agreed that there is not sufficient evidence of continuity in the genealogies of Genesis to afford either a computation of the age of the world or the assignment of a date in the creation of man. While the date of the arrival of Abraham in Palestine may be computed with a near approximation, "beyond that event," said Dr. Prichard, "we can never know how many centuries, *nor even how many chiliads of years*, may have elapsed since the first man of clay received the image of God and the breath of life." Such views were, however, generally regarded as unsupported by science and as opposed to Revelation. But at length they were urged by some with such sufficient force as to draw forth serious discussion. If, it was said in reply to them, man existed—as it is now asserted—in ages past along with at present extinct animals, myriads of whose remains have been discovered, how is it that we do not find traces of coëval man, or man in the fossil condition? We do find such, answered the recusants, and Donati, Germer, Rasoumouski, and Guetard asserted that human bones had been found intermixed with those of lost species of mammiferæ in several places. Some enthusiasts went almost to the extent of seeing human remains in every newly-discovered ossiferous treasure, whilst the majority still seemed determined that no such palæontologic curiosity should ever be found. The latter were like Diderot, when he said: "Si l'on venait de toutes partes me raconter qu'un mort se promène a Passy, je ne me derangerais pas pour l'aller voir," instead of going to see whether such a supposed miracle was not to be explained by somnambulism, galvanic excitation, or some other appreciable cause. A few, however, like Cuvier, made a scientific acquaintance with some of these strange fossils. Cuvier at once showed the *homo diluvii testis* of Scheuchzer to be a species of salamander; whilst some bones dug up near Lucerne, and described as those of a giant eighteen feet high, were demonstrated as elephantine. Even Spallanzani was proved to be wrong in supposing the osseous breccia of Arigo to contain human relics. But though time went on, the innovators refused to yield; they admitted such mistakes as the above had been made, but maintained that *all* examples were not to be explained away like them, nor, as in the well-known case of the Guadaloupe skeletons, with the supposition that though the bones were human they belonged to the recent or present period. Human remains, it was maintained, had been discovered in the cave at Kirkdale even so far back as 1786, and they were enumerated as found there by Dr. Buckland. They had been found at Meissen, at Durfort in the Jura, by M. Firmas, at Kostritz by Schlotheim, and elsewhere.* It was insinuated, also, that one-tenth part of the evidence produceable in substantiation of such facts would have sufficed to admit at once almost any other statement in general science. But although the humanity of many of these bones were admitted, as also their admixture with the fossil remains of extinct mammalia, Cuvier and Buckland shook their heads, and even Sir Charles Lyell, when visiting the collection of Dr. Schmerling, at

* See The Natural History of the Human Species, by Lieut.-Col. Charles Hamilton Smith. Edinburgh, 1848.

Liege, in 1833, was incredulous about that which, in 1863, he admits as positive evidence in favour of the antiquity of man. The truth was, no one was willing to commit themselves to an opinion which was as yet scientifically as well as theologically heretical. The new school maintained its point, however, and brought forward further evidence, as it supposed, in the shape of the discovery of the remains of human art (such as flint implements or kelts) in deposits anterior to the recent period. Such things, it was averred, must have been fashioned by human agency, and yet they were found in close juxta-position with the fossil bones of extinct pachydermata, and buried deep in strata or shut up in caves which did not present the least signs of having been disturbed since their first deposit or formation. Still, no general impression of there being truth in all this was made either upon the scientific or popular ear until 1858, when a new and intact bone cave being discovered at Brixham, about four miles south of Torquay, it was thought proper to have a thorough and systematic examination made of it. The Royal Society, incited by a memoir of Mr. Godwin-Austin,* made two grants towards defraying the expenses, and a committee of geologists was charged with the investigations, among whom Mr. Prestwich and Dr. Falconer took an active part, visiting Torquay while the excavations were in progress under the superintendence of Mr. Pengelly. The result of the Brixham examination was so striking as to induce Dr. Falconer to go to Sicily to examine certain ossiferous caverns there. On his way, in the autumn of 1858, he stopped at Abbeville to see the collection of M. Boucher de Perthes. An examination of the latter at once urged Dr. Falconer to beg Mr. Prestwich to thoroughly explore the geology of the valley of the Somme. Mr. Prestwich's report induced Mr. Flower and others to follow in his steps. Sir Charles Lyell was one of the number. Their conclusion has been, that not only do certain recent discoveries lead to the idea of the antiquity of man, but that many of the older and scouted ones bore truthful testimony of the same kind. Such, then, has been the force of evidence and weight of authority, that the facts relating to the co-existence of human remains and remains of human art with the bones of mostly extinct mammals, and the deposit of the remains of human art in ancient strata, could no longer be set aside. It has at length come to be admitted that there is such an amount and kind of evidence now before the scientific world as to demand that they be scrupulously but unprejudicedly examined, and the question of man's past duration on the globe no longer be repudiated. Sir Charles Lyell, in his well-known and very interesting work, places the most of this evidence before us. This, along with some other stores of information, we purpose analysing and laying our results before the reader.

The first and most direct testimony to the truth of the idea that man was an inhabitant of the earth in very far bygone ages, must be looked for in certain examples of the admixture of fossilized human bones with those of now extinct animals. Trustworthy examples of

* Transactions of the Geological Society, 2nd series, vol. vi. p. 444.

this kind are comparatively very rare. In the first place, the instances of mere admixture of such remains are very uncommon; and in the second place, when it exists, the conjunction may be explained generally, it has been thought, in a more satisfactory way than by supposing it to have existed from the time of the ancient *fauna*.

It is certainly somewhat remarkable, not only that we should be so deprived of the fossil remains of man, if he lived in long past ages, and that we should scarcely find a trace of his bones, associated with the comparatively numerous stores of what have been regarded as his handiwork—the flint instruments—but that we should miss them also under circumstances where we might naturally, geologically speaking, expect them. But the absence of them under the latter conditions, must naturally render us less surprised at the want of them under the former circumstances.

"It is not many years since the Government of Holland resolved to lay dry that great sheet of water formerly called the Lake of Haarlem, extending over forty-five thousand acres. They succeeded, in 1853, in turning it into dry land. . . . . There had been many a shipwreck and many a naval fight in those waters, and hundreds of Dutch and Spanish soldiers and sailors had there met a watery grave. The population which lived on the borders of this ancient sheet of water numbered between thirty and forty thousand souls. In digging the great canal, a fine section had been laid open about thirty miles long of the deposits which formed the ancient bottom of the lake. . . . . Mr. Stering, who had been for some years employed by the Dutch Government in constructing a geological map of Holland, was my companion and guide. He informed me that he and his associates had searched in vain for human bones in the deposits which had constituted for three centuries the bed of the great lake. . . . . If history had been silent, and if there had been a controversy whether man was already a denizen of this planet at the time when the area of the Haarlem lake was under water, the archæologist, in order to answer this question, must have appealed, as in the case of the valley of the Somme, not to fossil bones, but to works of art imbedded in the imperfect strata." (Lyell, p. 147.)

Mr. MacAndrew and the late Edward Forbes followed in the experience of other dredgers, for they not only utterly failed in drawing up from the deep a single human bone, but scarcely ever met with a work of art, even after counting tens of thousands of shells and zoophytes collected on coast lines of several hundred miles in extent, and approaching within less than half a mile of land peopled by millions of human beings. For an interesting account of this portion of our subject, we must refer for further information to Sir Charles Lyell's work, and also to Colonel G. Greenwood's 'Rain and Rivers,' chapter xiii.

Many think, however, that more examples have been met with than have been brought forward, from fear of opposition or ridicule, and that the hitherto favourite mode of explaining the union is more far-fetched than the interpretation which the few would place upon it. To deny bones to be human, and to suppose some mistake, or to admit them to be so, but to maintain that they became accidentally mixed in recent times with the remains of older animals, is to some as satisfactory a solution of the matter as it is repugnant to others.

There cannot be a doubt, however, that such has really been the key to some of the palæontologic puzzles, but the question remains: Are there not other instances of the union of such reliquiæ which do not permit of such explanation? High authorities are now inclined to answer in the affirmative. Of such instances we may refer to the following. Thirty years back, Dr. Schmerling, of Liège, a skilful anatomist and palæontologist, in the course of a very careful exploration of the ossiferous caverns bordering the valleys of the Meuse, more than once disinterred human bones in association with the bones of extinct species of bears, elephants, and rhinoceroses, and of certain present-existing creatures. All the bones were of the same colour and condition as to their amount of animal matter, and the human bones were so rolled and scattered as to preclude all idea of their having been intentionally buried on the spot. As no gnawed bones nor coprolites were found by the discoverer, he inferred that the caverns of Liège had not been the dens of wild beasts. The conclusion was that their organic and inorganic contents had been swept into them in ages past by streams communicating with the surface of the country, and that the periods of the life of the former could not have been separated by any long interval.

