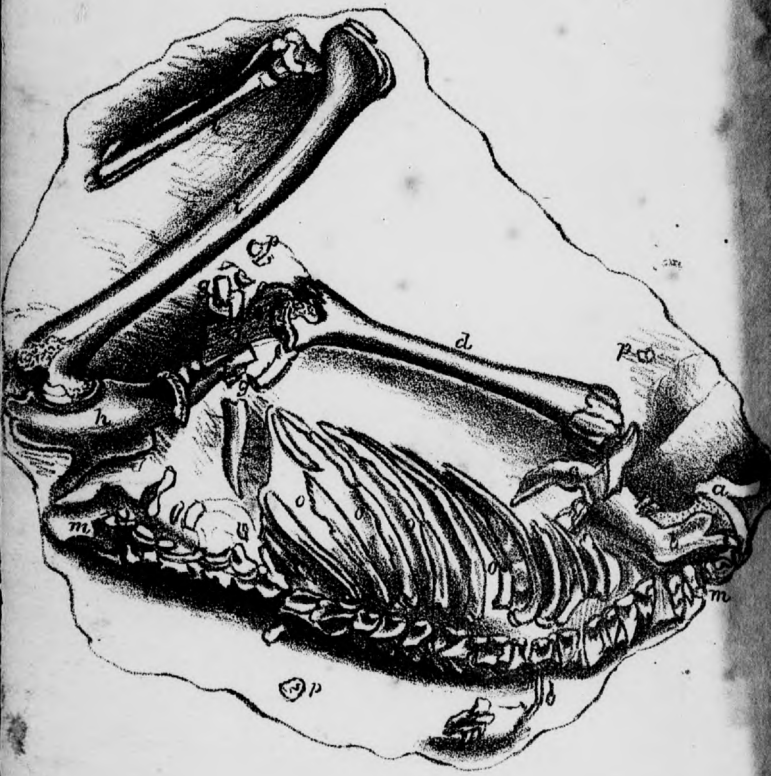
Fig. 1.



Human skeleton,
found in the Travertine at Guadeloupe.

A

DISCOURSE

ON THE

REVOLUTIONS OF THE SURFACE

OF

THE GLOBE,

AND THE

CHANGES THEREBY PRODUCED IN THE ANIMAL KINGDOM.

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Translated from the French,

WITH ILLUSTRATIONS AND A GLOSSARY.

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EXPLANATION OF THE ENGRAVINGS.

Figure 1.

A Human Skeleton incrusted in the travertine of Guadeloupe. It is on the right side, the skull and left leg raised.

a The left zygoma.
b The lower jaw.
c Anterior portion of the omoplate.
d The shoulder-bone.
e Part of the cubitus.
f Part of the radius.
gg Some of the wrist and finger-bones.
h Left os innominatum mutilated.
i The thigh-bone.
k The leg.
l The peroneum.
mm The spine.
ooo The ribs.
ppp Shells incrusted in the rock.

N. B.—There is a skeleton of the same kind at the British Museum.

Figure 2.

The upper jaw, palate and teeth, in fine preservation, of the Anoplotherium Leporinum, found in the plaster of Paris quaries of Montmartre; two-thirds of the real size.

Figure 3 *and* 4.

Two jaws from the plaster of Paris quarry of Montmartre, containing a portion of the Skeleton of a Bat, the first discovered in these quarries. Fig. 3, represents the back, in which are seen the relics of the omoplates, head, humerus and radius cut longitudinally, with a small part of the clavicules. Fig. 4, the under part, in which are the lower jaw teeth, portions of the vertebræ, clavicules, humerus and radius, cut longitudinally.

Figure 5 *and* 6.

One side of the lower jaw of the narrow-toothed Mastodon, found in the estate of M. le Comte de Breuner. It is here drawn rather more than a thirteenth of its real size.

Figure 7.

Skeleton of the Ibis.

Figure 8.

The Numenius Ibis. Letters *a b c* refer to the variations of the feathers alluded to in the work.

Figure 9.

An outline of the Ibis, drawn from an Egyptian monument.

Figure 10.

A beak of a mummy Ibis, discovered by M. Olivier.

A

DISCOURSE

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REVOLUTIONS OF THE SURFACE OF THE GLOBE,

AND THE CHANGES THEREBY PRODUCED IN THE ANIMAL KINGDOM.

In my work on Fossil Remains, I proposed to determine to what animals those fragments of bones should be assigned which occupy the superficial strata of the globe. It was attempting to traverse the whole of a region of which as yet the first approaches were scarcely known. An antiquary of a new stamp, it was necessary at the same time to restore these monuments of past revolutions, and to detect their meaning: I had to collect and arrange in their original order the component relics; to remodel the creatures to whom the fragments belonged; to reproduce them in their just proportions and with their proper characteristics; and then to compare them with those beings now existing:—an art almost unknown, and which implies a science scarcely before even glanced at,—that of the laws which preside

at the coexistence of the forms of the various parts of organized beings. For such an attempt it was necessary to prepare myself by long and indefatigable researches into the structure of living animals; by a survey of nearly the whole mass of created beings now existing, which alone could lead me to a certain and determinate result in my speculations on the ancient creation: this would at the same time afford me a great result of rules, and affinities not less useful, and the whole animal kingdom would thus, in some measure, become subjected to new laws, resulting from this essay on a small portion of the theory of the earth.

I was supported in my twofold labours by the interest which it seemed to evince both for anatomy, the essential basis of all those sciences which treat of organized bodies; and for the physical history of the globe, the foundation of mineralogy, of geography, and, we may say, of the history of man, and of all which it most imports him to know in relation to himself.

If we are interested in tracing out the nearly effaced vestiges of the infancy of our species, in so many nations utterly extinct, why should we not seek to discover, in the obscurity which envelopes the infancy of the earth, relics of revolutions long anterior to the existence of all nations? We admire that power of the human mind, the exercise of which has enabled us to ascertain those motions of the planets, which Nature seemed for ever to have held from us; genius and science have soared beyond the limits of space; some observations, developed by reason, have detected the mechanism of the world. Would it not be some renown for a man, in like manner, to penetrate beyond the limits of time, and to discover, by research and reflection, the his-

tory of this world, and of a succession of events which preceded the birth of the human race?

Astronomers have advanced in science more rapidly than naturalists; and the present state of the theory of the earth somewhat resembles that of the period when certain philosophers believed heaven to be formed of polished freestone, and the moon in size like the Peloponnesus; but, after Anaxagoras, have arisen Copernicus and Kepler, who paved the way for a Newton; and why should not natural history one day boast also of her Newton?

PLAN.

It is the plan and result of my labours on fossil bones, which I particularly intend to lay before you in this discourse: I shall also attempt to trace a rapid sketch of the means employed down to the present time to discover the history of the revolutions of the globe. The facts which I have been enabled to arrive at form certainly but a very small portion of those of which doubtlessly this history of antiquity was composed; but many of them lead to decisive results, and the severe method which I have exercised in deciding on them, gives me reason to believe that they may be received as assured data, and will constitute an epoch in the science. I trust their novelty will be my excuse, if I ask for them the undivided attention of my readers.

My first object will be to show the relation between the history of fossil bones of terrestrial animals, and the theory of the earth, and the motives which in this respect give it a peculiar importance. I shall then unfold the principles of deciding on these bones, or in other words, of ascertaining a

genus, and distinguishing a species, by a single fragment of bone; an art on the certainty of which rests that of the whole of my labours. I shall slightly notice new species and genera formerly unknown, which I have discovered by the application of these principles, as well as the different kinds of earth which contain them; and, as the difference between these species and those of the present day is confined to certain limits, I shall show that these limits much exceed those which at present distinguish the varieties of the same species. I shall make known how these varieties are limited, either by the influence of time, climate, or domesticity. I shall thus be enabled to conclude, and enable my readers to arrive at a similar conclusion, that there must have been remarkable events to have effected the great differences that I have detected. I shall detail the peculiar modification which my researches have enabled me to introduce into the opinions at present entertained respecting the revolutions of the globe; and finally, I shall examine how far the civil and religious history of nations agree with the results of my observations on the physical history of the earth, and with the probabilities which these observations give rise to concerning the period when human societies found fixed dwellings and fields capable of cultivation; and when, consequently, they received a settled permanent form.

