

NOTICES OF MEMOIRS.

NOTES ON SOME OF THE FOSSIL MAMMALS OF GREAT BRITAIN.

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[Being the substance of a discourse delivered at Apperley Court, the residence of Miss Strickland, to the members of the Malvern Naturalists' Field-club, June 30, 1868.]¹

I HAVE on more than one occasion directed the attention of the members of this society to the fossil remains of Mammalia found by the late Mr. Hugh Strickland in old Post-glacial river drifts of an ancient Avon, near the villages of Cropthorne, Bricklehampton, and Fladbury, all in the vicinity of Pershore, Worcestershire. The fossils in the collection at Apperley Court were carefully examined and named last January by Mr. Boyd Dawkins, the well-known comparative anatomist, and among them we find the remains of two species of elephant, *E. antiquus* and *E. primigenius*; the long haired rhinoceros, *R. tichorhinus*; many fine teeth and bones of a hippopotamus, *H. major*; the remains of two large extinct oxen, *Bos primigenius*, and *Bison prisus*; with many bones and horns of deer, *Cervus elaphus*; all of which were associated with fresh-water shells still living in the Avon, with the exception of the *Unio littoralis*, a *Unio* which is extinct in Great Britain, although still living in the rivers of France and Spain. It is now ascertained that this group of mammals lived in Great Britain during that period which is known to geologists as the Post-glacial period, a period which succeeded the intense cold of the long Glacial epoch. It must, however, be remembered that the term Post-glacial is rendered in contradistinction to the term Pre-glacial, which is applied to the period which preceded the Glacial epoch; and that it is not to be supposed that the Post-glacial animals existed after the age of glaciers had altogether ceased in Great Britain: for we now know that in Post-glacial times the climate was very severe, though gradually becoming more temperate. There is no greater mistake than to suppose that the term Post-glacial, either as applied to climate or animals, means that the age of glaciers, icebergs, and ice-drifts, or the age of mammoths and rhinoceri had ceased in Great Britain in the times when Post-glacial drifts containing extinct animals were deposited. A few notes, therefore, on some of the principal fossil mammals, and their range in geologic time, may not be uninteresting on the present occasion. Every one who takes any interest in geology knows that no remains of any fossil quadruped have hitherto been detected in the vast thickness of stratified deposits which constitute the mass of strata from the Laurentian to the Permian, inclusive, and which were deposited during the successive geological periods known as the Primary or Palæozoic periods. The older rocks up to the close of the Old Red or Devonian period are all the relics of marine strata,

¹ From the *Worcester Herald*, of July 11th and 18th, 1868.

in which the skeletons of land mammalia may have been very rarely preserved if mammals existed; but the same argument hardly applies to the Carboniferous strata, in which land reptiles, land shells, and land insects have been detected; and which afford evidence, at least during the deposition of the coal, of the proximity of land. No mammalia, however, have as yet been detected in any palæozoic rock.

After the Permian period had passed away a great thickness of strata known as the New Red or Triassic formation were laid down upon the submerged and depressed Palæozoic rocks, and as far as we can judge the New Red formations were deposited, at least in England, in lagoons or salt lakes. This may account for the precipitation of salt at the base of the Lower Keuper marls, as well as for the entire absence of marine shells and the paucity of animal remains of all kinds, with the exception of a few fish spines, the bones and footprints of a few reptiles, and the carapaces of some minute crustaceans (*Estheria*), very similar to allied species which inhabit salt lagoons at the present day. The Triassic rocks of England were however submerged, and are covered up conformably by the Rhætic series, which contain marine shells, a Bone-bed full of the triturated remains of reptiles and fish, and, what is more to our purpose in this paper, the teeth of a small mammal, called *Microlestes*. The teeth of this animal led Dr. Falconer to the conclusion that it was a plant-eating marsupial, such as is the existing kangaroo rat, many species of which feed on plants in the wilds and forests of Australia. At all events, up to the present time, the Upper Triassic rocks, which the Club visited to-day at Wainlode cliff, are the strata which have rendered to the researches of geologists the oldest known mammalian relic upon the face of the globe. The remains of this little animal have been found by Mr. Moore in Somersetshire, near Frome, and by Mr. Boyd Dawkins, near Watchet. It occurs also in the Trias of Germany. It is evident that both the Bone-bed in which the remains of this first known mammal were detected, and the Insect-limestone, made famous by the researches of my friend Mr. Brodie, were shore-deposits, and the Insect-limestone, with its thin layers of mud which preserve so beautifully the delicate forms of the soft bodies and wings of insects, is just the stratum where we should have expected to find the bones and teeth of land animals that strayed by the sea shores of the Triassic epoch. But it is not so. Deeper sea beds, with Nautili and cuttle-fish, gigantic marine reptiles, and fishes of the deep, cover up the Insect-limestone at the base of the Lias; and all the thickness of the Liassic rocks, with a large portion of the Lower Oolites, intervene between the burial-place of the little Triassic quadruped and the Stonesfield slate, which furnishes the remains of the next mammalian animals that are known to the geologists. Now mark the deficiency of the geological record! Unknown and unnumbered ages must have elapsed between the deposition of the Upper Trias and its imbedded *Microlestes*, and the deposition of the Stonesfield slate. The hills of the Cotteswolds are piled mass above mass between them, yet not a mammalian