"Some rude flint implements of the kind commonly called knives or flakes, of a triangular form in the cross section were found by Schmerling dispersed generally through the cave mud, but he was too much engrossed with his osteological inquiries to collect them diligently. . . . . He also discovered in the cave of Chokier, two and a half miles south-west from Liège, a polished and jointed and needle-shaped bone, with a hole pierced obliquely through it at the base, such a cavity, he observed, as had never given passage to an artery. This instrument was imbedded in the same matrix with the remains of a rhinoceros. . . . . Although in some forty fossiliferous caves explored by him human bones were the exception, yet these flint instruments were universal, and he added, that 'none of them could have been subsequently introduced, being precisely in the same position as the remains of the accompanying animals. I therefore,' he continues, 'attach great importance to their presence, for even if I had not found the human bones under conditions entirely favourable to their being considered as belonging to the antediluvian epoch, proofs of man's existence would still have been supplied by the cut bones and worked flints.'" (Lyell, p. 66.)

These discoveries of the Belgian naturalist, so far at least as the import of the human bones and instruments went, were disregarded by the scientific world, and continued so until the memoir of Mr. Prestwich appeared relative to certain researches at Amiens and Abbeville, to be presently referred to. Sir Charles Lyell himself, who saw Schmerling's collection in 1833, expressed, he tells us, "some incredulity respecting the alleged antiquity of the fossil human bones." (p. 68.)

"One positive fact, it will be said, attested by so competent a witness ought to have outweighed any amount of negative testimony previously accumulated respecting the non-occurrence elsewhere of human remains in formations of the like antiquity. In reply I can only plead that a discovery which seems to contradict the general tenor of previous investigations is naturally received with much hesitation." (p. 68.)

Soon after the publication of the memoir alluded to, Sir Charles again visited Liège, and examined along with Professor Malaise some of the caverns which still remained, and the latter, continuing the investigation after the departure of Sir Charles, found at the depth of two feet below a crust of stalagmite, three fragments of a human skull and two perfect lower jaws with teeth, all associated in such a manner with the bones of bears, large pachyderms, and ruminants, and so precisely resembling these in colour and state of preservation as to leave no doubt in his mind that man was contemporary with the extinct animals. In these caverns the decay and decomposition of the fossil bones appear to have been arrested by a constant supply of water charged with carbonate of lime, which dripped from the roofs while the caves were becoming gradually filled up. By similar agency the mud, sand, and pebbles were usually consolidated. Amongst the portions originally discovered by Dr. Schmerling was a particular skull, now known as the Engis skull, and in the Museum of Liège, existing in such a state of integrity as to enable the anatomist to speculate on its race. It was buried five feet deep in a breccia along with the tooth of a rhinoceros, several bones of a horse, of a reindeer, and of certain ruminants. This skull has since become famous, and either directly or by means of casts, photographs, and engravings, has been studied by the *savans* of Europe. The discoverer himself thus wrote concerning it: "For my own part, I hold it to be demonstrated that this cranium has belonged to a person of limited intellectual faculties, and we conclude thence that it belonged to a man of a low degree of civilization; a deduction which is borne out by contrasting the capacity of the frontal with that of the occipital region." This quotation is made by Professor Huxley from Dr. Schmerling's 'Recherches sur les Ossements Fossiles,' &c., and he tells us likewise that upon the high authority of Sir Charles Lyell, he takes it for granted

"That the Engis skull belonged to a contemporary of the mammoth (*Elephas primigenius*), and of the woolly rhinoceros (*Rhinoceros tichorhinus*), with the bones of which it was found associated;" and that it "takes us to at least the farther side of the vague biological limit which separates the present geological epoch from that which immediately preceded it; and there can be no doubt that the physical geography of Europe has changed wonderfully since the bones of men and mammoths, hyænas, and rhinoceroses were washed pell-mell into the cave of Engis." (p. 121.)

In the early part of the year 1857 a human skeleton was discovered in a limestone cave in the Neanderthal, near Hochdal, between Düsseldorf and Elberfeld. It is supposed that, when first discovered, the skeleton was complete, but that the workmen, ignorant of its value, scattered and lost most of the bones, preserving the larger ones only. No other animal remains were found with it, but three years afterwards the tusk of a bear was disinterred from a lateral embranchment of the cave, though whether it was referrible to a recent or extinct species of bear, Sir Charles Lyell could not determine. The skull, and indeed, all that remains of the skeleton, have on account of the peculiar formation of the bones, lately excited very much discussion. The

former was covered both on its outer and inner surface, and especially on the latter, with a profusion of dendritical crystallizations, and some of the other bones were marked in a similar way. The bones had lost so much of their animal matter as to adhere strongly to the tongue, agreeing in this respect, according to Sir Charles Lyell, "with the ordinary condition of the fossil remains of the post-Pliocene period." (p. 78.) The great point of interest, however, in connexion with this skeleton is, that it is thought by many to exceed all other human forms in those peculiarities of cranial development and osseous protuberances, &c., which mark a barbarous savage or degraded animal-like race. From this "degraded character" of the skull and its approximation to the cranial development of the chimpanzee, together with the great thickness of the bones, the great development of all the elevations and depressions for the attachment of muscles, and the unusually-rounded shape and abrupt curvature of some of the ribs, a few have assumed this skeleton to be one of an antique race more human than any anthropoïd ape we know of now, and more pithecoïd than any human race existing at present. Professor King, at the last meeting of the British Association for the Advancement of Science, read a paper on "The Neanderthal Skull," in which

"He gave reasons for believing it to belong to the Clydian period, and to be specifically distinct from man. He contended that the Neanderthal man was living in the concluding division of the Glacial or Clydian period. . . . . Why may there not," said Professor King, "have been a Pliocene or Clydian species possessed of no higher faculties than such as would enable it to erect a protecting shed, fashion a stone for special purposes, or store up food for winter, but like the gorilla or chimpanzee, be devoid of speech, and equally unconscious of the existence of a Godhead? Man's psychical endowments are visibly expressed in the prominent frontal and elevated vertex of his cranium.

"But considering that the Neanderthal skull is eminently simial in its great characters, I feel myself constrained to believe that the thoughts and desires which once dwelt within it never soared beyond that of the brute. . . . . Psychical gifts of a lower grade than those characterizing the Andamana cannot be conceived to exist—they stand next to brute benightedness. Applying the above argument to the Neanderthal skull, and considering its close resemblance to that of the chimpanzee, and moreover, knowing that the simial peculiarities are unimprovable—incapable of moral and theistic conceptions—I see no reason to believe otherwise than that similar darkness characterized the being whom I do not hesitate to call *homo Neanderthalenis*."

Sir Charles Lyell observes:

"There is doubtless, as shown in the diagram (fig. 4), a nearer resemblance in the outline of the Neanderthal skull to that of a chimpanzee than had ever been observed before in any human cranium, and Professor Huxley's description of the occipital region shows that the resemblance is not confined to the mere excessive prominency of the superciliary ridges. The direct bearing of the ape-like character of the Neanderthal skull on Lamarck's doctrine of progressive development and transmutation, or on that modification of it which has of late been so ably advocated by Mr. Darwin, consists in this, that the newly-observed deviation from a normal standard of human structure is not in a casual or random direction, but just what might have been anticipated, if the laws of variation were such as the transmutationists desire. For if we conceive the cranium to be very ancient, it exemplifies a less advanced stage of

progressive development and improvement. If it be a comparatively modern race, owing its peculiarities of conformation to degeneracy, it is an illustration of what the botanists have called 'atavism,' or the tendency of varieties to revert to an ancestral type, which type, in proportion to its antiquity, would be of a lower grade." (p. 92.)

In the year 1852, a labourer employed in mending the roads near Aurignac, of the Haute Garonne, not far from the Pyrenees, observed that rabbits, when hotly pursued, ran into a certain hole on the side of the hill. He put his arm into this hole, and pulled out one of the long bones of a human skeleton. Further inquiry showed a cave to exist there containing bones that must have formed parts of not less than seventeen skeletons, of different sexes and various ages; some so young, that the ossification of particular bones was incomplete. The mayor ordered all of the remains to be re-interred in the parish cemetery. No further heed was given to the matter until M. Lartet visited Aurignac, in 1860, and determined to investigate systematically what remained of the deposits both outside and inside the cave. The village sexton was unable, unfortunately, to inform M. Lartet in what exact spot the trench was dug into which the skeletons removed in 1852 had been thrown. Outside the great slab of stone forming the door of the cave not one human bone occurred. In the substratum of the inside which remained, after the skeletons had been taken away, were found about ten detached human bones, including a molar tooth; and M. Delesse ascertained, by careful analysis of one of these, as well as of the bones of a rhinoceros, bear, and some other extinct animals, that they all contained precisely the same proportion of azote, or had lost an equal quantity of their animal matter. In this substratum was also found the tusk of a young *Ursus spelæus*, the crown of which had been stripped of its enamel, and had been carved into apparently the shape of a bird's head. It was perforated lengthwise, as if for suspension as an ornament or amulet. A flint knife also was found in the interior, which had evidently never been used. There was no stalagmite in the grotto; and M. Lartet came to the conclusion that all the bones and soil found in the interior had been artificially introduced. Outside the grotto he found a

"Layer of ashes and charcoal about seven inches thick, extending over an area of six or seven square yards, and going as far as the entrance of the grotto, and no farther, there being no cinders or charcoal in the interior. Among the cinders outside the vault were fragments of fissile sandstone, reddened by heat, which were observed to rest on a levelled surface of nummulitic limestone, and to have formed a hearth. The nearest place from whence such slabs of sandstone could have been brought was the opposite side of the valley. Among the ashes, and in some overlying earthy layers separating the ashes from the talus, were a great variety of bones and implements. . . . Among other articles outside the entrance was found a stone of a circular form, and flattened on two sides, with a central depression composed of a tough rock, which does not belong to that region of the Pyrenees. This instrument is supposed, by the Danish antiquaries, to have been used for removing, by skilful blows, the edges of flint knives, the fingers and thumb being placed in the two opposite depressions during the operation. Among the bone instruments were arrows without barbs, and other tools made of reindeer horn, and a bodkin formed out

of the more compact horn of the roedeer. This instrument was well shaped and sharply pointed, and in so good a state of preservation, that it might still be used for piercing the tough skins of animals." (p. 184.)