FIRST APPEARANCE OF THE EARTH.

When the traveller passes over those fertile plains where the peaceful waters preserve, by their regular course, an abundant vegetation, and the soil of which, crowded by an extensive population, en-

riched by flourishing villages, vast cities, and splended monuments, is never disturbed but by the ravages of war, or the oppression of despotism, he is not inclined to believe that nature has there had her intestine war; and that the surface of the globe has been overthrown by revolutions and catastrophes; but his opinions change as he begins to penetrate into that soil at present so peaceful, or as he ascends the hills which bound the plain; they extend as it were with the prospect, they begin to comprehend the extent and grandeur of those events of ages past as soon as he ascends that more elevated chains of which these hills form the base, or, in following the beds of those torrents which descend from these chains, he penetrates into their interior.

FIRST PROOFS OF REVOLUTIONS.

The strata of the earth, the lowest and most level, only show, even when penetrated to very great depths, horizontal layers of matter more or less varied, which contain countless marine productions. Similar layers and similar productions form the hills to very considerable heights. Sometimes the shells are so numerous that they form by themselves the entire soil; they are found at heights greatly above the level of the sea, and where at the present day no sea could reach from existing causes; they are not only imbedded in light sand, but the hardest stones often incrust them and are everywhere penetrated by them. Every part of the world, both hemispheres, all the continents, all the islands of any extent, afford the same phenomenon. The time is past when ignorance could assert that these relics of organic bodies were but freaks of nature, pro-

ductions engendered in the bosom of the earth by its innate creative power; and the efforts of metaphysicians will not suffice to establish such assertions. A minute investigation of the formation of these deposites, of their contexture, even of their chemical composition, does not detect the least difference between the fossil shells and those produced from the sea; their conformation is not less perfect; we do not observe either the marks of friction or fracture, evincing violent removal; the smallest of them preserve their most delicate parts, their finest points, their most minute indications; thus they have not only lived in the sea, but have been deposited by the sea; the sea has left them in the places where they are found; but the sea has for a time remained in these places, it has remained there sufficiently long and undisturbedly to be enabled to form those deposites so regular, so thick, so extensive, and so solid, which compose these layers of aquatic animals. The basis of the sea has then experienced a change either in extent or situation. What a result from the first examination, and the most superficial observation!

The traces of revolutions become more striking when we ascend higher, when we approach closer to the foot of the great chains of mountains.

There are besides banks of shells; we remark them of great thickness and solidity; the shells are there equally numerous, equally well preserved, but they are not the same species; the layers which contain them are no longer generally horizontal; they lie obliquely, sometimes nearly perpendicular; instead of digging deeply, as in the plains and broad hills, to ascertain the order of the banks, we here have them side-ways, in following the valleys formed by the convulsions which have rent them asunder; im-

mense masses of their remains constitute at the foot of their pinnacles heavy mounds, the height of which is increased by every thaw and every storm.

And these upright (redressés) banks, which form the crests of the secondary mountains, are not placed on the horizontal banks of the hills which form their lower ascents; on the contrary, they are sunk beneath them. These hills rest on their declivities. When the horizontal layers in the vicinity of these mountains with oblique strata, are laid open, we again find the layers oblique in the excavation; sometimes even when the oblique layers are not very much elevated, their summit is crowned with horizontal layers. The oblique layers are then more ancient than the horizontal layers; and as it is impossible, at least with regard to the greater number, that they were originally formed horizontally, it is evident that they have been lifted up; that they have been so before the others were deposited on them.(1)

Thus the sea, previously to the formation of horizontal layers, had formed others which certain causes had broken up, formed again, again destroyed in a thousand ways; and, as many of these oblique banks which it had first formed, are loftier than those horizontal layers which have succeeded them, and which environ them, the causes which have given this obliquity to these banks have also forced them above the level of the sea, and formed them

(1) The idea supported by some geologists, that certain layers have been formed in the oblique position in which we now find them, in supposing it true with respect to some that are crystallized, as Mr. Greenhough says, in the same manner as a deposite incrusts the inside of all vessels in which gypseous waters are boiled; it cannot be applied to those which contain shells or round stones which could not remain thus suspended, awaiting the formation of the cement which was necessary to conglomerate them.

into islands, or at least into rocks and inequalities, whether elevated at one end, or that the sinking of the other end had thrown off the waters; a second result not less clear, nor less apparent than the former to any one who will give himself the trouble to study the monuments which authenticate this fact.

PROOFS THAT THESE REVOLUTIONS HAVE BEEN NUMEROUS.

But the revolutions and changes which have left the earth as we now find it, are not confined to the overthrow of the ancient layers, to this retreat of the sea after the formation of new layers.

When we compare in detail the various layers one with another, and the productions of nature which they comprise, we soon discover that this ancient sea has not always deposited stones exactly similar, nor the remains of animals of the same species, and that each of its deposites has not extended over the whole surface that it has covered. There have been successive variations there established, the first of which has been in a great measure general, and the others appear to be less so. The more ancient the layers are, the greater their uniformity and extent; the more recent, the more limited and more subject are they to vary at short distances. Thus the displacing of the layers was accompanied and followed by alterations in the nature of the liquid and the materials which it held in solution: and when certain layers, raising themselves above the waters, had divided the surface of the sea into islands by projecting chains, there must have been various changes in many particular basins.

We must perceive that in the midst of such changes in the nature of the liquid, the animals which it nourished could not remain the same. The species, their very genus, changed with the layers; and, although at short intervals we may meet with a recurrence of similar species, it is correct to say, in a general sense, that the shells of the ancient layers have their peculiar shapes, which are gradually lost, and not found again in recent layers, still less in the sea itself, where we never detect analagous species, nor are many of the species itself found; that the shells of recent layers, on the contrary, resemble in genus those still to be found in our seas, and that in the most recent and most shifting of these layers, and in certain lakes and more limited deposites, there are some species which the most practised eye cannot distinguish from those to be found on neighbouring coasts.

There has been in animal nature a succession of changes which has been occasioned by those of the liquid in which the animals lived, or which at least have had relation to them, and these variations have gradually brought the classes of aquatic animals to their present state: in fact, when the sea finally quitted the continent, its inhabitants differed but very little from those which it now produces.

We say, *finally quitted*, because if we scrutinize with the most exact care these relics of organic beings, and discover amidst marine layers, even the most ancient, layers composed of animal or vegetable productions of the earth and soft water; and amongst the most recent layers, that is the most superficial, we shall find those in which terrestrial animals are buried beneath masses of marine productions. Thus the various catastrophes which have shaken the layers have not only produced by de-

grees from the bosom of the waters the different portions of our continents, and lessened the basin of the sea; but the basin has been displaced in many ways. It has often happened that lands left dry by the retiring of the waters have been again overflowed by that element, whether they have been cast down, or the waters have only flowed over them; and as to the soil left dry by the sea at its last retreat, which man and terrestrial animals now inhabit, it had been already left dry once before, and then nourished quadrupeds, birds, plants, and every kind of terrestrial productions; the sea which has left it had formerly covered it. The changes in the height of the waters have not arisen solely from a retiring, more or less gradual or general; it has proceeded from divers overflowings and divers retirings, the final result of which has been a universal sinking of the level.

PROOFS THAT THE REVOLUTIONS HAVE BEEN SUDDEN.

But, it is of great importance to note that these repeated irruptions and retreats have not all been gradual, not all uniform; on the contrary, the greater portion of these catastrophes have been sudden; and that is easily proved by the last of these events, that which by a twofold action inundated, and then left dry, our present continent, or at least a great portion of the soil which now composes them. It also left, in the northern countries, carcasses of large quadrupeds frozen in the ice, and which have been preserved down to the present period with their skin, their hair and their flesh. If they had not

been frozen as soon as killed, putrefaction would have decomposed them. And besides, this eternal frost did not previously exist in those parts in which they were frozen, for they could not have existed in such a temperature. The same instant that these animals were bereft of life, the country which they inhabited became frozen. This event was sudden, momentary, without gradation; and what is so clearly proved as to this last catastrophe, equally applies to that which preceded it. The convulsions, the alterations, the reversings of the most ancient layers, leave not a doubt on the mind but that sudden and violent causes reduced them to their present state; and even the powerful action of the mass of waters is proved by the accumulation of relics and round flints which in many places intervene between the solid layers. Existence has thus been often troubled on this earth by appalling events. Living creatures without number have fallen victims to these catastrophes: some, the inhabitants of dry land, have been swallowed up by a deluge; others, who peopled the depths of the waters, have been cast on land by the sudden receding of the waters, their very race become extinct, and only a few remains left of them in the world, scarcely recognised by the naturalist.