relic do the intervening strata furnish. It is true that those strata were in all probability deposited at a considerable distance from land. Nevertheless we must feel assured that throughout all those periods which elapsed, during which the whole of the Lias and Inferior Oolite beds were deposited, Mammalia of some kind or other must have lived upon the neighbouring shores, but of which not a single fragment has yet been detected. The Stonesfield slate, which lies at the base of the Great Oolite, appears to be either a shore-deposit, or a shore-deposit broken up and redeposited in somewhat deeper water. It contains marine shells, fossil wood, with the impressions of ferns, cones, and other parts of land plants. The remains of insects are sometimes beautifully preserved, and no less than ten jaws of small quadrupeds belonging to three distinct genera have been found in these rocks. All of these animals are believed to have been *Marsupials*.

There are few persons who are not acquainted with the "Purbeck marble," which is so much used for shafts and columns in many of our old English cathedrals and churches. The Purbeck marble belongs to the uppermost division of the Oolite rocks, and is a freshwater limestone, containing freshwater shells and fishes. In the Purbeck series eight or nine genera and about fourteen or fifteen species of plant-eating, insectivorous, and predacious *Marsupials* have been found by Mr. Beckles and Mr. Brodie. Of one of these Mammalia, the *Plagiaulax*, the late Dr. Falconer says that "it may be regarded in the natural system as a marsupial form of rodent," and "may have had the volant habits of the flying *Plalangens*, and flitted from tree to tree among the Oolite forests by means of parachute-folds of their skin." (Falconer's Palæontological Memoirs, vol. ii. p. 425.) These Purbeck Mammalia lived in the same Oolitic period with the strange birds of Solenhofen, birds with tails like lizards (the *Archæopteryx*), and also with the gigantic reptiles that abounded in those days on the land and in the rivers and seas. Yet another change occurred, and we have a long lapse of time, during which all evidence of the existence of Mammals is again wanting. The seas of the Chalk period rolled their waves for ages above the tombs of the Purbeck Mammalia, and with the exception of some winged reptiles (*Pterodactyles*), and a few pieces of drift-wood, all the fossils of the Chalk indicate the existence over a large portion of our northern hemisphere of a wide open sea. During that long protracted epoch, the Secondary epoch, the northern hemisphere appears to have been occupied far more by sea than land, so that the Secondary rocks are, with one or two exceptions, solely the remains of sea-beds widely spread, and deposited in the course of long ages one above the other. With the exception of the freshwater strata of the Wealden and Purbeck beds, the great masses which constitute the Secondary rocks are all of marine origin. No sooner, however, do we examine the *Lower Tertiaries*, than we find evidences of the elevation of land throughout an area over which, during the antecedent period, there rolled the waves of a deep Cretaceous sea, and on this elevated land we know there lived numerous strange and extinct quadrupeds,

whose remains are mingled with the relics of extinct reptiles, plants, and shells.

It appears to me that the present school of geologists do not lay sufficient stress upon the gradual elevation of land throughout the northern hemisphere as connected with what I may term the igneous, volcanic, and earthquake forces after the close of the Secondary epoch; and which elevatory forces were destined in the course of unnumbered ages to elevate the sea-beds of the Secondary and the earlier Tertiary epochs on the flanks and even to the summits of the highest mountains in the world. The diminution of volcanic intensity over the portion of the globe we inhabit from the period of the New Red Sandstone up to the close of the Chalk period has not been sufficiently remarked upon; and it is most important to note that it is to the renewal of this volcanic activity and of earthquake movements that so much of the present physical geography of the northern hemisphere owes its origin.