Scattered through the same ashes and earth at the entrance were the osseous remains of the mammoth, Siberian rhinoceros, cave-bear, cave-hyæna, gigantic Irish deer, aurochs, &c. &c. :

"The bones of the herbivora were the most numerous, and all those on the outside of the grotto which had contained marrow were invariably split open, as if for its extraction, many of them being also burnt. The spongy parts, moreover, were wanting, having been eaten off and gnawed after they were broken—the work, according to M. Lartet, of hyænas, the bones and coprolites of which were plentifully mixed with the cinders, and dispersed through the overlying soil." (Lyell, p. 186.)

"We can scarcely doubt that we have here an example of an ancient place of sepulture, closed at the opening so effectually against the hyænas or other carnivora, that no marks of their teeth appear on any of the bones, whether human or brute. (p. 188.) . . . . These beasts of prey are supposed to have prowled about the spot, and fed on such relics of the funeral feast as remained after the retreat of the human visitors, or during the intervals between successive funeral ceremonies which accompanied the interment of the corpses within the sepulchre. (p. 186.) . . . . If the fossil memorials have been correctly interpreted—if we have here before us, at the northern base of the Pyrenees, a sepulchral vault, with skeletons of human beings consigned by friends and relatives to their last resting-place—if we have also at the portal of the tomb the relics of funeral feasts, and within it indications of viands destined for the use of the departed, on their way to a land of spirits, while among the funeral gifts are weapons wherewith, in other fields, to chase the gigantic deer, the cave-lion, the cave-bear, and woolly rhinoceros—we have at last succeeded in tracing back the sacred rites of burial, and, more interesting still, a belief in a future state to times long anterior to those of history and tradition." (p. 192.)

Among the fossil remains of man which have been put forward with claims of very high antiquity may be mentioned "the fossil man of Denise," said to have been found in a volcanic breccia near the town of Le Puy-en-Velay, in Central France, and the fossil human bone of Natchez, on the Mississippi, supposed to have been derived from a deposit containing the remains of the mastodon and of the megalonyx. But no fossil bone has become more famous than the "jaw-bone of Moulin Quignon." On the 28th of March last, whilst some workmen were engaged in the gravel-pits of Moulin Quignon, near Abbeville, they discovered first a human tooth and then a jaw-bone. These bones were found in a deposit containing flint instruments of antique type and the bones of elephants. Controversy had long been going on—as we shall presently see — respecting the flint implements; and one reason why certain persons considered the latter to have been formed by nature, and not by art, was, that no human bones had been met with near them. Sir Charles Lyell remarked :

"It is naturally a matter of no small surprise that after we have collected many hundred flint instruments (including knives, many thousands) not a single human bone has yet been met with in the alluvial sand and gravel of the Somme . . . . That ere long, now that curiosity has been so much excited on this subject, some human remains will be detected in the older alluvium of European valleys I confidently expect." (pp. 144, 145.)

Scarcely had this been written when a jaw-bone was found in the "black-band flinty gravel" of the Somme valley beds! To it we shall return presently. The last examples of this kind of testimony to the antiquity of man to which we shall refer, are to a few human remains found in the peculiar loamy deposits commonly called "loess," of the basins of the Rhine, Danube, and some other large rivers, draining the Alps, and which extend down the Rhine into the low countries. In 1823, M. Ami Bonè,

"Well known by his numerous works on geology, and a well-practised observer in every branch of the science, disinterred with his own hands many bones of a human skeleton from ancient, undisturbed 'loess,' at Lahrr, nearly opposite Strasbourg, on the right side of the great valley of the Rhine. No skull was detected, but the tibia, fibula, and several other bones, were obtained in a good state of preservation, and shown at the time to Cuvier, who pronounced them to be human." (p. 338.)

In some period between 1815 and 1823, a human lower jaw, with teeth, was found along with the molars, tusks, and bones of elephants, in a terrace of gravel, covered with "loess," on the right bank of the Meuse, at Maestricht. The jaw was deposited at nineteen feet from the surface. The stratum is said to have been intact and undisturbed; and Sir Charles Lyell, who visited the site in 1860, where these fossils were found, states that he "could see no reason for suspecting the human jaw to belong to a different geological period from that of the extinct elephant." With other illustrations, such as the "cavern of Bize,"* the "Mickleton tunnel skeleton;"† and the "Muskham and Hanbury Burn cave remains,"‡ we need not detain the reader, as they are evidently out of court. What objections are to be urged against those we have referred to we shall state after having gone over the other forms of evidence in favour of the antiquity of man. The next to be noticed is that afforded by the remains of human art—such as "flint implements," imbedded in alluvial gravels or fluviatile drifts, and in caves of limestone, along with the fossil bones of the mammoth hippopotamus, rhinoceros, and other extinct animals. The existence of these rude implements on the floors of limestone caverns along with the fossil bones of long since lost species, has been occasionally referred to for more than half a century. But since it appeared that no precise geological time could be affixed to the incrustating deposit forming the floors of these caverns, the mere admixture itself of the remains in it did not necessarily determine that the things so mixed had been contemporaneous. Hence here, as under other circumstances, the testimony afforded by caverns was read with very great suspicion. But the results of the examination of the Brixham cave, in 1858, were such as to lead several authorities to attach not only a very high probable value to its own apparent teachings, but to some of the cave-evidence which had been so unscrupulously rejected. At Brixham,

"No human bones were obtained anywhere during these excavations, but many flint knives, chiefly from the lowest part of the bone-earth, and one of

* Lyell, p. 59. † Edin. New Philosoph. Journal, April, 1856.
‡ Trans. Ethnological Society, 2nd series, 1863.

the most perfect, lay at the depth of thirteen feet from the surface, and was covered with bone-earth of that thickness. . . . . About fifteen knives, recognised as artificially formed by the most experienced antiquaries, were taken from the bone-earth, and usually near the bottom. . . . . The anteriority of those at Brixham to the extinct animals is demonstrated not only by the occurrence at one point in overlying stalagmite of the bone of a cave-bear, but also by the discovery at the same level in the bone-earth, and in close proximity to a very perfect flint tool, of the entire left hind leg of a cave-bear. . . . . Every bone was in its natural place, the femur, tibia, fibula, ankle-bone, or astragalus, all in juxtaposition. Even the patella, or detached bone of the knee-pan, was searched for and not in vain. Here, therefore, we have evidence of an entire limb not having been washed in a fossil state out of an older alluvium, and then swept afterwards into a cave so as to be mingled with flint implements, but having been introduced when clothed with its flesh, or at least when it had the separate bones bound together by their natural ligaments, and in that state buried in mud. If they were not all of contemporary date, it is clear from this case and from the humerus of the *Ursus spelæus* before cited, as found in a floor of stalagmite, that the bear lived after the flint tools were manufactured, or, in other words, that man in this district preceded the cave-bear." (p. 101.)

But such cave evidence even as this has sunk into some neglect in comparison with the importance which is attached to the occurrence of the same remains of human art in beds of gravel. So long back as 1797, Mr. J. Frere drew attention to the discovery of some flint instruments in a bed of gravel twelve feet from the surface at Hoxne, in Suffolk. Above the gravel lay, in a sandy bed with shells, the jaw-bone and teeth of an enormous unknown animal. Not much regard was paid to this discovery, however. But in 1847, M. Boucher de Perthes announced that he had found, since 1841, flint implements in the lowest beds of a series of ancient alluvial strata bordering the Valley of the Somme, which geologists had termed "diluvium." Still, as Sir Charles Lyell expresses it, the scientific world had no faith in the statement that works of art, however rude, had been met with in undisturbed beds of such antiquity. A few years later, MM. Rigollot and Buteux corroborated M. Boucher's statement. Little attention was accorded, nevertheless, to these discoveries in the Valley of the Somme, until the investigation of the Brixham Cave before mentioned, at which Dr. Falconer assisted. Struck by the discoveries here, this gentleman left for Sicily to pursue further inquiries in certain ossiferous caverns, and stopped at Abbeville on his road, examining the collection of M. Boucher. Being satisfied that the flints called "hatchets," in possession of the latter, had really been fashioned by the hand of man, Dr. Falconer wrote to Mr. Prestwich, urging him to explore the geology of the Valley of the Somme. This Mr. Prestwich did, in company with Mr. John Evans, of the Society of Antiquaries. He found the gravel beds of St. Acheul, capping a low chalk hill a mile S.E. of Amiens, more than one hundred feet above the level of the Somme, and not commanded by any higher ground. The upper beds consisted of about from ten to fifteen feet of brown brick-earth, containing many old tombs and some coins, but without organic remains; under this was

a whitish marl and sand, with recent shells, mammalian bones and teeth whose thickness varied from two to eight feet; while, lastly, there was found from six to twelve feet of coarse, subangular flint gravel (identical with the gravel of East Croydon, of Wandsworth Common, and other places), with remains of shells in sand, and the teeth and bones of the elephant, horse, ox, and deer. With these were found the worked flints in considerable numbers. The whole deposit rested on chalk. At Menchecourt, near Abbeville, along with the remains of two extinct deer, an extinct species of horse, of the mammoth and tichorine rhinoceros, flint implements were discovered at depths varying from sixteen to twenty-two feet. Before Mr. Prestwich's return, he succeeded, says Sir Charles Lyell—

"In dissipating all doubts from the minds of his geological friends, by extracting with his own hands from a bed of undisturbed gravel at St. Acheul, a well-shaped flint hatchet. . . . . There were no signs of vertical rents in the enveloping matrix, nor in the overlying beds of sand and loam, so that it was impossible to imagine that the tool had gradually worked its way downwards, as some had suggested, through the incumbent soil into an older formation. . . . . Mr. Flower, who accompanied Mr. Prestwich on his second excursion to St. Acheul in June, 1859, succeeded, by digging into the bank of gravel, in disinterring at the depth of twenty-two feet from the surface, a fine symmetrically-shaped weapon of an oval form lying in and beneath strata, which were observed by many witnesses to be perfectly undisturbed." (p. 103.)