These are the consequences to which the subjects which meet us at every step, and which we may find in almost every clime, necessarily conduct us. These overpowering and stupendous events are clearly imprinted everywhere, and are legible to the eye that knows how to trace their history in the monuments they have left. But what is yet more remarkable and no less certain, is, that life has not always existed on the globe, and that it is easy

for the observer to discover the precise point whence it began to deposite its productions.

PROOFS THAT THERE HAVE BEEN REVOLUTIONS ANTERIOR TO THE EXISTENCE OF LIVING BEINGS.

Let us ascend, let us mount the lofty mountain tops, the steep summits of the great chains, soon these relics of marine animals, these numberless shells will become more and more rare, and finally disappear; we shall reach layers of a different nature, which contain no vestige of a living being. They will however show by their crystallization and even their stratification, that they were originally formed in a liquid state; by their oblique situation, their steepness, that they have been overthrown; by the manner in which they bury themselves obliquely under the layers of shells, that they were formed before them; finally, by the elevation with which their jagged and naked tops rise above all these layers of shells, that these summits were already above the level of the waters when these shelly layers were formed.

Such are those famous primitive or primordial mountains which traverse our continents in different directions; elevated above the clouds, separating the beds of rivers; they hold in their perpetual snows the reservoirs which feed the sources, and in a manner form the skeleton or vast frame-work of the earth.

From a vast distance the eye perceives by the indentions with which their crests are marked, in the sharp points which form their summits, signs of the violent manner of their formation: far different from

those conical mountains, those hills with long broad surfaces, in which the recent mass has remained since the period when it was quietly deposited by the latest receding of the seas.

These signs become more manifest in proportion as we contemplate them nearer.

The valleys have no longer sides with gradual declivities, those projecting angles, intersecting each other, which seem to have been the beds of some ancient currents: they expand and contract without regularity; their waters sometimes spread out into lakes, sometimes are precipitated in torrents, sometimes their rocks, suddenly approximating, form transverse clefts, whence the waters fall in cataracts. The disturbed layers on the one side exposing their edge to the summit, present on the other large and oblique portions of their surface. They do not correspond in height, but that which on the one side forms the peak of the steep height, is buried on the other side, and does not reappear.

However, in the midst of all this disorder, great naturalists have arrived at the conclusion that there is a certain arrangement, and that these immense banks, broken and misplaced as they are, yet have a systematic order, which is nearly the same in all great chains. The granite, they say, of which the greater portion of the summits of the chains are composed, the granite which protrudes beyond all, is also the stone which is buried under all others, it is the most ancient of those which we are enabled to see in the place assigned to it by nature, whether it owe its origin to that universal liquid which formerly held all bodies in solution, or that it was originally the first body consolidated by the sudden cooling of a vast mass in a state of fusion or even

of evaporation. (1) Rocks repose on their sides, and form the lateral crests of these vast chains; rocks of schist, porphyry, freestone, and talc, mingle in layers; then coarse marble, and other calcareous substances without shells, resting on the schistus, form the exterior crests, the lower divisions, the supporters of these chains, and are the last work by which this unknown liquid, this sea without inhabitants, seemed to congregate materials wherewith to form mollusca and zoophytes, which would soon deposite on these foundations immense masses of their shells or corals. We even see the first productions of these mollusca, of these zoophytes, showing themselves in small numbers, at intervals, amongst the latest layers of these primitive earths, or in that portion of the superfices of the globe which geologists have termed transition rocks. We meet here and there with layers of shells interposing between some granites more recent than others, amongst divers schists and amongst some later deposites of the coarse marble; life which sought to possess itself of this globe, seems in these early periods to have struggled against the inert nature which first predominated; it was a long time ere it entirely gained the mastery it contended for, and appropriated to itself the right of continuing and raising the solid coating of the earth.

Thus it is undeniable, that the masses which now form our highest mountains were originally in a state of liquefaction; for a long time they were

(1) The conjecture of M. le Marquis de Leplace, that the materials which constitute this globe were originally in an elastic form, and then in cooling assumed a liquid consistency, and finally became solid, is greatly strengthened by the late experiments of M. Mitcherlich, who composed and crystallized by the heat of intense furnaces many of the mineralogical species which enter into the composition of primitive mountains.

covered by waters which did not then nourish living bodies; it was not only after the appearance of vitality that important changes took place in the nature of the deposited matter; the masses formed before have changed, as well as those subsequently produced; they have even undergone violent changes in their situation, and a portion of these changes took place when these masses alone were existing, and were not covered by layers of shells. The proof is evident in the overthrows, in the dislocations, the rents, which we perceive in the layers, as well as in the posterior layers of earth, which are even more numerous and more strongly marked.

But these primitive masses have experienced other revolutions, subsequently to the formation of these secondary layers of earth, and have perhaps occasioned, or at least shared, some of those changes which these layers themselves have undergone. There are indeed considerable portions of these primitive layers exposed, although in situations even lower than those of secondary layers; if they had not been exposed by subsequent convulsions, the latter would have concealed them. Vast and various blocks of primitive substances are found scattered, in particular countries, over the secondary layers, separated by deep valleys, or even arms of the sea, from the summits of crests whence they must have come. They have been either thrown there by eruption, or the depths which would have arrested their progress did not exist at the period of their removal, or else the fury of the waters which conveyed them there exceeded in violence any thing that we can imagine from our own experience.(1)

(1) The travels of Saussure and Deluc present us with a multitude of these facts; and these geologists have judged that they

Here then is a combination of facts, a series of epochs anterior to the present, the order of which can be infallibly verified, although the period of their intervals cannot be precisely defined. They

could only have been effected by surprising eruptions. MM. de Buch and Escher have employed themselves on this subject more recently. The memoir of the latter, inserted in 'La Nouvelle Alpina de Steinmuller,' vol. i., details the whole in a remarkable manner, of which this is the summary:—Those blocks which are scattered in the lowlands of Switzerland or Lombardy came from the Alps, and have descended along the valleys. They are in all parts and of all dimensions, even to fifty thousand cubic feet, in the great extent which separates the Alps from Mount Jura, and they are found on the declivities of Jura which front the Alps to the height of four thousand feet above the level of the sea; they are on the surface or in the superficial layers of remains, but not in those of freestone, or pudding stone, which may occupy nearly the whole space in question; they are sometimes found perfectly isolated, sometimes in masses: the height of their situation has no relation to the size, only that the smaller appear sometimes a little worn, but the larger not at all so. Those which form the bed of any river are found, on examination, of the same kind as the mountains of the peaks or sides of the high valleys, whence arise the sources of these rivers; we observe them in the valleys, and they are found accumulated especially in those places where they are narrowest; they have passed over defiles when they have not exceeded four thousand feet; and then we see them on the other sides of the summits in the cantons between the Alps and Jura and on Jura itself; it is opposite the openings of the valleys of the Alps that they are seen of greatest size and in greatest numbers; those in the space between are carried less high: in the chains of Jura, the most distant from the Alps, they are only found in places exactly opposite to the openings of the nearest chains.

From these facts, the author draws this conclusion, that the conveyance of the blocks took place subsequently to the deposites of freestone and pudding stone: that it was probably effected at the last revolution of this globe. He compares their removal to that which still occurs amongst the torrents; but the objection of the vastness of the blocks, and that of the depth of the intervening valleys, seem to us to offer a powerful opposition to this part of his hypothesis.

are so many points which serve as rules and directions in the ancient chronology.

EXAMINATION OF THE CAUSES WHICH OPERATE AT PRESENT ON THE SURFACE OF THE GLOBE.