The Eocene Epoch.—Eocene is the term invented by Sir Charles Lyell for the lowest and oldest of the Tertiary rocks which succeed the Secondary rock-masses in stratigraphical position, and in which the prototypes and progenitors of succeeding and existing Mammalia are first known to geologists. Eocene means the shadowing forth or the dawn of those animals whose modified successors in after Miocene, Pliocene, and Post-pliocene times, lived in thousands for long eras on ancient European lands. The points to which I would especially direct attention are the indications afforded by organic remains, by the shells, plants, and animals, of the climate of this part of the world during the Eocene epoch. Everywhere the evidence derivable from the study of the organic remains furnished by the Lower Tertiary Strata of the Continent and Great Britain, is in favour of the existence of a much higher temperature during Eocene times, than now attains in these temperate latitudes. The oldest known Tertiary quadruped is the *Arctocyon primævus* of the Lower Eocenes of Paris, an animal related to the bear, and the Kinkajou or Honey Bear of South America; while in the Lower Eocenes of England there are found the remains of animals which lived *before* that Middle Eocene period, when the great Nummulite formation of marine strata was deposited over a wide sea bed, the strata of which has since been elevated into the mountain chains of the Alps and Pyrenees, the Carpathians, and Himalayas. Many Lower Eocene animals lived and died on the banks of the great river that floated down the tropical fruits of the Isle of Sheppey, in Kent. Among them was the *Coryphodon*, a tapir-like animal, but twice the size of the American tapir, and like it, probably inhabiting densely wooded regions and the banks of rivers. Here also was the *Hyrcotherium* of Owen, an animal allied to the rhinoceros and hippopotamus, and whose representatives still linger in the *Hyrae* of the Cape, and the Syrian "coney." Here also are found the bones of *Lophodon*, an animal which was allied to and was of the size of the tapir, but which appears from its remarkable comparative anatomy to have had affinities connected with its

structure which led to the Rhinoceros on one hand, and to the *Palæotheres* on the other. It was probably the prototype of both. The strata of the Upper Eocenes consist, both in England and on the Continent, of a series of both marine and fresh-water strata. The assemblage of shells indicate a more temperate climate, and in the uppermost strata in France, which are probably of later date than the Upper Eocenes of England, the plants indicate distinctly a more temperate climate, as they resemble the vegetation on the borders of the Mediterranean. Still, plants of warm latitudes are associated with those of newer types, as we have the Fan Palm or Palmetto associated with the remains of fresh-water fish, crocodiles, and other reptiles. With regard to the Mammalia the history is most striking. More than fifty extinct species of quadrupeds have been found in rocks of this age in France alone, while many have been found in England. Among these the best known are the *Palæotheres* and *Anoplotheres*, the former being allied to the rhinoceros, the horse, and the tapir; and the latter exhibiting links between the tapirs and camels. With these and many other herbivorous animals there co-existed carnivorous quadrupeds which, says Professor Owen, "to judge by the character of their flesh-cutting teeth, were more fell and deadly than modern wolves and tigers." Not a single quadruped, as far as I know, lived on from the period of the Lower Eocene to that of the Upper Eocenes. New forms modified from the old forms succeed, and we learn that distinct groups of Mammalia lived and died out for ever during the Eocene epoch. (See Lyell's Elements, 6th Ed. 1865).

The Miocene Epoch.—As we ascend from the Lower Tertiary rocks to the Middle Tertiary strata we find evidences of a gradual change in the physical geography and the climate and temperature of this part of the globe, and also of the introduction of new species of animals and plants, and the dying out of the older forms of life; but the change was so gradual that it is most difficult to decide where to draw the line of separation between strata of the Eocene and Miocene epochs, and even now it is found necessary to draw lines of demarcation by the grouping of the fossil Mammalia rather than by the shells and other marine and fresh-water remains. In our English Lower Miocenes of the Isle of Wight remains have been found of the *Hypotamus*, an early representative of the hog family, extinct species of boar having been found in Germany, which appear to culminate in Post-pliocene deposits in the common wild boar (*Sus scrofa fossilis*). Seven species of *Hypotamus* are known. The *Cainotherium* (new beast) of the Lower Miocenes is a genus of quadrupeds distinct, yet allied to the Eocene *Anoplotheres*. A species of Rhinoceros (*R. incisivus*), makes its appearance for the first time in strata of this age. The coming in of new species and the dying out of old ones is well illustrated by the Mammalia of the Upper Miocene deposits. Professor Owen says, "Our knowledge of the progression of Mammalian life during the Miocene period teaches us that one or two of the generic forms most frequent in the older Tertiary strata still lingered