Sir Charles himself shortly afterwards visited the same pits and obtained seventy flint tools, one of which was taken out while he was present, though he confesses that he did not see it before it had fallen from the matrix. He afterwards, in the same year, expressed his opinion to the British Association in favour of the antiquity of the flint tools. M. Pouchet, who was subsequently commissioned by the municipality of Rouen, saw a hatchet extracted from the gravel in its natural position. MM. Gundry, Garnier, and two others, afterwards went over the ground previously traversed by the above investigators. The former, in his Report to the French Academy, stated:

"The great point was not to leave the workmen for a single instant, and to satisfy one's-self by actual inspection, whether the hatchets were found *in situ*. I caused a deep excavation to be made, and found nine hatchets most distinctly *in situ*, in the diluvium associated with teeth of *Equus fossilis*, and a species of *Bos*, different from any now living, and similar to that of the diluvium and of caverns."

We may add to this, that still more recently M. Desnoyers has followed M. Gundry, and with analogous results. The alluvium of the Valley of Somme exhibits, according to most geologists, nothing extraordinary or exceptional in its position or its external appearance. It is of the post-Pliocene period, similar in arrangement and composition of materials, and in its organic remains with the drift in numerous other valleys of France and England. The claim of these gravels to particular attention is due purely to their containing the "flint instruments." Many of the latter are said to be not at all unlike

some stone implements used to this day, as hatchets and tomahawks, by natives of Australia. Of them Professor Ramsay remarks: "For more than twenty years, like others of my craft, I have daily handled stones, whether fashioned by nature or art, and the flint hatchets of Amiens and Abbeville seem to me as clearly works of art as any Sheffield whittle."*

Professor Ansted thus expresses himself in a contemporary journal:

"Concerning the various weapons or tools, or whatever else the human remains buried with hyænas' and bears' bones may have been, one fact is very significant—namely, that in all parts of the world—in England and France, Germany and Italy, Russia and Scandinavia, everywhere, in a word, throughout Europe—these remains, wherever found, are in all essentials the same, and are not unfrequently of foreign material. This of itself is interesting; but when we find that from the interior of India and China, the banks of the Mississippi, and the vast plains of South America, specimens of sculptured stone are obtained always precisely similar; that the jade of the East is mixed up in caverns and gravel with flints from Western Europe, and with greenstones from America, and that even the northern parts of Australia and Madagascar appear to contain examples of manufacture differing from these nothing in style and little in material—we are reminded pointedly of the original unity of the human race, and we see that an undetermined question of time forms the only serious difficulty interfering with the reception of one of the most startling innovations resulting from modern geological investigation"

When found, some of the Somme implements are of an ochreous-yellow colour, others are white or brown, according to the colour of their immediate matrix. The surface of many is encrusted with a film of carbonate of lime, while others are marked by those ramifying crystallizations called dendrites. But for fuller information on these points, and on the shapes, sizes, purposes, &c., of the "flint implements," we must be content to refer to the pages of Sir Charles Lyell. Some of these curious tools have also been discovered in this country in the ancient fluviatile gravel of the valley of the Ouse, near Bedford, and in a bed of gravel in the valley of the Lark, below Bury St. Edmunds. In connexion with these Sir Charles observes:

"One step, at least, we gain by the Bedford sections which those of Amiens and Abbeville had not enabled us to make. They teach us that the fabricators of the antique tools, and the extinct mammalia coeval with them, were all post-Glacial, or, in other words, posterior to the grand submergence of central England beneath the waters of the glacial sea." (p. 166.)

Nor has the valley of the Thames been absolutely barren of them, even in association with the skeleton of the elephant. The valley of the Wey (with so ancient a drift that one part of it had been disturbed and tilted before another part was thrown down), has also yielded at least one specimen. Before we pass to the next kind of testimony to the antiquity of man, this may be the appropriate place to notice, that M. Desnoyers has recently communicated to the French Academy the description of a series of markings upon fossil bones discovered near Chartres, and which he attributes in great part to the

* Athenæum, 1859.

action of flint implements. Many of these "striæ gashes and incisions" on the ancient mammalian bones have the same appearance, and must have the same origin as those met with on more modern bones—viz., the action of human weapons—whilst other striæ of a finer and more rectilinear character, and which intersect each other, seem to be analogous to those seen on blocks and pebbles which have been scratched and polished by the action of glaciers. From these and associated facts alluded to by M. Desnoyers in his Report, he concludes that man lived upon the French soil before the great and first glacial period (at the same time as *Elephas meridionalis* and the other Pliocene species characteristic of the Val d'Arno, in Tuscany), and that he was contemporary with these huge animals anterior to *Elephas primigenius* and the other mammals whose *débris* have been associated with the remains or indications of man in the gravels or quarternary beds of great valleys and in caverns.

The last description of evidence we have to refer to is that obtained from the old mud deposits and alluvial plains of large river deltas, such as those of the Mississippi, Nile, &c. In these, the remains of human art, and even human bones, have been stated to have been found at very great depths below the surface. The deposits being assumed to be thrown down with a certain degree of regularity or measurable rate in time and amount, the depths from which such remains have been withdrawn, afford a clue to the length of time which has been passed in thus covering them over. Mr. Horner's researches in the delta of the Nile afford a prominent illustration. At this spot historical momuments of great antiquity exist, originally built upon the mud of the river, and which have been since covered over, or partially hidden by such a thickness of deposit as belongs to the time which has progressively elapsed. The obelisk at Heliopolis, e.g., is thought to have been erected two thousand three hundred years B.C. It is now buried nearly twelve and a half feet, and of which but sixteen and a half inches are supposed to indicate the portion originally sunk. Thirty miles from the apex of the delta is Memphis, a city believed to have been constructed four thousand years B.C. M. Girard, of the French expedition, calculated the average rate of increase of Nile mud on the plain between Assouan and Cairo, to be five English inches in one hundred years. By Mr. Horner this rate is reduced to about three and a half inches; whilst M. Rosiere estimates the mean rate of deposit at two inches and three lines in a century. It is generally admitted, however, that whatever the actual rate may be, the vast accumulation of mud forming the delta of the Nile has been deposited at the rate of only a few inches in one hundred years. In this mud numerous borings were made at the suggestion of Mr. Horner, partly at the expense of the Royal Society, and partly at that of the late Viceroy Abbas Pacha. For the first sixteen or twenty-four feet, jars, vases, pots, a small human figure in burnt clay, a copper knife, and other entire articles were brought up; but when water soaking through fissured the Nile was reached, the boring instrument employed was too small to allow of more than fragments of works of

art being brought to the surface. But pieces of burnt brick and pottery were extracted almost at every spot, and from all depths, even where the sinking was sixty feet below the surface, towards the central parts of the valley, and in none of these cases did the borers get to the bottom of the alluvial soil.

"Were we to assume six inches in a century, the burnt brick met with at a depth of sixty feet would be 12,000 years old. Another fragment of red brick was found by Linaut Bey in a boring seventy-two feet deep. . . . . Were we to take two-and-a-half inches, a work of art seventy-two feet deep must have been buried more than 30,000 years ago." (Lyell, p. 38.)

According to Sir Charles Lyell, the lowest estimate of time required to form the existing delta of the Mississippi would be probably more than 100,000 years. In a portion of it, near New Orleans, at the depth of sixteen feet from the surface, and beneath four buried forests superimposed one upon the other, some charcoal and a human skeleton (the cranium of which is said to belong to the aboriginal type of the Red Indian race) are asserted to have been found. From particular chronological calculations, Dr. Dowler has ascribed to these remains an antiquity of 50,000 years. In a calcareous conglomerate, forming part of the coral reefs of Florida, supposed by Agassiz (in accordance with his mode of estimating the rate of growths of these reefs) to be about 10,000 years old, some fossil human remains are said to have been discovered by Count Portalis. But we are now getting quite into the cloudland of palæontologic history, and it is time to inquire what criticism has to offer on the evidence upon which most stress is likely to be placed.