Let us now examine what is at present operating on the habitable globe; let us analyse the causes which still affect its surface, and let us determine the possible extent of their effects. It is a portion of the history of the earth so much the more important, as we have long thought we could explain anterior revolutions by existing causes; as in political history we easily unfold past events, when we are well acquainted with the systems and intrigues of our own times. But unfortunately we shall find that this is not the case with physical history; the thread of the operations is broken; the march of nature is changed; and not one of her agents now at work would have sufficed to have affected her ancient works.

There are now existing four active causes which contribute to alter the suface of our continents: the rains and thaws which lower our lofty mountains, and cast their relics at their feet; the flowing waters, which carry away their remains, and leave them in places where they retard their currents; the sea, which saps the base of the lofty coasts, and which forms the beach on which it casts the sand hills; and finally, the volcanoes, which perforate the solid layers, and elevate or scatter on the surface the masses which they vomit forth.(1)

(1) See, on the changes of the earth's surface, known from history or tradition, and consequently attributable to known

THE FALLING AWAY OF PORTIONS OF THE MASSES.

Every where, where the broken layers present their edge on the ruggid fronts, there falls at their base every spring, and even at every storm, fragments of their component parts, which become round by rolling one on the other, and which in a mass, assume a determined inclination, conformably with the laws of cohesion, thus forming, at the foot of the height, a ridge more or less elevated, according as the fall of the materials be more or less abundant; these ridges form the sides of the valleys in all the high mountains, and are covered with rich vegetation when the falling away of the upper parts becomes less frequent; but their want of solidity renders them liable to slip themselves, when they are undermined by streams; and it is then that cities, rich and thickly populated districts are overwhelmed by the slipping of a mountain; that the course of rivers is interrupted; and that lakes are formed on spots once fertile and luxuriant. But fortunately these slips occur but seldom, and the principal influence of these accumulated hills is to supply materials for the ravages of the torrents.

ALLUVIAL DEPOSITES.

The waters which fall on the peaks and summits of mountains, the condensed vapours, or the liquified snows, descend along their declivities by innumerable channels; they collect in their progress some

causes, the German work of M. de Hof, in 2 vols. 8vo. The collection of facts is gathered with as much care as learning.

particles, and trace light furrows in their passage. These channels soon unite in the deepest cavities which are indented in the mountain's side; they glide along the deepened valleys which are formed at the foot, and proceed thus to produce those rivers and streams which return to the sea those waters which had been previously imbibed from it by the atmosphere. At the melting of the snows, or when a storm arises, the mass of these mountainous waters suddenly increases, and precipitates itself with a rapidity proportional to the slope of the declivity. Dashing with violence against the foot of those ridges which cover the sides of all the lofty valleys, the torrents carry with them the rounded fragments of which they are composed; they rub and polish them in their passage; but in proportion as they arrive in the closer valleys where their fall is lessened, or in large basins where they can spread themselves, they cast on the beach the largest of these stones which they have thus rounded; the lesser are deposited lower, and nothing reaches the main channel of the river but the smallest particles, or a scarcely perceptible slime. The course of these waters, before they form the larger and lower stream, is often through an extensive and deep lake, in which they deposite their mud, and emerge perfectly pure. But the lower rivers, and all the streams which arise in the lower mountains or hills, also produce, in the soils through which they run, effects more or less analogous to those of the torrents of the lofty mountains. When they are swollen by heavy rains, they assail the foot of the clayey or sandy hills which oppose them in their progress, and carry portions of them into the lower lands which they overflow, and which each inundation thus tends to elevate to a

certain extent; and when these rivers reach the extensive lakes of the sea, and that rapidity which carried with it the particles of mud suddenly ceases, these particles are left at the sides of the mouth: they finally form lands which extend the coast; and if it be a coast where the sea also deposites her sand, and contributes to this accumulation, it produces in this way provinces, whole kingdoms; usually the most fertile, and soon the richest in the world, if their governors will allow industry to use its efforts without interruption.

DOWNS.

The effects of the sea without the co-operation of these inland rivers are less productive. When the coast is flat and the bottom sandy, the waves drive the sand towards the shore; at each ebb a portion is left dry, and the wind, which generally blows from the sea, casts it higher on the beach. Thus the *downs* are formed, those sandy hills which, if the invention of man does not teach him how to fix by introducing herbage suited to the soil, progress slowly, but with certainty, towards the interior of the country, and then overwhelm fields and dwellings; because the same wind which conveys the sand of the beach on the *down*, casts that of the summit of the *down* still farther inland. But if the nature of the sand and that of the water it absorbs, are such as form a durable cement, the shells and bones cast on the shore will become incrusted with it; woods, trunks of trees, and plants which grow near the seaside, will become enveloped in these accumulations; and thus will be formed those solid downs, such

as are to be met with on the coasts of New Holland. We can have a clear idea of them from the description given by Péron. (1)

STEEP SHORES.

When, on the contrary, the coast is lofty, the sea, which can deposite nothing, is perpetually destroying: its waves wear away the bank, and destroy the summit, because the higher parts, being left without foundation, are incessantly falling away into the sea, where they are tossed about by the waves until the softer and looser particles are lost. The harder portions, by dint of continued friction, form those round pebbles, or that accumulated strand which serves to strengthen the base of the steeps.

Such is the action of the waters on terra firma, which consists only in small levellings, and those not indefinite. The falling materials of the mountain tops into the valleys; their particles, those of the hills and plains, conveyed to the sea; the alluvial deposites extending the coasts at the expense of the heights,—are the limited effects which vegetation has in some degree put a boundary to; which suppose, besides the pre-existence of mountains, valleys, in short, of all the inequalities of the globe, and which consequently could not themselves have produced those inequalities. The downs are a still more limited phenomenon, both in height and horizontal extent; they have no relation to those enormous masses into the origin of which geology seeks to penetrate.

As to the operation of the waves in their own ele-

(1) In his 'Voyage aux Terres Australes.'

ment, although we cannot accurately ascertain it, yet we can to a certain extent point out its effects.

DEPOSITES UNDER THE WATERS.

Lakes, ponds, marshes, and sea-ports into which streams flow, particularly when issuing from neighbouring and rugged hills, deposite at their bottom shoals of mud, which would in time choak them up, if constant care was not taken to cleanse them; the sea also leaves in harbours, creeks, and all parts where its waters are most calm, mud and sediment. Currents are formed amongst these deposites, or throw upon them the sand which they collect from the sea; and thus are shoals and shallows made.

STALACTITES.

Certain waters, after depositing the calcareous substances, by means of the superabundant carbonic acid with which they are impregnated, become crystallized when the acid has evaporated, and form stalactites and other concretions. There are mingled crystallized layers in soft water, sufficiently extensive to be compared with some of those left by the ancient sea. Every one knows the famous Travertine quarries in the vicinity of Rome, and the rocks of this stone which the river Teverona accumulates and produces, perpetually varying in form. Its twofold action may be thus accounted for: the accumulated deposites of the sea may become hardened by stalactites; when, perhaps, springs replete with calcareous matter, or containing some other substance in solution, fall into the places where these

masses are formed, and then become a combination formed by the union of the marine deposites with the fresh water. Such are the banks of Guadeloupe, which contain marine and terrestrial shells and human skeletons. Such, also, is the quarry near Messina, described by Saussure, where the sandstone is produced by the sands cast up by the sea, and which there consolidate.

LITOPHYTES.

In the torrid zone, where litophytes are numerous in species and propagate rapidly, their stony columns are formed into rocks, reefs, &c.; and, reaching to the level of the waves, block up the entrance of the ports, and are the destructive foes of navigation. The sea casting sand and slime on the top of these rocks, frequently raises their surface above the proper level, and thus generates islands which soon exult in rich vegetation. (1)

INCRUSTATION.

It is possible, also, that in certain places shell-fish leave their testaceous coverings, which, amalgamated with slime more or less concreted, or with some other cements, form extensive deposites, or a kind of shelly reef; but we have no evidence that the sea at present can incrust these shells with a paste as solid as marble, sand-stone, and even the compact limestone in which we see the shells of our layers em-

(1) See Forster's 'Observations on the South Sea.'

bedded. Still less do we find that it deposites any portion of those more solid and more flinty layers which preceded the formation of shell-reefs.