on the earth, but that the rest of the Eocene Mammalia had been superseded by new forms, some of which present characters intermediate between those of Eocene and those of Pliocene genera. The *Dinotherium* and narrow-toothed *Mastodon*, for example, diminish the interval between the *Lophiodon* and the elephant," (Owen's Pal., p. 343.) Dr. Falconer also shows how the great *Proboscidiæ* make their first appearance in the Upper Miocenes, and were represented in Europe by the great *Dinotherium* and *Mastodon*, and in India by three sub-genera of elephants. (Pal. Memoirs, Vol. II., p. 13). The *Dinotherium* was an aquatic animal like the hippopotamus, but allied to the tapir, and had large tusks like those of the walrus, but growing from the under jaw instead of the upper, as if for the purpose of rooting up water plants. The *Mastodons* were like the elephants, with the grinding teeth less complex in structure and "adapted for bruising coarser vegetable substances." (Owen). Four species inhabited Europe in Miocene times, one of which (*Mastodon angustidens*) has left its remains among the fossil pond-weeds of the ancient Swiss lake of Ceningen. The Pangolins of Africa, and the Manis of tropical Asia, which have now no living representative in Europe, were nevertheless represented in Germany in Miocene times by the *Macrotherium*, an edentate animal which Cuvier calculated must be 24 feet in length. The first evidence of the appearance of the deer-tribe dates from Upper Miocene times, and with these are associated the remains of the lion-like and sabre-toothed *Machairodi*, with species varying in size from that of a lion to the size of a leopard. These powerful carnivora have left their remains in the freshwater beds of Auvergne and of Eppelsheim, and their descendants lived on to Post-glacial times, their teeth having been found among those of the cave animals of Devonshire. Monkeys lived in Miocene days where now the lofty Pyrenees rise, and one of them, the *Dryopithecus* (tree-ape), equalled man in stature. Another, closely allied to the Gibbon, called *Pliopithecus*, has been also discovered in France, and a third, *Sennopithecus*, near Athens. Associated with this monkey were the remains of *Mastodon*, *Dinotheres*, *Hipparion*, *Antilopes*, and two *Giraffes*, the giraffe being now confined to the continent of Africa.

The Pliocene Period.—The Pliocene period is that in which there are more existing species of shells than there are of extinct species, and in the older strata of this age there are nearly as many shells of extinct species as there are of shells whose representatives are still in existence. The fossil mammalia of the Pliocene epoch are little known in England, but have been found in abundance in the continental strata of this age in France and Italy. They differ from those of Miocene times so far, that I believe there is not a single species of quadruped which is common to the Miocene and Pliocene strata of Auvergne. The Miocene genera of Auvergne became extinct before the Pliocene forms were buried in the tuffs, and below the Pliocene lavas, but of all the large assemblage of Pliocene quadrupeds determined by M. Pomel, only two genera, the *Mastodon* and a large genus of tiger, have become extinct. The *Mastodon* (*M.*

arvernensis) is common to the Red Crag of England and the Pliocene beds of Italy, but appears to have died out before the deposition of the Forest-bed of Cromer. A species of elephant (*E. meridionalis*) ranges from the older Pliocene times on to the days when it roamed in the Forest of Cromer on the old lands of Norfolk, and is a good example of the long range in time in which the large mammalia inhabited the earth.