If a geologist were asked what would be the least trustworthy stratigraphical conditions under which an admixture of human bones and remains of art with the bones of extinct animals being found, inferences could be drawn as to their contemporaneous existence, he would point out exactly such as have been pressed into the modern service. True it is we have no other, and that in itself is suspicious. Such geologist would say to an enthusiastic novice, "Be very cautious how you reason upon what you may find mixed up together in limestone caves and in beds of gravel." And why so? Because in the bone mud of caverns are to be found local and accidental accretions, disconnected with ordinary geologic causes and devoid of definite position in the recognised strata of the globe. Because the gravel or alluvial drift, upon which so much stress is laid, may have been formed out of some older gravel, and from which the remains of the ancient animals may have been procured. The caves, too, may have served as the channels through which the waters of occasional land-floods, or engulfed rivers have flowed, so that the remains of living beings which have peopled the district at more than one era may have subsequently been mingled in such caverns, and confounded together in one and the same deposit. *Mere juxtaposition* of fossils, as proof of contemporaneity, must, under any circumstances, be reasoned upon with the utmost caution, but juxtaposition in the stalagmitic crusts and breccia of ossiferous caves and in beds of gravel requires more than ordinary circumspection in its use.

"The convulsions and revolutions of the geological world," says Hugh Miller, in his 'Old Red Sandstone,' "like those of the political, are sad confounders of place and station, and bring into close fellowship the high and the low; nor is it safe in either world—such have been the effects of the disturbing agencies—to judge of ancient relations by existing neighbourhoods, or of original situations, by present places of occupancy."

The ossiferous caverns have in many instances remained accessible ages after the mud deposits of their floors were formed, and some may have served for occasional concealment or shelter down even to comparatively modern times; at all events, as the writer in the 'Edinburgh Review' remarks, they

"Were tenanted for long periods by successive races, whether of animals or men, and the record of their antiquity was not, as in the case of strata, geologically superimposed, sealed up, and verified by a succession of later deposits." (Op. cit.)

In the interesting papers on "Caverns and their Contents," by Professor Ansted, recently appearing in the 'Popular Science Review,' the author writes:

"In countries little cultivated, and where wild animals are common in the adjacent forests, the bear, the hyæna, and some other beasts of prey, occupy caverns as dens, or use them either as larders or as burial-places. Sometimes they bring in and deposit there the carcases of their victims; sometimes they would seem to retire there to die. The skeletons and bones accumulated from either of these habits are not unfrequently heaped in quantities almost incredible, and they are sometimes mixed with and sometimes coated with recently-formed stalagmite. Elsewhere bones, shells, and various remains of animals, have been washed into caverns on the occasion of some unusual flood, or have fallen in from above with stones, boulders, or angular fragments of rocks." (Op. cit., July, 1862.)

What is true to-day was true yesterday. In other instances such caves have been found to communicate with the surface by narrow vertical or oblique fissures, the upper extremities of which have become choked up with sand and gravel. There is thus little difficulty in understanding how much of the materials, organic and inorganic, now filling the cave may have been washed into it through such fissures, and subsequently consolidated by a constant supply of water, charged with carbonate of lime, dripping from the roof during their gradual accumulation. In the ninth edition of his 'Principles of Geology,' Sir Charles Lyell writes as follows:

"After giving no small weight to the arguments of M. Desnoyers and the writings of Dr. Buckland on the same subject, and visiting several caves in Germany, I came to the opinion that the human bones mixed with those of extinct animals in osseous breccia and cavern-mud in different parts of Europe were probably not coëval. The caverns having been at one period the dens of wild beasts, and having served at other times as places of human habitation, worship, sepulture, concealment or defence, one might easily conceive that the bones of man and those of animals which were strewed over the floors of subterranean cavities, or which had fallen into tortuous rents, connecting them with the surface, might, when swept away by floods, be mingled in one promiscuous heap in the same ossiferous mud or breccia." (Op. cit., p. 740.)

That such intermixtures have really taken place, and that geologists

have been deceived by them, and assigned to one and the same period fossils which had been introduced at successive times, all unprejudiced observers are now willing to allow. But the question remains, whether there are not certain examples—such as those we have referred to—in which surrounding conditions and circumstances tend to prove that the caves have been undisturbed from the first, and that what has been discovered in them has been buried in undisturbed loam or clay, beneath a crust of stalagmite that must have been formed subsequently to their introduction, the hypothesis of sepulture being quite inapplicable. Sir Charles Lyell and other eminent geologists now answer in the affirmative, and believe that there is *cave* as well as other evidence to show that man and the mammoth coëxisted. The Brixham cave was examined with such precautions as might free it from the objections urged against its predecessors. It is thought to have come out of the ordeal successfully, and to show also that it is probable that if the depositories explored by Schmerling, McEnery, and others, had now to be opened, and with the same care, they would offer valid testimony. The time has passed for this, however, and hence we are justified in accepting them only as very qualified witnesses. As regards the interesting cavern of Aurignac, it has been objected that M. Lartet was personal witness to only a portion of the facts which he relates, eight years having passed since it was first opened to when he visited the locality. In the second place, it would seem to prove *too* much, for by it we are carried back either to the sacred rites of burial, to the relics of the funeral feasts, and to the very portal of the tomb of a people living innumerable cycles before Œdipus or Priam, before Tyre, before Memphis, before the Flood, or are landed simply on the shore of a comparatively very recent historic time. Who shall determine which? Cautious and sceptical in our mood, we shall believe the latter; but when speculative and poetical, we shall exclaim, in De Quincey's apostrophe to opium as to geology:

"O just and righteous opium—*geology*—that to the chancery of dreams summonest, for the triumphs of despairing innocence, false witnesses, and confoundest perjury, and dost reverse the sentences of unrighteous judges—thou buildest on the bosom of darkness, out of the fantastic imagery of the brain, cities and temples beyond the art of Phidias and Praxiteles, beyond the splendours of Babylon and Hekatompylos, and from 'the anarchy of dreaming sleep' callest into sunny light the faces of long-buried beauties and the blessed household countenances cleansed from the 'dishonours of the grave.' Thou only givest these gifts to man, and thou hast the keys of Paradise, O just, subtle, and mighty opium—*geology*."

Assuming for the present that every remain asserted to have been found in the gravel-beds of the Valley of the Somme has really been so discovered, the question has to be asked, What is the geological age of these diluvia? If general opinion be correct, the gravel of the Somme is true diluvium, formed chiefly from the denudation of the tertiary strata by an excavating river at a time when the great extinct pachyderms were inhabitants of the earth. The upper gravels in which the remains have been found are assumed to be the oldest, being "deposited at a time when the chalk had only been scooped out to the level on which they are now found resting, and that the

lowering of the bottom of the valley from that level to thirty or forty feet below the present surface of the peat—that is to say, the removal of from one hundred to one hundred and forty feet of chalk by the denuding action of water—must have taken place since the deposit of the upper gravels." Now, it is said, "he must be a bold man who would fix even a *minimum* limit to the period required to effect such a denudation by any body of water which can be reasonably conceived to have flowed down the valley." But the fact stares us in the face, that one of the most eminent geologists of France, M. Elie de Beaumont, denies the accuracy of the current opinion regarding the age and formation of the gravel of the Somme. Twenty years back this high authority expressed certain views regarding the nature of the ground of Moulin Quignon, where the famous jaw-bone was found last spring. Since the present controversy, M. de Beaumont has declared that he still holds the same views—viz., that certain gravel deposits like that of Moulon Quignon must be distinguished from the Alpine drift, or *diluvium*, properly so called, and the origin of which latter is owing to causes which have ceased to operate. The Somme gravels are owing to other causes—that is, to such as we still see in operation. These gravels have been attributed either to the action of the polar ice which may have floated on the Bay of Somme, or to various successive changes of level in the general mass of the adjacent land. Whether it be justifiable or not to ascribe so small an effect to such gigantic causes is to M. de Beaumont less than doubtful. But even if not so, the production of the latter would after all lie within the range of *actual* causes. If, also insists M. de Beaumont, the gravelbank of Moulin Quignon be the result of a later mixture of grey and red drift, it certainly does not belong to that grey which is the real Alpine drift, considered by Cuvier as well as by himself as representing the end of the period of fossil elephants, and as anterior to the presence of man.