All these causes united would not perceptibly affect the level of the sea, would not raise a single layer above that level, and assuredly would not produce the least hillock on the surface of the earth. It has been asserted, with some appearance of probability, that the sea gradually decreases, and that observations to that effect have been made on the shores of the Baltic.(1) But whatever may be the causes of these variations, it is certain that they are not universal; that in the greatest number of ports, where there are so many persons interested in observing the height of the sea, and when fixed and ancient works afford so many means of computing these variations, the mean level is constantly the same; there is no general sinking; there is no universal encroaching. In other places, as Scotland and various parts in the Mediterranean, they have supposed, on the contrary, that the sea has become higher, and now covers shores formerly above its level.(2)

(1) It is a prevalent opinion in Sweden, that the sea lowers, and that we can ford or even walk dry-shod in many places where formerly it was impassable. Very learned men have espoused this popular idea, and to so great an extent is M. de Buch imbued with it, that he supposes that gradually the whole soil of Sweden will become dry land. But it is singular that no regular and precise observations to confirm a theory broached so long, have been made, and made public, which would leave no doubt, if, as Linnæus says, this difference of level be as much as four or five feet annually.

(2) Mr. R. Stevenson, in his observations on the bed of the North Sea, and the British Channel, asserts that the level of these seas has become constantly and sensibly higher during the last three centuries. Fortis says the same thing of certain places in the Adriatic; but the example of the temple of Serapis, near Pozzuola, proves that the borders of this sea are in many places of a nature occasionally to elevate themselves

VOLCANOES.

The action of volcanoes is still more limited and more locally confined than any others which we have adverted to. Although we have no clear idea of the means by which nature feeds these fierce furnaces at depths so profound, we yet judge clearly, by their effects, of the alterations which they have occasioned on the earth's surface. When a volcano appears, after some shocks, some earthquakes, it finds an opening. Stones and ashes are thrown far and wide; lava is vomited forth; the more fluid portion glides away in long streams; the more solid is stopped at the edges of the aperture which it serves to elevate, and forms a cone terminated by a crater. Thus volcanoes accumulate on the surface, (after having in a measure modified them,) materials before buried in the depths of the earth; they form mountains; they have in earlier ages covered some parts of our continents with them; they have suddenly produced islands in the midst of the ocean; but these mountains, these islands are always composed of lava, all their materials have undergone the action of fire; they are distributed as materials must be which emanate from an elevated spot. Volcanoes do not elevate, nor overthrow the layers which lie along their apertures; and if certain causes have operated from their abysses, and assisted in overthrowing vast mountains, it has not been

and sink again. But, on the other hand, there are thousands of quays, roads, and other places made along the coast by the Romans, from Alexandria to Belgium, the relative level of which has never altered.

by means of volcanic agents of which we have any knowledge.

Thus, we repeat, it is in vain to seek amidst the forces now acting on the surface of the earth, for causes sufficiently powerful to produce the revolutions and catastrophes of which its exterior bears traces; and if we have recourse to the external causes at present in action, we shall not find them adapted for the purpose.

CONSTANT ASTRONOMICAL CAUSES.

The pole of the earth moves in a circle about the pole of the ecliptic; its axis inclines more or less according to the ecliptic; but these two motions (which are well understood) are performed within known directions and limits, and have no proportion to the effects, the extent of which we have just considered. In every instance, their extreme slowness would preclude the idea that they had any influence on the catastrophe which we have proved to be violent and sudden.

This latter reason is applied to all the slow agencies that have been imagined, doubtlessly, in the hope that their existence could not be denied, because it would be always easy to assert that their tardiness made them imperceptible. True, or not, is of little consequence; they explain nothing, for no slow causes can produce sudden results. There may have been a gradual diminution of the waters, the sea may have conveyed every kind of solid matter, the temperature of the globe may have increased or diminished, but none of them have been the agents which have disturbed our layers, which have clothed with ice great quad-

rupeds with their flesh and skin; which have thrown on dry land those testaceous remains, still as perfect as if they contained living fish; which have, in fine, destroyed whole species and genera.

These arguments have struck the majority of naturalists: and amongst those who have sought to explain the present state of the globe, there is scarcely one who has attributed it entirely to slow causes, still less to causes operating before our eyes. The necessity they have experienced of discovering different causes from those now in action has given rise to many extraordinary speculations, and has involved them in so many and so contrary suppositions, that the very name of their science has been long a subject of raillery for some prejudiced persons, who only look at the various systems that have been broached, and forget, or are ignorant of the long and important series of positive facts that have been developed. (1)

ANCIENT SYSTEMS OF GEOLOGISTS.

For a long time only two events, only two changes of the globe, have been admitted—the creation and the deluge; and all the labours of geologists have tended to explain the present state, by imagining a certain primitive state, afterwards modified by the deluge, and to which each speculist assigned his own causes, action, and effects.

Thus, according to one,(2) the earth at first had

(1) When I say this, I announce a fact daily proved, but I have not pretended to express my own opinion, as some geologists have thought. As some ambiguity in my speech has given rise to the error, I must apologize for it.

(2) Burnet Telluris Theoria Sacra. 1681.

an equal and light crust which covered the abyss of waters, and which burst to produce the deluge; its relics formed the mountains. According to another,(1) the deluge was occasioned by a momentaneous suspension of the cohesion in minerals; the whole mass of the globe was dissolved, and the paste of it was penetrated by shells. According to a third,(2) God lifted up the mountains to allow the waters, which produced the deluge, to escape; and removed them to places where there were more stones, because otherwise they could not have been supported. A fourth(3) created the earth with the atmosphere of one comet, and deluged it through the tail of another; the heat which remained to it from its first origin excited all mankind to sin; thus they were all drowned except the fishes, which had apparently passions less unruly.

We see, that, even in confining ourselves to the limits fixed by Genesis, naturalists have a wide field before them: they soon found themselves in difficulties, and when they had succeeded in attributing to the six days of creation indefinite periods, ages costing them nothing, their systems took a flight proportioned to the intervals which they could dispose of.

The great Leibnitz amused himself, like Descartes, in making the earth a quenched sun,(4) a vitrified globe, on which vapours having fallen at the time of its extinction, seas were formed, which in their turn deposited calcareous formations.

(1) Woodward's Essay towards the Natural History of the Earth. 1702.
(2) Scheuchzer, Mem. de l'Acad. 1708.
(3) Whiston. A New Theory of the Earth. Lond. 1708.
(4) Leibnitz, Protogæa. Act. Leips. 1683. Gott. 1749.

Demaillet covered the whole globe with water for thousands of years; he caused those waters gradually to retire; all terrestrial animals had at first been marine; man himself was at first a fish; and the author assures his readers that it is not uncommon to find in the ocean fishes which have only become half men, but which will some day become entire human beings.(1)

The system of Buffon is only a development of that of Leibnitz, with the sole addition of a comet, which produced from the sun, by a violent shock, the liquefied mass of the earth, together with all the planets: whence result his positive data, for by the actual temperature of the earth we can calculate how long a time has elapsed since it grew cool; and, since the other planets came from the sun at the same time as the earth, we may reckon how many ages must elapse before the larger ones cool, and to what extent the smaller ones have become refrigerated.(2)

THE LATEST SYSTEMS.