Post-Pliocene Deposits.—We now pass upwards to the domain of existing species of shells, and to strata where no extinct species are known of marine shells. Sir Charles Lyell divides the Post-tertiary formations into two groups, the Post-pliocene and the Recent, a necessary division, for in the Post-pliocene formations many of the mammalia belong to extinct species, while the shells are identical with those now living; but in the Recent formations the mammalia, as well as the shells, are identical with existing species. The oldest of the Post-tertiary deposits is the celebrated Forest of Cromer bed, the remains of an old buried forest which has been traced for 40 miles, and which has been covered up by a series of strata, containing in some parts fresh-water shells and land plants, and animals which are themselves covered up by marine strata with marine shells, shewing that both the site of the Post-pliocene forest and the river silts were afterwards depressed beneath the sea. The shells, whether fluviatile or marine, are all of living species. The trees consist of the Scotch and spruce firs, yew, sloe, oak, alder, and birch, with the yellow and white water lilies, the buckbean, the hornwort, and other pond weeds. The fresh-water shells are such as now inhabit the rivers and ponds of England, but both the plants and the shells indicate that the climate when that ancient forest grew was temperate, but, perhaps, somewhat colder than at present. What strikes the geologist and naturalist most are the remains of the mammalia that are found in these beds. They contain the remains of three species of elephant, two species of rhinoceros, a hippopotamus, a gigantic extinct beaver, the great Irish elk (the *Megaceros*), several other kinds of deer, bears, the bison, and several marine mammalia, as the walrus and the narwhal. These great quadrupeds must have lived in abundance on the old forest land when the marine mammalia lived in the sea. But mark what follows. Over the extinct forest, and its extinct quadrupeds, its plants, and its shells, rests the Boulder-clay, the unerring, indubitable witness that the Forest of Cromer and its history was Pre-glacial, that is to say, the intense cold or maximum of the Glacial Epoch had not arrived when the animals lived and the trees and plants flourished; nor had the forest land been submerged beneath a Glacial ocean to receive above them the deposits of melting icebergs, and their deep covering of ice-borne till, and rocks.

The Pre-glacial Brick-earths of the Thames Valley.—It appears that certain strata known as the "Lower Brick-earths of the Thames Valley" are intermediate in time between the Pre-glacial Forest-bed of Cromer and the Glacial Boulder deposits, the mammalia forming a connecting link between the animals of the Forest-bed and those of Post-glacial times. One of the most notable of all

the phenomena that occurred during the Glacial epoch is the fact of the submergence of a great portion of the land of Pre-glacial Britain and Western Europe beneath the Glacial seas. The Forest-bed of Cromer was submerged, and the Glacial Boulder-clay rest above it; while certain old river deposits of the Thames Valley appear from the researches of Mr. Boyd Dawkins to belong to a somewhat later period, with a climate comparatively temperate, but colder than that of the Cromer Forest-bed (Quart. Journ. Geol. Soc., vol. xxiii.). Dr. Falconer in 1857 had been struck with the Pliocene assemblage of species in these Lower Brick-earths of the Thames Valley, and had inferred that they were of an earlier age than any part of the Till or Boulder-clay (Quart. Journ. Geol. Soc., vol. xiv., p. 83). It appears that these Thames Brick-earths are covered by a Glacial deposit of angular ice-borne *débris*, as is the Forest-bed by Boulder-clay. The mammalian relics are very abundant, and the assemblage of species found in the river gravels which underlie the Glacial *débris* have led Mr. Boyd Dawkins to draw some very important inferences and conclusions. Three species of elephants having an unequal range in time and space, and all extinct, have been found in these lower Brick-earth deposits. The *Elephas primigenius* (the mammoth) occurs in the Pre-glacial Forest-bed of Norfolk. This animal was well defended during the intense cold of the Glacial period by his long wool and hair, and its remains are most abundant in the Post-glacial strata of Europe and in the frozen gravels of Siberia and North America. *Elephas antiquus* lived in Pliocene times on the continent of Europe, is found abundantly in the Forest-bed of Cromer, and like the Mammoth, lived on to Post-glacial times, but not in such abundance. It is as remarkable, says Mr. Dawkins, for its southern range as the Mammoth is for its northern visitations. It appears "to be a Pliocene species that lived in great numbers in Britain, while the Pre-glacial deposits of the Norfolk shores were being formed, that was gradually supplanted by the Mammoth (*E. primigenius*), and was driven southward by the lowering of the temperature." *Elephas prisus* was a Pliocene species of Italy and Central France, which lived on to the Forest of Cromer period, and the later period of the Thames Brick-earths, but has not been found in Post-glacial strata. Three species of rhinoceros are found in the Brick-earths of the Thames valley but one (*R. megarhinus*), which is a Pliocene animal, and is found in the Forest-bed, does not ascend to the Post-glacial deposits, as do both *R. tichorhinus* and *R. leptorhinus*, which were more adapted to bear severe cold. *R. tichorhinus* was protected like the Mammoth by long wool and hair. The presence of *Elephas prisus* and *Rhinoceros megarhinus*, indicate, says Mr. Dawkins, the affinity of the group of Mammalia from the Brick-earths to those of the Pre-glacial Forest-bed, and to the continental Pliocene strata; but a still more important inference is derived from the absence of that Arctic group of animals which marks the drifts and gravels of Post-glacial times. If the climate of the maximum of the Glacial epoch was intensely cold, so was the climate