In support of this opinion that the gravel deposit in question is owing to the most common among the actual causes—viz., storms, frost, snow, &c.—M. de Beaumont draws attention to the fact that the bank of Moulin Quignon is situate at an altitude of 30 metres above the Somme at Abbeville, and consequently at 39 metres above the level of the sea. It is overlooked at a distance of less than 2 kilometres by points the altitudes of which are respectively 61, 65, and 67 metres, at less than 3 kilometres by another point 80 metres above the level of the sea, and at less than 5 kilometres by points marking 100 metres. The gradients of the lines going from Moulin Quignon to these points all exceed the proportion of 1 to 100, or more than tenfold the *maximum* inclination of the beds of navigable rivers, and greater than those of the Arve, Isère, &c., near their sources, where their waters, even when but slightly swollen, flow with immense rapidity, and will occasionally commit the greatest ravages. Now to produce similar ravages on the undulated plains of Picardy, a single heavy snow-storm would be quite sufficient; and who would venture to guess, asks M. de Beaumont, the *maximum* effect of this kind which may have taken place in the environs of Abbeville since the age of stone? The deposit of Moulin

Quignon may therefore be very well owing to such a cause, though anterior to the turf deposits of the North of France, many of which are posterior to the Roman roads. Such deposits, which M. de Beaumont calls "moveable deposits on declivities," are particularly abundant in the North of France, owing to want of coherence of the Eocene, Miocene, and Pliocene deposits which cover the chalk formation, and are essentially contemporaneous with the alluvial beds of valleys—those along the coasts and turf-deposits. Thus, then, these Somme gravels upon which so much stress has been laid are, according to one of the highest authorities, not even alluvia deposited by the encroachments of rivers on their banks, but are composed simply of washed soil, deposited on the flanks of a valley by excessive and frequent falls of rain and of snow of the age of the "stone period," of peat-moss, and of the Swiss lacustrine habitations! The views of M. Elie de Beaumont have been confirmed, we may remark, very recently by the Abbé Chevalier, who, in a report to the French Academy upon the superficial strata of Touraine, stated, that the "moveable deposits on declivities" described by the former were there very frequently met with, and that flint hatchets had been discovered in such moveable deposits, whilst none had been met with in the real drift. We would here draw attention likewise to the statement of Sir Roderick Murchison concerning the drift of the South-east of England*—a formation regarded by some good authorities to be geographically and geologically the counterpart of that of the valley of the Somme. This writer finds evidence for believing that the "flint drift" was not the lingering deposit of long ages of comparative repose, but was the result of short turbulent agencies, performing in a few years the work thought by one school of geology to require hundreds or even thousands of centuries. At the last meeting of the British Association, we find Mr. Philips† coming to the conclusion, in his paper on the flint instruments and gravel-beds of St. Acheul, "that the changes were local, and that they afforded no evidence of the great antiquity of man." Mr. Austin also, in speaking at the same meeting of the Bedford section, "endeavoured to show that the remains of the extinct animals taken out of the gravel, which was thirty feet above the level of the sea, were derived from an older gravel, and that this view would equally apply to the accumulations of the Somme and Ouse." Now may we not with great emphasis repeat the words of the writer in the 'Edinburgh Review'—viz., that the existing fundamental opposition which has arisen between such eminent geologists as M. Elie de Beaumont and Sir Charles Lyell, Mr. Prestwich, and others, as to the age and formation of the Abbeville gravels, is sufficient evidence to show that the very grammar of this part of geological science requires, if not to be written, at least to receive an adequate sanction. Let us pass from the caves and gravel-beds to what has been disinterred from them, or asserted to have been so.

First, in respect to the statement that the chemical condition of the bones found in union with those of the extinct animals has been proved to be identical (Marcel de Serres and others), it may be replied, that

* Journal Geol. Soc., vii. p. 349. † Prof. Geol., Oxford.

after a certain period had elapsed, the chemical condition of the former would remain the same, and that no conclusions of accuracy as regards the age of the bones could be deduced from such conditions. Some years ago, a party of geologists had placed before them a jelly made with gelatine extracted from bones taken out of the Kirkdale cavern, or from a similar source;* whilst a piece of an ancient Burgundian skull, supposed to be about 2000 years old, a fragment of the skull of an ancient Roman found in a tomb on the road between Cumæ and Baiæ, and a fragment of the skull of a young aboriginal female, taken from an ancient tomb at Picul, in Yucatan, were found to consist almost wholly of earthy matter, the animal matter having very nearly disappeared.† Bones placed in a porous bed, through which water can freely pass, will have their gelatinous portions washed away, in comparatively few years, by a process somewhat like that recommended by the eminent director of the French Mint, M. D'Arcet, for the extraction of gelatine for culinary purposes.‡ Sir Charles Lyell, in commenting on the chemical condition of the bones from the Aurignac cave, remarks:

"No doubt, had the human skeletons been found to contain more gelatine than those of the extinct mammalia, it would have shown that they were the more modern of the two; but it is possible that after a bone has gone on losing its animal matter up to a certain point, it may then part with no more so long as it continues enveloped in the same matrix. If this be so, it follows that bones of very different degrees of antiquity, after they have lain for many thousand years in a particular soil, may all have reached long ago the maximum of decomposition attainable in such a matrix." (p. 187.)

A French chemist, M. Couerbe, has recently proposed a definite rate of loss as occurring in ossific remains. He concludes, from experiments made on skeletons dug up at the Chateau of Vertheul, that the organic nitrogenous elements disappear at the rate of three per cent. in a century. But what is the value of such theories, if the following statement be true? Lieutenant-Colonel Hamilton Smith, before referred to, tells us,§ that whilst one fossil bone from the Yealm Bridge cave, under the influence of hydrochloric acid, was "reduced to a spongy, flocculent mass, which, having become lighter than the fluid, rose to the surface in the shape of a mere pellicle," in a metatarsal bone of an hyæna from the same cavern "the animal substance remained so abundant that the bone retains its complete form, is only translucent, and remains at the bottom of the liquor as if it were a recent specimen, of which it preserves all the characters." The jaw-bone of the gravel bed of Moulin Quignon has been subjected, as may be imagined, to a very close and lengthened investigation. As this *reliqua* is a very important one, and its history extremely interesting, we shall give an account of it in the following quotation from the 'Edinburgh Review,' premising, however, that the *procès-verbaux* of this *cause*

* Transac. Ethnolog. Soc., vol. ii. p. 127.

† For further and interesting information on this point, the reader may refer to a 'Description of a Deformed Fragmentary Human Skull found in an ancient Quarry-cave at Jerusalem, &c.,' by J. Aitken Meigs, M.D. Philadelphia, 1859.

‡ Transac. Ethnolog. Soc., op. cit. § Op. cit., p. 99.

célèbre may be found in the June number of the 'Natural History Review.'

"In March last, the workmen at Moulin Quignon, near Abbeville, brought to M. de Perthes a human tooth, which they declared they had found in the usual site. Having directed that special care should be taken to report to him the first appearance of further relics, on the 28th of the same month a workman named Vasseur announced that a bone projected about an inch from the matrix. This was extracted under the eyes of M. de Perthes himself, and proved to be one-half of a human jaw. A flint axe was not many inches distant. The exact depth of the jaw from the surface was 4½ metres, or 15 feet. The bed in which it lay was a sandy one, in contact with the chalk, and dark-coloured, from the admixture of iron and manganese. There were found by M. de Perthes on the same day in the yellow sand belonging to the same bed, and 3½ metres from the surface, fragments of mammoths' teeth. When the discovery was published, geologists flocked to the spot both from Paris and London, especially M. de Quatrefages, Professor of Anthropology at the Paris Museum of Natural History, from the former; Messrs. Prestwich and Evans, Drs. Carpenter and Falconer, from the latter. The verdict given on the spot seems to have been entirely favourable to the genuineness of the relic. The jaw-bone was conveyed to Paris, and one tooth and some hatchets to London. It appears that at the time no doubt was entertained by any of those who visited Moulin Quignon on the 14th and 15th of April that the jaw was authentically found in the locality described, and where it was seen by M. Boucher de Perthes. The Englishmen, however, moved partly by the subsequent opinion of skilled antiquaries that the hatchets were forged, as they presented no palpable proofs of antiquity, and partly by the fresh condition (when sawn open) of the interior of the single tooth in their possession, surrendered their first opinion.

"Dr. Falconer, in a letter to the 'Times' of April 20th, declared that M. de Perthes had been deceived by the men. He further added that the undoubted osteological peculiarities of the jaw which led the most skilful naturalists to consider it as bearing internal evidence of remote antiquity were merely accidental, though presenting an extraordinary coincidence with the alleged circumstances of its discovery. The Parisian naturalists, however, and especially M. de Quatrefages, who had possession of the jaw, firmly adhered to the first opinion. Under these circumstances, the controversy might have been hopelessly prolonged, had not the happy idea been entertained and acted on of holding a meeting of *savans* of both nations, which took place at Paris, under the able presidency of M. Milne-Edwards, from whence it was adjourned, on the 12th of May, to Abbeville. The assembly consisted of MM. Milne-Edwards, De Quatrefages, Lartet, Delesse, and Desnoyers, from Paris; and Drs. Falconer and Carpenter, Messrs. Prestwich and Busk, from London. Fresh excavations were undertaken beneath the very eyes of the commission, and were attended with the discovery of several hatchets, which were believed to be genuine, though not possessing the *patina* or other proofs of antiquity formerly relied on. These results, together with a full investigation of the circumstances attending the discovery of the jaw, terminated in the conviction of every individual present at the inquiry on that occasion, that no fraud had been practised.* . . . . (To speak rigorously, Dr. Falconer, while perfectly satisfied of the authenticity of the flint-tools, expressed in the presence of the Commission, on the 12th of May, and also of the jaw itself, declined to commit himself to the authenticity of the tools discovered near the jaw; and on the 28th of March, Mr. Evans, who did not take part in the conference either at Paris or Abbeville, and who, therefore, was not a witness to the extraction of the five

* Edin. Rev., p. 271.