In our times imagination has exercised itself with more freedom than before on this important subject. Some writers have reproduced and greatly extended the ideas of Demaillet; they say, that at first, every thing was in a state of liquefaction; that the liquid at first engendered animals of the simplest kind, such as *monads* and others of the infusory and microscopic species, that in the progress time, and in assuming different habits, the the animalia complicated and diversified their species to the extent which we now have in existence. It is these animals who have converted the waters

(1) Telliamed. Amster. 1748.
(2) Théorie de la Terre, 1749; et Epoques de la Nature, 1775.

of the ocean gradually into calcareous earth; vegetables, on the origin and changes of which they tell us nothing, have changed the water into clay; but these two earths, by dint of being deprived of the characteristics which life had impressed on them, were resolved, by the last analysis, into flint; and that is the reason why the oldest mountains are the most flinty. All the solid portions of the earth owe their birth, then, to life, and without life the whole globe would be still wholly liquid.(1)

Other writers have given the preference to the theory of Kepler. Like this great astronomer, they assign vital powers to the globe; they say that a fluid circulates around it; an assimilation is made as in animate bodies; each of its component parts has life: not only the very elementary atoms have instinct and will, which attract and repel by sympathies and antipathies: but every sort of mineral can convert immense masses into its own proper nature as we convert our aliments into flesh and blood. Mountains are the organs of the respiration of the globe, and the schists the secreting organs; it is by these that sea water is decomposed to engender volcanic eruptions; the veins in mines are the caries, the abscesses, of the mineral kingdom; and the metals a production of putrefaction and disease; and this accounts for their bad smell.(2)

Still more recent is a philosophy which substitutes metaphors for reasoning, setting out with a

(1) See La Physique de Rodig. p. 106. Leips. 1801; and p. 169, vol. ii. of Telliamed, as well as a great number of German works. M. de Lamark has, with much research and talent, developed this system in his 'Hydrogeology and Zoological Philosophy.'

(2) M. Patrin has shown much imagination in supporting these fantastic ideas, in many articles in 'Le Nouveau Dictionnaire d'Histoire Naturelle.'

system of absolute identity, or pantheism, produces all phenomena or (what it thinks the same thing) all beings by polarization similar to the two electricities; and calling polarization, all opposition, every obstacle, whether we consider its situation, nature, or functions, it seems to oppose God and the world; in the world the sun and planets; in each planet solidity and liquidity, and pursuing this system, changing when needful its figures and allegories, it reaches at last to the minutest details of organized species.(1)

We must allow that we have selected the most opposite examples, and that all geologists have not carried the boldness of their conceptions as far as those we have cited. But amongst those who have advanced with more caution, and have not sought arguments beyond physics or ordinary chemistry, how much diversity of opinion and contradiction have arisen!

OPPOSITION OF ALL THESE SYSTEMS.

According to one, all is precipitated successively by crystallization: all was deposited as it now is; but the sea which covered all has retired gradually.(2)

With another the materials of mountains are incessantly lowered and carried away by rivers to the depths of the ocean, there to become heated beneath enormous pressure, and to form layers which the heat that hardens them will one day elevate with violence.(3)

(1) We particularly find this application of pantheism to geology in the works of M. Steffens and M. Oken.

(2) M. Delamétherie admits crystallization as a principal cause in his Geology.

(3) Hutton and Playfair: Illustrations of the Huttonian Theory of the Earth. Edinb. 1802.

A third supposes the liquid divided into a multitude of lakes, amphitheatrically one above another, which, after having deposited our layers of shells, have successively broken down their banks to fill the basin of the ocean. (1)

It is the theory of a fourth that the tides of seven or eight hundred fathoms have, on the contrary, carried off from time to time the bottoms of the sea, and cast them as mountains and hills in the valleys, or on the primitive plains of the continent. (2)

A fifth has thought that meteoric stones have fallen successively from heaven, which have been the component parts of the earth, and which bear the imprint of their strange origin in the unknown beings whose relics they contain. (3)

A sixth makes the earth hollow, and places in the centre a diamond, which conveys itself by intervention of comets from one pole to another, drawing with it the centre of gravity and the mass of waters, and thus alternately drowning the two hemispheres. (4)

We could quote twenty other systems, equally contradictory with these. And do not let us be understood as criticising the authors of them; on the contrary, we know that these opinions have generally been elicited from men of genius and understanding, who were not ignorant of facts to examine which many of them had travelled far and long, and have added many and important truths to the science.

(1) Lamanon, in many parts of the Journal de Physique, after Michaelis, and many others.

(2) Dolomieu, ibid.

(3) MM. de Marschall: Recherches sur l'Origine et le Developpement de l'Ordre actual du Mondee. Giessen 1802.

(4) M. Bertrand: Renouvellement Periodique des Continens Terrestres. Hambourg, 1799.

CAUSES OF THESE CONTRADICTIONS.

How then can such opposing facts occur in the results of those who have started with the same first principles to resolve the same problem?

Must it not be that the terms of the problem have not *all* been thoroughly considered; which has left it to this day undetermined, though capable of many solutions, all equally plausible when this or that condition is overlooked; all equally unworthy of adoption when a new condition arises, or when attention is arrested by some well-known but neglected fact.

THE NATURE AND TERMS OF THE PROBLEM.

To quit the language of mathematics, we will say that nearly all the authors of these systems, having only regarded certain difficulties which opposed them more forcibly than others, have solved them in a manner more or less plausible, and have thrown aside others as numerous and important. One, for instance, has only contemplated the difficulty of changing the level of the sea; another, that of dissolving all terrestrial substances in one and the same liquid; a third, that of accounting for the existence of animals in the frigid zone, which he supposed could only live in the torrid zone. Exhausting on these points the whole powers of their imagination, they thought they had effected all in devising a means of answering them. Besides, in neglecting other phenomena, they did not always think of determining precisely the measure and limits of those which they attempted to explain.

This is particularly true in reference to the se-

condary formations, which form the most important and difficult part of the problem. For a long time naturalists employed themselves very unavailingly in determining the superstrata of their layers and the relation of these layers with those sorts of animals and plants whose remains they contain.

Are there animals and plants peculiar to certain layers, and which are not met with in others? What is the species of those which first appear, or which come after? Are those two species ever found together? Are there variations in their return; or, in other words, do the first again recur, and do the second then disappear? Have these animals and plants all lived in the places where their remains are found, or have some of them been conveyed elsewhere? Do they all exist at present any where, or have they been wholly or partly destroyed? Is there a perpetual uniformity between the antiquity of the layers and the resemblance or non-resemblance of the fossils with living beings? Is there a similarity of climate between fossils and those of living beings which most resemble them? Can we determine that the removal of these beings (if there has been any) has been from north to south or from east to west, or by scattering and mixture; and can we distinguish the epochs of those removals by the layers which have these marks impressed on them?

How can we decide on the actual state of the globe, if we cannot answer these questions, if we have not sufficient grounds to enable us to determine in the affirmative or negative? Besides, it is but too true that during a long period none of these points have been absolutely cleared up; in fact, it was scarcely deemed expedient to clear them up previous to the formation of a system.

REASON WHY THESE PRELIMINARIES HAVE BEEN NEGLECTED.

It may be assigned as a cause of this peculiar neglect, that geologists have all been either naturalists of the closet, who had themselves but very superficially examined the structure of mountains, or mineralogists who had not studied in sufficient detail the innumerable varieties of animals, and the infinite complication of their different component parts. The former have only framed systems; the latter have made admirable observations; they have in fact laid down the foundations of the science, but were inadequate to the task of elevating the superstructure.

PROGRESS OF MINERAL GEOLOGY.

In truth, the mineral portion of the great problem of the theory of the earth has been studied with admirable care by Saussure, and brought to a wonderful development by Werner, and by the numerous and talented disciples of his school.

The former of these celebrated men, scrutinizing with indefatigable toil for twenty years the most inaccessible mountainous districts, in a manner attacking the Alps themselves in every direction, in every defile, has laid open to us all the confusion of the primitive formations, and has clearly traced the secondary formations. The latter, availing himself of the numerous excavations made in countries containing the oldest mines, has fixed the laws relating to the succession of layers; he has pointed out their relative antiquity, and traced each through its respective

change. It is he, and he only, who has given a date to geology, as far as regards the mineral nature of the layers; but neither Saussure nor Werner has determined the fossilized organized species in each sort of layer, with that necessary exactness which is so requisite, from the prodigious number of known animals which they contain.

Other men of science indeed studied the fossil relics of organized bodies; they collected and published drawings of them by thousands: their works will be valuable collections of materials; but, more engrossed with animals or plants, considered as such, than with the theory of the earth, or regarding these petrifactions or fossils as curiosities rather than historical documents, or, in truth, contenting themselves with partial explanations on the relative bearings of each relic, they have almost always neglected to seek for the general laws of position, or the relation of fossils with the layers.