of the deposition of the Post-glacial river and sea drifts very severe, and gradually becoming temperate as we approach present times. The Post-glacial Arctic Mammalia, such as the Glutton, Lemming, Marmot, Musk Sheep, Elk, and Reindeer, are altogether wanting in the Brick-earths of the Thames. Now it is the presence of these animals that marks the Post-glacial deposits most especially.

The Glacial Epoch.—The next step carries us to the Glacial epoch, the commencement of which was immensely anterior to the deposition of our valley drifts and Cave-deposits. Those who choose to take the trouble to follow out the reasoning and proofs adduced by Sir Charles Lyell will best appreciate the overwhelming evidence he brings to bear on the oscillations during the Glacial epoch, the submergence of continents, and the conversion of continents into islands; and, again, in after periods, the reconversion of sea beds into islands and continents. It was probably during the period of this great gradual submergence that inch by inch, and little by little, some of the great Mammalia of the Pre-glacial continental period were, with the plants and shells, driven southward, and that thousands perished, leaving their skeletons in the frozen drifts of Siberia and the ice-caverns of the far north. It is a problem to be yet solved, whether or not the Mammoth and Rhinoceros of Siberia were all Pre-glacial inhabitants of those arctic regions, whose descendants migrated southwards, and thus the species were preserved in temperate latitudes until Post-glacial times. It is difficult to believe that those animals lived in Siberia in Post-glacial times, for there is little doubt that great cold existed in temperate Europe for long ages after the land had assumed much the same contour which it now possesses. It is not, however, my intention to day, to do more than allude to the Glacial epoch, or the effect of that long era of cold on the northern hemisphere. What I wish to do is to impress upon my hearers the fact that the maximum of intense cold did not arrive suddenly, or as a catastrophic change, but approached gradually; and was brought about by physical changes of sea and land, by the elevation of highlands within the Arctic circle, and, possibly, by astronomical causes assisting; also that these causes were in operation and had commenced in later Tertiary times. There have been few discoveries of late which have so much interested geologists as the discovery of the fact, through the investigation of Professor Heer and other botanists, that during the Miocene epoch a rich flora grew within the arctic zone, in latitudes where now only a vast sheet of ice and snow extends. One hundred and sixty-two species of flowering plants, forest trees, ferns, and cryptogamous plants have been determined, of which no less than 128 species of woody plants alone once flourished in the now icy north; while during the same period we know that in England there flourished, in the neighbourhood of Exeter, cinnamons, vines, figs, laurels, and gigantic Wellingtonias, with tree ferns and other plants, indicating a warm temperature. And to these points I would especially direct attention. The difference of latitude was marked distinctly in Miocene times by