'haches' in presence of the commission, still denies the authenticity of those not possessing the criteria of patina, dendrites, or worn edges; and it is proper to add, that the strong doubts he has expressed on this subject are still entertained by many geologists of eminence. The facts stated in the text are based on documentary evidence; but we are informed that at recent meetings of the Geological Society of London more than one of the English commissioners has seen reason to retract the opinion he formed at Abbeville. These frequent alterations of judgment have thrown doubt on the whole transaction. It is certain that many genuine remains have been found at Abbeville, but it is not less certain that many spurious objects have been introduced into the beds of gravel there.*) . . . . The reader must not, however, suppose that with the admission of the relics being truly found, as alleged, in an undisturbed bed, at the depth of fifteen feet, coincidence of opinion as to the age of the fossil was thereby attained. Dr. Falconer and Mr. Busk restated the doubts they originally entertained as to the absolute age of the jaw, which was now sawn across, and displayed an amount of freshness inconsistent, in their opinion, with its being coëval with the remains of the extinct quadrupeds. These doubts do not seem to have been shared by the French members of the Commission; but the eminent physiologists who belonged to it, especially MM. Milne-Edwards and De Quatrefages, expressly held themselves uncommitted to any opinion as to the geological age of the Moulin Quignon beds." (Op. cit.)

The particular reasons why Dr. Falconer and Mr. Busk have withheld their assent to what have been termed "the startling conclusions of the *procès-verbaux* of the Commission," are *quoad* the jaw-bone as follows: (*a*) the black coating due to the matrix was washed off with the greatest readiness; (*b*) there was no infiltration of metallic matter; (*c*) there was no appearance of dendrites externally or within; (*d*) the outer surface was rather smooth, and quite unlike the condition in which buried bones are usually found; (*e*) the substance of the bone was firm, and when sawn gave the peculiar odour produced when the saw cuts through fresh bone; (*f*) the dentine of the tooth was white, and the enamel quite brilliant, and in every way resembling that of a recent tooth; (*g*) the dental canal was lined with a layer of grey sand, which was not mixed with the black matrix, and seemed to indicate that the bone had been at one period in a ferruginous sandy deposit; (*h*) the mere adhesion of the particles of the black *gangue* to the bone did not indicate that the bone had remained in the deposit for any considerable time, as experiments proved that when this substance was applied in its soft state to any surface, no matter how smooth, it adhered to it when dry with the greatest tenacity. The characters of the bone and tooth, observes a writer in the 'Popular Science Review,' October, 1863—

"Are remarkable, when contrasted with those of bones of an earlier date than the beds of Moulin Quignon. The human lower jaw from a gravel heap of an Ipswich coprolite bed alluded to in the discussion, although retaining some of its gelatine, is completely infiltrated with iron, the Haversian canals being filled with red oxide, and a section of the fang proving that the dentine has been penetrated by the same metal. This demonstrates that a human jaw, if favourably placed, is equally susceptible of impregnation with metallic matter as the bone of any other mammal. It is worthy of note, that the tooth which had been so carefully examined in London, and had been forwarded from

* Note in Edin. Rev., p. 272.

Abbeville, was not permitted a place in the evidence, it having been insinuated by the French *savans* that it might, through some error, have been confounded with some other specimen. The French men of science relied almost exclusively on circumstantial evidence, and seemed to reject the intrinsic variety which was regarded by the English as of more importance."

The third portion of Professor Huxley's work gives an admirable summary of what is known of the history and of the author's critical investigation of the Engis and Neanderthal skulls. In the former, Professor Huxley tells us (p. 156) that he cannot find any character which, if the cranium were recent, would give a trustworthy clue as to the race to which it might appertain. Its contours and measurements agree very well with those of some Australian skulls, particularly as respects the occipital flattening which is to be met with in some of the latter. But it must be admitted that all Australian skulls do not present this flattening, and the superciliary ridge of the Engis skull is quite unlike that of the typical Australians.

"On the other hand, its measurements agree equally well with those of some European skulls. And, assuredly, there is no mark of degradation about any part of its structure. It is, in fact, a fair average human skull, which might have belonged to a philosopher, or might have contained the thoughtless brains of a savage." (Huxley, p. 156.)

With respect to the "Neanderthal skull," it has been observed by Dr. Hermann von Meyer that the possession of dendritical crystallizations covering both its inner and outer surfaces, and upon which stress has been laid as indicative of its extreme antiquity, is no real criterion of its age, since such dendrites have been found upon Roman bones. Sir Charles Lyell remarks upon the fact that "the skull and bones of the Neanderthal skeleton had lost so much of their animal matter as to adhere strongly to the tongue, agreeing in this respect with the ordinary condition of fossil remains of the post-Pliocene period." (p. 78.) But a piece of the "Jerusalem skull" examined by Meigs (op. cit.), and thought to be Turanian, of historic time, adhered to the tongue likewise. We have already learnt, however, how small a dependence can be placed upon this part of the argument. When the Neanderthal skull and bones were first exhibited at a scientific meeting at Bonn, in 1857, some doubts were expressed by several naturalists as to their being truly human. Even Professor Schaffhausen, who did not share these doubts, admitted that the thickness of the bones was very extraordinary, and that the elevations and depressions from the attachment of muscles were developed in an unusual degree. Sir Charles Lyell remarks: "When on my return to England I showed the cast of the cranium to Professor Huxley, he remarked at once that it was the most ape-like skull he had ever beheld." (p. 79) Since a more recent examination of casts and photographs from it, the anatomist just mentioned allows, with Messrs. Schafthausen and Busk, that this skull is the most brutal of all known human skulls, resembling those of the apes, not only in the prodigious development of the superciliary prominences and the forward extension of the orbits, but still more in the depressed form of the brain-case, in the straightness of the squamosal

suture, and in the complete retreat of the occiput forward and upward from the superior occipital ridges. But, writes Professor Huxley, in his chapter "On some Fossil Remains of Man":

"In no sense can the Neanderthal bones be regarded as the remains of a human being intermediate between men and apes. At most they demonstrate the existence of a man whose skull may be said to revert somewhat towards the pithecoïd type—just as a Carrier, or a Pouter, or a Tumbler, may sometimes put on the plumage of its primitive stock, the *Columbia livia*. And, indeed, though truly the most pithecoïd of known human skulls, the Neanderthal cranium is by no means so isolated as it appears to be at first, but forms, in reality, the extreme term of a series leading gradually from it to the highest and best developed of human crania. On the one hand, it is closely approached by the flattened Australian skulls of which I have spoken, from which other Australian forms lead us gradually up to skulls having very much the type of the Engis cranium. And, on the other hand, it is even more closely affined to the skulls of certain ancient people who inhabited Denmark during the 'stone period,' and were probably either contemporaneous with or later than the makers of the 'refuse heaps,' or 'Kjokkenmöddings' of that country. . . . . Where, then, must we look for primæval man? Was the oldest *homo sapiens* Pliocene or Miocene, or yet more ancient? In still older strata do the fossilized bones of an ape more anthropoïd or a man more pithecoïd than any yet known await the researches of some unborn palæontologist?" (p. 157.)

It must not be forgotten that the peculiarity of the original position of the Neanderthal skeleton, and the want of the remains of extinct or other animals, render it necessary that any inferences regarding its antiquity must be drawn with the greatest caution.

With respect to the "fossil-man of Denise" it may be said that no trust can be placed upon it. The high prices given for "human fossils" at Le Puy, and the known fact that certain fabrications had there been made, render it quite impossible to say that perpetration of some kind of fraud did not take place in this especial instance. As far as relates to the Natchez case, the want of direct and sufficient evidence as to the *find* must be clear to every unprejudiced person. Even were it not so, the association of the human bone with the remains of a mastodon and megalonyx may be, under the particular circumstances, explained in the way Sir Charles Lyell stated in his 'Second Visit to America,' in 1846—viz., that "the former may possibly have been derived from the vegetable soil at the top of the cliff; whereas, the remains of extinct mammalia were dislodged from a lower position, and both may have fallen into the same heap or talus at the bottom of the ravine." This idea has also occurred to Colonel Wiley, of Natchez. We will now consider the "flint implements." With reference to them it may be remarked, that there are not wanting geologists and antiquaries who take very different views of their age and origin to those usually prevalent. The sceptics, no doubt, form the exception, and are almost ridiculed by some of the opposite party; still our duty is to state all possible objections. Mr. Wright, no mean antiquarian authority, has endeavoured to throw doubt on the artificial origin of the "flakes," or more simple implements, and of which the number found has been very large. He maintains that they might have been produced

naturally by a violent and continuous gyratory motion (perhaps in water), in which they were liable to be struck by other bodies in the same movement. According to Mr. Wright, the mere number also of "flakes" found in the same locality renders it improbable that they can be other than natural phenomena. We ourselves have been forcibly struck with this circumstance. We hear of "basketfuls" of flint implements having been collected, and then of the assumption of the localities in which they were found having been places for the *manufacture* of such articles, and of the early hunting and fishing tribes of the times of the mastodon frequenting the same spots for hundreds or thousands of years in succession, so that

"The number of the stone implements lost in the bed of the river need not surprise us. Ice-chisels, flint-hatchets, and spear-heads may have slipped accidentally through holes kept constantly open, and the recovery of a lost treasure once sunk in the bed of the ice-bound stream inevitably swept away with gravel on the breaking up of the ice in spring, would be hopeless. During a long winter, in a country affording abundance of flint, the manufacture of tools would be continually in progress; and if so, thousands of chips and flakes would be purposely thrown into the ice-hole, besides a great number of implements having flaws, or rejected as too unskilfully made to be worth preserving." (Lyell, p. 141.)