IMPORTANCE OF FOSSILS IN GEOLOGY.

And yet the idea of such a research was very natural. How was it overlooked that it is to fossils alone that must be attributed the birth of the theory of the earth; that, without them we could never have surmised that there were successive epochs in the formation of the globe, and a series of different operations? Indeed, they alone prove that the globe has not always had the same crust, by the certainty of the fact that they must have existed at the surface before they were buried in the depths where they are now found. It is only by analogy that we extend to primitive formations that conclusion which fossils enable us definitively to ascribe

to secondary formations; and if there were only formations without fossils, no one could prove that these formations were not simultaneously produced.

Again, it is to fossils, small as has been our acquaintance with them, that we owe the little knowledge we have attained respecting the nature of the revolutions of the globe. They have taught us, that the layers which comprise them have been undisturbedly deposited in a liquid; that their alterations have corresponded with those of the liquid; that their exposure was occasioned by the removal of this liquid; that these exposures have taken place more than once. None of these facts could have been decided on without these fossils.

The study of the mineral portion of geology, which is not less necessary, which is even of still greater utility with regard to the mechanical arts, is yet much less instructive with relation to the object of which we are treating.

We are in positive ignorance regarding the causes which can have produced the changes of the substances composing the layers; we do not even know the agents which could have held certain of them in solution; and it is yet a matter of controversy, whether certain of them owe their origin to water or fire. To come at once to the point, we observe that there is a general agreement on one point only; namely, that the sea has changed its situation. And how should we know that if we had no fossils?

Fossils, which have given birth to the theory of the earth, have also furnished it with its principal lights, the only ones which have been generally recognised down to the present period.

It is this idea which has encouraged us to take up the subject; but the field is immense; a single person

could only glance over but a very trifling part. A choice was to be made therefore, and we did not hesitate. The class of fossils which forms the object of this work at once determined us, because we saw that it is at the same time more pregnant with precise results, and yet less known and more rich in novel matters of research. (1)

PARAMOUNT IMPORTANCE OF THE FOSSIL BONES OF QUADRUPEDS.

It is apparent that the bones of quadrupeds conduct us, by various reasonings, to more precise results than any other relics of organized bodies.

In the first place, they characterize more clearly the revolutions which have effected them. Shells prove that the sea was once where they are now found; but their change of species could only at the utmost proceed from slight variations in the nature of the liquid, or merely in its temperature.

They might have had relation to causes still more accidental. There is nothing to assure us that at the bottom of the sea, certain species, even certain genera, after having occupied for a larger or shorter period determinate situations, have not been forced away by others. Here, on the contrary, all is precise; the appearance of the bones of quadrupeds, particu-

(1) My work has in fact proved the situation of this subject when I took it up in spite of the admirable labours of Camper, Pallas, Blumenbach, Merk, Sœmmering, Rusenmuller, Fischer, Faujas, Home, and other learned men, whose works I have quoted with much care in those chapters of my books to which they relate.

larly the whole carcases in the layers, betokens either that the layer itself which contains them was formerly dry land, or that there was terra firma in its immediate vicinity. Their disappearance renders it certain that this layer was inundated, or that this dry land ceased to exist. It is then by these that we learn in a positive manner the important fact of the repeated irruptions of the sea, with which shells and other marine productions could not have made us acquainted; it is by studying them profoundly that we may hope to ascertain the numbers and periods of these irruptions.

Secondly, the nature of the revolutions which have altered the surface of the globe must have exercised a more entire action over terrestrial quadrupeds than marine animals. As these revolutions have in a great measure consisted in changes of the bed of the sea, and the waters must have destroyed all the quadrupeds which they reached, if the irruption were general the whole class must have perished; or, if only operating on certain continents, it must have destroyed at least the species peculiar to these continents, without exercising the same influence upon marine animals. On the contrary, millions of aquatic individuals might have been left on dry land, or buried under new layers, or thrown with violence on the shore, and their race be still preserved in some places more tranquil, where it might again be propagated after the disturbance of the waters had ceased.

Thirdly, this action, as more complete, is more easily seized on; it is more easy to demonstrate its effects, because, the number of quadrupeds being limited, the greater part of their species, at least of the larger kind, being known, we have still farther

means afforded us of ascertaining whether the fossil bones belong to one of them, or if they formed a part of a species now extinct. As we are, on the contrary, very far from knowing all the marine testacea and sea fish; as we are probably ignorant yet of the greater part which are in the depths of the ocean, it is impossible to know with certainty if a species found fossilized be or be not extinct. Thus we observe learned men obstinately bent on giving the name of pelagian shells, that is, shells of the deep sea, to belemnites, to cornua-amonis, and other shelly relics, which have as yet only been observed in ancient layers; meaning by that, that if they have not been yet found in a living state, it is because they inhabit depths beyond the reach of our nets.

Certainly naturalists have not yet traversed every continent, and do not even know all the quadrupeds which inhabit the countries over which they have travelled. New species of this class are from time to time discovered; and those who have not attentively examined all the circumstances of these discoveries, might believe also that the unknown quadrupeds whose bones are found in our layers have remained concealed to the present time in some islands not yet discovered, or in some of the vast deserts which occupy the middle of Asia, Africa, the two Americas, and New Holland.

LITTLE PROBABILITY OF FINDING NEW SPECIES OF GREAT QUADRUPEDS.

However, if we examine what species of quadrupeds have been recently found, and in what circum-

stances they have been discovered, we shall see that there is but little hope of ever finding those that we have only seen as fossils.

Islands of moderate extent, situated at a distance from extensive continents, have very few quadrupeds, and those very small; when they have large ones, it is because they have been brought from elsewhere. Bougainville and Cook found only dogs and hogs on the South Sea Islands; and the largest species of the West India Islands was the agouti.

In fact, large territories, such as Asia, Africa, the two Americas, and New Holland, have large quadrupeds, and generally species peculiar to each of them; so that wherever it has been found that the situation of these lands has kept them isolated from the rest of the world, a class of quadrupeds has been there found entirely different from any elsewhere existing. Thus, when the Spaniards first overran South America, they did not find one of the quadrupeds common to Europe, Asia, or Africa. The puma, the jaguar, the tapir, the cabiai, the lama, the vicuna, sloths, armadilloes, opossums, and all the species of monkeys, were to them entirely strange, and beings of which they had no idea. The same phenomenon occurred in our time, when the first survey of the coast of New Holland and the adjacent islands took place. The different kangaroos, phascolomys, dasyurus, and perameles, the flying phalangers, the ornithorynchi, and echidnæ, have been found to astonish naturalists by their strange conformations, which broke through all rules and overthrew all systems.

If then there remained any extensive continent to discover, we might hope to find new species, amongst which some might be found more or less

resembling those of which the bowels of the earth have presented us with the relics; but it is sufficient to cast a glance over the mass of the world, and see the numerous directions in which navigators have ploughed the ocean, to judge that there cannot be any other large tract of land, unless it be at the North Pole, where the ice would not admit of any duration of existence.

Thus, we find that it is from the interior of the large divisions of the world that we can expect unknown quadrupeds.

But, on a little reflection, we shall soon see that this expectation is hardly more likely to be realized here than in the islands.

The European traveller does not easily effect his passage through vast extent of countries, desert, or only supporting a ferocious population, and this is more particularly the case in Africa; but nothing prevents animals from overrunning these countries in every direction and approaching the coasts. Although great mountainous chains may intervene between the coasts and the deserts of the interior, they would be broken in some places to allow of the passage of the rivers; and, in these burning deserts quadrupeds give the preference to the banks of the rivers. The population of these coasts ascend these rivers, and soon acquire a knowledge, either from experience, or by commerce and tradition, of the more remote population, and of all the remarkable species which live near the sources of the streams.

At no period have the civilized nations, who have frequented the coast of a great country, failed in acquiring a knowledge of the largest animals, or those whose formation is peculiar and striking.

Facts bear out this reasoning. Although the ancients did not pass the Imaus or the Ganges, in Asia, and had not got beyond Mount Atlas, in Africa, they yet knew all the large animals of these parts of the world, and if they did not distinguish all these species, it was not because they could not have seen or heard speak of them, but because the resemblance of the species would not allow of their discriminating their peculiar characteristics. The only great exception which may be brought against me is the tapir of Malacca, recently sent from India by two young naturalists, pupils of mine, MM. Duvaucel and Diard, and which in fact is one of the most brilliant discoveries with which modern times have enriched natural history.