the difference between the flowers and trees which grew in the Arctic zone and those that grew on the sites of what is now Devonshire and the Isle of Wight. The latter were more tropical in character. And now we return once more to the Pre-glacial and Post-glacial epochs. The Pre-glacial plants in the Forest-bed of Norfolk, which are found associated with the numerous fossil Mammalia I have already alluded to, are plants that indicate a somewhat colder climate than now exists in Norfolk, as is shown by the presence of Scotch and spruce firs, northern firs which are not now indigenous to Norfolk. In Pre-glacial times we have evidence of the climate being colder than at present, and far colder than in Tertiary days. The Glacial epoch proper succeeds, and this term, "Glacial epoch," should be understood to apply to those unnumbered ages when the cold stole gradually on over-Pre-glacial lands and continents, and drove the Mammoth from the frozen North, and wrapped Northern and temperate Europe and the British Isles with snow, and ice, and glaciers, as North Greenland is covered now; also to that later period when much of Northern Europe and the British Isles were submerged beneath the waves of a Glacial sea. The term Post-glacial may apply to those subsequent periods when the present lands re-emerged from the sea, and when, though great cold was still prevalent, and glaciers swept down from every mountain in Wales and Scotland, the climate was ameliorating, and a more temperate change was gradually coming on, until the floating iceberg vanished from the British seas, the glacier melted from the heights of Snowdon, Ben Nevis, and Carran Tual, and the Arctic plants died out among the vales of England to linger only among her mountain tops. But it was before this change from Glacial times that the animals of the Apperley collection lived and died, and left their bones to tell us of their history among the old river-beds and sea-side caves of ancient England. Little by little we gather the fragments of the past, and the geologist, the botanist, and the comparative anatomist, labour to bring the fragments together, and to restore, with some degree of accuracy, the records of the men, the animals, the plants, and the climate of Europe, which in Post-glacial times preceded our own. And what are those records? Why that in Post-glacial times, when the land of Great Britain was fashioned much as it is now, and the hills rose, and the vales swept down, and the rivers flowed as you now behold them, bitter cold still lingered. The winter's snow and ice filled every valley, the sea-straits were frozen more than half the year round, and the long-haired elephant and rhinoceros, with the musk-ox, the bison, and the elk, roamed over the ice from France and Germany to the downs of Salisbury and Malvern, and along the banks of a frozen Avon, Severn, and Wye. And the hunter man was with them, for, entombed in the old drifts which were deposited by melting ice and snow, or swept down by ice-traversed rivers, or gathered together in caves no longer washed by torrential streams, we find the bones, weapons, and even the ornaments of the rude race which feasted on the mammoth, the

rhinoceros, and the bear; and we know that man's intellect was there, for sometimes we find graven the shapes of those extinct mammalia, and graven upon their old bones, to tell us gatherers of these dimly-preserved records that, long ages ago, a representative of God's noblest creature, at least on this planet, lived, and not only lived but reasoned.

REVIEWS.

I.—PALEONTOLOGICAL MEMOIRS AND NOTES OF THE LATE HUGH FALCONER, A.M., M.D., V.P.R.S., For. Sec. G.S., etc., etc., with a Biographical Sketch of the author. Compiled and edited by CHARLES MURCHISON, M.D., F.R.S., etc. Vol. I., Fauna Antiqua Sivalensis, pp. 590, 34 plates. Vol. II., Mastodon, Elephant, Rhinoceros, Ossiferous Caves, Primeval Man and his Cotemporaries, pp. 675, 38 plates. 8vo. London: Robert Hardwicke, 1868.

THE severest test of friendship is death. Happy is that man, who, after death, shall be borne in kindly remembrance by the friends and comrades of past years. Yet, of these, who would be found willing and able to turn aside from his own pursuits and engage in the task of raising—not a subscription for a bust or statue—but a colossal literary monument to the memory of his departed friend? To the late Dr. Hugh Falconer's memory both these tributes of friendship have been fully paid. Looking back over the three years and a half that have passed away since his death, we recall numerous instances of the way in which his memory lives among us still, and for a literary monument, which will outlast our brief remembrance, the book before us attests both the sterling worth of Falconer's labours, and of Dr. Murchison's friendship.

Volume I. commences with a biographical notice of Dr. Falconer. The sketch of such a life cannot be read without exciting an interest, not only in the man, but in the pursuits to which he devoted his best energies, and may serve as a stimulus to others.

If not already printed as a separate pamphlet, we would suggest to the editor that copies might be so prepared and given away to our public schools and elsewhere with the best results. For if, as Longfellow writes:—

“Lives of great men all remind us
We can make our lives sublime,
And departing leave behind us
Footprints on the sands of time”—

certainly it may be said of Falconer that he has left behind an example of energetic work and earnest labour in science that many may do well to imitate.

No better illustration can be cited of the way in which Falconer overcame difficulties than that mentioned by Lyell in his address in 1837, on presenting him with the Wollaston Gold Medal of the Geological Society of London (given that year in duplicate to Capt. Cautley and Dr. Falconer). When they failed to obtain Cuvier's works they made for themselves a Museum of Comparative Anatomy,