Of the *ingenuity* of such explanations there cannot be a doubt, but we feel unsatisfied as we think over them. Further, we would remark that Mr. Whitley has recently found beneath the surface soil at Croyde Bay, North Devon, at the mouth of a small transverse valley, broken flints in considerable number. About ten per cent. of these had more or less of an arrow-head form, passing by insensible gradations from what appears to be perfect arrow-heads of human manufacture to such rough splinters as are clearly the result of natural causes. It has been maintained by others, that although "flint implements" are found which are unquestionably the work of human hands, those of the Valley of the Somme were fabrications, or modern imitations, introduced surreptitiously into the gravel, and afterwards brought to the scientific men as having been disinterred from there. At one time, M. Boucher de Perthes was accustomed to give from two to five francs for an implement—a price very likely, in the opinion of many, to lead to the practice of deception. But it has been said that such a price would not really pay any one to make these weapons. As the writer in the 'Edinburgh Review' remarks, perhaps not at first, but now that the English market is craving flint instruments, it might answer the purpose to manufacture them. Certain it is, that such things are fabricated; and no one reading the *procès-verbaux*, in the 'Natural History Review' can avoid perceiving that the learned in such matters cannot always distinguish the genuine from the manufactured article. The grounds upon which Messrs. Falconer and Busk found their scepticism as to the genuineness of the particular Moulin Quignon "haches," are (*a*) they possess a form different from all others previously found at Abbeville or Amiens; (*b*) their angles are sharper than those of any other specimens except those of La Porte Mercadè; (*c*) they present no staining nor discoloration; (*d*) they

exhibit neither dendritic markings nor adherent matrix ; (*e*) the great sameness of character presented by all the specimens, as though they had all been made by one or two persons ; (*f*) none of the specimens were tinted with iron, although all the larger pebbles of the *couche noire* were so tinged ; (*g*) the matrix of the St. Gilles' specimen contained "unquestionable traces of recent vegetable structure." In reference to M. Desnoyer's theory of the cause of the striæ on extinct mammalian bones, it will be sufficient to state that M. Eugene Robert, in reply to it, maintains that all the grooves, gashes, and scratches, which the former attributes to the action of the flint weapons used by an early race of men, have been produced by the implements of the artisans employed in extracting, and afterwards preparing the fossils. M. Robert's attention was first directed to such an origin by the remark of a person engaged in the French School of Mines, to the effect that they were due to the awkwardness of those who removed the earth from the specimens. In one instance, M. Robert was enabled, from the character of the injury, to infer that the mark had been produced by a workman's pickaxe. A few words will suffice relative to the testimony of the deltas of large rivers. We have already seen that Mr. Horner and the French *savans* differ as to the rate of deposition, some calculating it to occur at twice the rate believed by others. But are either right? The experiments instituted by Mr. Horner to obtain an accurate chronometric scale are not considered by experienced Egyptologists as at all satisfactory. It has likewise been objected that the Arabs can always find whatever their employers desire to obtain ; and that the artificial objects got up by the borers might have fallen into old wells which had become gradually filled up. It may not be out of place, also, that we recall the following fact: In the course of making the excavations for the Thames Tunnel, the difficulties that arose from the nature of the soil in some parts induced the contractors to procure a diving-bell, for the purpose of examining the bottom of the river. On the first inspection, a shovel and hammer were left on the spot by the divers; but these tools were, contrary to their expectations, nowhere to be found on the next visit. In the progress of the excavations, however, while advancing the protecting wooden framework, the missing shovel and hammer were found in the way of it, having descended at least eighteen feet in the ground, and probably resting or mixed up with some ancient deposit. It now remains for us to notice another interpretation, which has been put upon these strange pages in the great "stone-book of nature," which so puzzle us. The facts, speaking generally, are admitted; the caves and gravels are held to be above suspicion; and the remains and objects said to have been extracted from them are believed to have been actually found in them. This view admits, then, that we have proof that man was contemporary in Europe with two species of elephant, two species of rhinoceros, at least one species of hippopotamus, with the cave-bear, cave-lion, cave-hyæna, and many smaller extinct animals. But it prefers to regard the geologic and palæontologic facts which necessitate this admission, as being more in favour of the prolongation of

the mammalian period, or of the days of the great extinct pachyderms, down to recent times, than of the carrying back of the existence of man into the remoter ages. Our contemporary, when commenting on M. Lartet's account of the Aurignac cave, observes:

"Assuming all the conclusions from the observations of M. Lartet to be correct (and from the great majority of them we see no cause to dissent), it appears to be almost incontestable that the result is unfavourable to the idea of assigning an almost measureless antiquity to those numerous deposits which are proved to be coëval with extinct mammalia, and of which we have treated in this article. It goes a long way to convince us that the existence in Europe of the cave-bear, cave-lion, rhinoceros, and mammoth must be approximated much more towards recent times rather than that the creation of man must be drawn back into a region of quite hypothetical remoteness on account of his association with the extinct species. But Sir Charles Lyell and M. Lartet (who appears to be a thorough disciple of his school) try to persuade us that absence of any mark of important change in the physical condition of the country about Aurignac is no proof that the antiquity of the tomb may not be indefinitely great. Great, no doubt, it must be, but every fact connected with its position and discovery seems to show that it belongs to what we may (somewhat vaguely, no doubt) call *the present age of the world.* There is nothing unreasonable in assuming that these mammals survived to a later period of the world's history than geologists have usually allowed. Even the changes of climate which they were once considered to establish has disappeared as a difficulty." ('Edinburgh Review.')

But once admitting the contemporaneousness of man with the extinct pachyderms before mentioned, his duration upon the globe must under any view of the case, be still allowed to be of a far greater antiquity than has hitherto been suspected. But we are warned that we have already exceeded our usual limits, and we must relinquish our obscure, though very interesting theme. It will be recollected then that the theory of Cuvier was, that the earth, when sufficiently free from water to support animal existence did so in the successive order of—1. An age of reptiles; 2. Of palæotheria; 3. Of the mammoth and mastodon; and 4. Of man. Down to the time of Cuvier and Buckland, no very definite idea existed that man was contemporaneous with the extinct pachydermata of the third series. In their day, however, a few explorers of the labyrinthine passages of the past ventured, as we have seen, to hint that there was testimony to show that Man did tread the earth, for however short a period, with the cave-bears, hyænas, and rhinoceroses which have been extinct for ages. Now we find many of our highest geologic and palæontologic authorities strenuously supporting such an opinion, and carrying back the origin of man, geologically speaking, into the post-Pliocene period of the upper tertiary series. Whether he is to be finally located in these strata along with the mammoth and cave-bear, or whether he is to be brought forward again into a brighter daylight in company with certain extinct species, which were once thought to have been lost before they actually were so, or whether after all, certain grand mistakes have not been made, must be regarded as yet—in our opinion, at least, quite undetermined. Not only, however, do Sir Charles Lyell and others, for whose opinion we should have the highest respect, lean towards

the belief that man inhabited the earth in far distant ages, along with the elephant and the rhinoceros in the valley of the Ouse at Bedford, and in "post-Pliocene" times fashioned the flint implements of Amiens and Abbeville, but they maintain that the "recent period" of his existence here has been of so long duration as to carry it back to an incalculable antiquity, or one at least, to which five or six thousand years are but an insignificance, and in comparison with whose archives the records of the valley of the Nile must be considered as extremely modern. The evidence for thus lengthening the "præ-historic period" of man will be found displayed in a most interesting manner in Sir Charles's recent volume. It is founded upon the history of Danish peat and its remains, upon the Kjôkkenmödding of Denmark, the lacustrine habitations of ancient Switzerland, the "crannoges" of Ireland, &c. &c. To discuss it would require nearly as many pages as we have already consumed. In conclusion, we feel bound to say, then, that however *suspicious* we still feel in respect to the nature of the testimony which has been offered us in proof that our race existed in past ages, almost bewildering to think of, we consider that neither the scientific world nor the general reading public have received for some time past two more welcome gifts than those of Sir Charles Lyell and of Professor Huxley. We do not know which to rate more highly—their scientific importance, or their general interest.

Review X.

1. *Report of the Commissioners appointed to Inquire into the Sanitary State of the Army in India, with Précis of Evidence.* 8vo, pp. 265.
2. *Minutes of Evidence, Reports from Stations in India and its Dependencies, &c. &c.* 2 vols. folio, pp. 943 and 959.

The appearance of this Report, with its documentary evidence, will form an era in the literature of State Medicine, and of the Hygiene, not of armies and military establishments only, but of communities and peoples also. From the very wide extent and varied nature of the field of inquiry, as well as from the comprehensive and searching system of investigation pursued, and the highly-intelligent character of the testimony received, whether orally or in writing, an amount of valuable information on many of the most important subjects relating to public health is collected together, such as has never before been obtained. The Commission was appointed in the summer of 1859, and the Report is dated May 19th, 1863, so that their labours extended over four years. The period had, alas! not passed away without leaving more than one blank in the roll of the original members. The brave and earnest-hearted Alexander, who, by the sheer vigour of his straightforward, resolute character, had swiftly raised himself to the highest post of professional ambition, was early cut off, to the infinite regret of his brother officers and numerous friends. Who that knew him, as he stood at the door of his Malta hut, "in the front," by the side of the Woronzoff road, or ever accompanied him over the hospitals of the Light Division, of which he was so proud, can forget his manly bearing,