The ancients were acquainted with the elephant, and the history of this quadruped is more exact in Aristotle than in Buffon.

They were not even ignorant of the distinguishing marks between the elephants of Africa and those of Asia. (1)

They knew the double-horned rhinoceros, now no longer living in modern Europe. Domitian exhibited one at Rome, and had it engraved on medals. Pausanias describes it with much exactness.

The unicorn rhinoceros, though very remote from Rome, was equally well known there. Pompey exhibited one. Strabo has accurately described another at Alexandria. (2)

The rhinoceros of Sumatra, described by Mr. Bell, and that of Java, discovered and sent over by Messrs. Duvaucel and Diard, do not appear to live on the continent. Therefore it is not astonishing

(1) See in the 1st vol. of my Researches, the chapter on elephants.

(2) See vol. ii. of my work, chapter 1, on the rhinoceros.

that the ancients had no knowledge of them, and perhaps if they had they would not have distinguished them.

The hippopotamus has not been so well described as the preceding species; but we find very exact delineations of it on the monuments left by the Romans, which represent things relative to Egypt, such as the statue of Nilus, the Mosaic of Palestrina, and a great many medals. In fact, the Romans saw them often, they were exhibited by Scaurus, Augustus, Antoninus, Commodus, Heliogabalus, Philip and Carinus.(1)

The two species of camels, that of Bactria, and that of Arabia, are already well described and characterized by Aristotle.(2) The ancients knew the giraffe or camel-leopard; they even had a living one at Rome in the circus under the dictatorship of Julius Cæsar, in the year of Rome 708. Gordian III. had ten at one time, which were killed at the secular games of Philip,(3) which must astonish the moderns, who have only seen one in the fifteenth century.(4)

If we read attentively the descriptions of the hippopotamus, given by Herodotus and Aristotle, and which are said to be borrowed from Hecatæus of Miletus, we shall find that they must have been composed of two different animals, of which one perhaps was the real hippopotamus, and the other certainly the gnu, a quadruped of which our naturalists have made no mention till the end of the

(1) See vol. i. of my Researches, chapter on the hippopotamus.

(2) His. Anim. lib. ii. c. 1.

(3) Jul. Capitol. Gord. III. cap. 23.

(4) That which the soldan of Egypt sent to Lorenzo de Medicis, and which is painted in the frescoes of Poggio Cajano.

eighteenth century. It was the same animal of which so many fabled narratives were told under the name of catoblepas or catablepon.(1)

The Ethiopian wild boar of Agatharchides, which had horns, was the same as our Ethiopian wild boar, whose enormous weapons of defence have almost as much claim to the name of horns as the tusks of the elephant.(2)

The bubalus and nagor are described by Pliny,(3) the gazelle, by Elian;(4) the oryx, by Oppian;(5) the axis was known in the time of Ctesias;(6) the algazel and the corinna are perfectly depicted on Egyptian monuments.(7)

Ælian well describes the yak or *bos grunniens*, under the name of the ox, whose tail serves for a fly-flapper.(8)

The buffalo has not been domesticated amongst the ancients, but the ox of the Indies, of which Ælian(9) speaks, and which had horns large enough to hold three amphoræ, was a variety of the buffalo, called *arni*.

And even this wild ox, with depressed horns, whom Aristotle places in Arachosia,(10) must be the common buffalo.

The ancients knew the oxen without horns;(11) the oxen of Africa, whose horns, attached to the

(1) See Pliny, lib. viii. cap. 32, and Elian, lib. vii. cap. 5.
(2) Ælian, Anim. v. 27.
(3) Pliny, lib. viii. cap. 15, and lib. xi. cap. 37.
(4) Ælian, Anim. l. xiv. c. 14.
(5) Op. Cyneg. ii. v. 445, et seq.
(6) Pliny, lib. viii. cap. 21.
(7) See the great work on Egypt, Antiq. iv. pl. 49 and 66.
(8) Ælian, Anim. xv. 14.
(9) Id. iii. 34.
(10) Arist. Hist. an. lib. ii. cap. 5.
(11) Ælian, ii. 53.

skin only, are shaken with it;(1) the oxen of India as swift in flight as horses;(2) those no larger than a goat;(3) sheep with a large tail;(4) and those of India as large as asses.(5)

Although the ancient accounts of the aurochs, the rein-deer, and the elk, are mixed with fable, they still prove that they had some knowledge of them; but that the knowledge, founded on the accounts of ignorant persons, had not been submitted to a critical judgment.(6) These animals dwell in the country assigned to them by the ancients, and have only disappeared in countries too much cultivated for their habits of life; the aurochs and the elks still live in the forests of Lithuania, which formerly joined the forest of Hercynia. There are aurochs in the north of Greece, as in the times of Pausanias. The rein-deer inhabits the north, in the cold regions which it has always inhabited; there it changes colour, not according to its will, but to the seasons. It was by a series of inexcusable mistakes that it was thought they would be found in the Pyrenees in the fourteenth century.(7) The white bear was seen in Egypt during the reign of the Ptolemies.(8)

(1) Ælian, ii. 20.
(2) Id. xv. 24.
(3) Id. ibid.
(4) Id. Anim. iii. 5.
(5) Id. iv. 32.
(6) See in my Researches, vol. iv. chapters on deer and oxen.
(7) Buffon having read in Du Fouilloux, a passage quoted from Gaston-Phebus, Count de Foix, in which that prince describes the rein-deer hunt, imagined that that animal existed in the Pyrenees at that period; and the printed editions of Gaston are so faulty, that it was with difficulty ascertained what the author meant to say; but having reverted to the original manuscript, which is preserved in the king's library, I have found that it was in Xueden and Nourwergue (Sweden and Norway,) that he says, he saw and partook of the chase of rein-deer.
(8) Athenée, lib. v.

Lions and panthers were common at Rome in the games; they were exhibited by hundreds; there were even tigers; the striped hyena, and the crocodile of the Nile were there produced. There are in the artificial mosaics preserved at Rome, excellent representations of the rarest of these species, amongst others, the striped hyena accurately depicted on a fragment preserved in the museum in the Vatican, and when I was in Rome (in 1809,) they discovered in a garden beside the arch of Gallienus, a mosaic pavement of natural stones arranged in the Florentine manner, representing four Bengal tigers, admirably done.

The museum of the Vatican contains a basalt crocodile, very nearly accurate,(1) we cannot doubt but that the *hipotigris* was the zebra, which however is only found in the southern parts of Africa.(2)

It would be easy to show that nearly all the most remarkable species of apes have been accurately defined by the ancients under the names of pitheci, sphynxes, satyrs, cebi, cynocephali, cercopitheci.(3)

They knew and described even the smaller descriptions of glires, when they had any peculiarity of conformation or remarkable property.(4) But the smaller species do not concern us; it is enough to have shown that all the larger kinds, distinguished by some marked characteristic, which we have now any knowledge of in Europe, Asia and Africa, were already known to the ancients; whence we may safe-

(1) There is no error except that there is a nail too many at the back of the foot. Augustus exhibited thirty-six. Dion. lib. xv.

(2) Caracalla killed one in the circus. Dion. lib. lxxvii. Cinf. Gisb. Cuperi de Elipt. in nummis obviis, ex. ii. cap. 7.

(3) See Lichtenstein, Comment. de Simiarium quotquot veteribus innotuerint formis. Hamburg, 1791.

(4) The jerboa is engraved on the medals of Cyrene, and pointed out by Aristotle as the *rat with two feet.*

ly draw the conclusion, that if they do not describe the smaller, or if they do not discriminate between those which closely resemble each other, as the gazelles and others, they were prevented by carelessness or want of method, rather than by opposition from the climate. We shall also determine, that if eighteen or twenty ages, and the circumnavigation of Africa and the Indies, have added nothing in this species to what the ancients already knew, that there is no likelihood that ages to come will bring much additional information to our posterity.

But perhaps an inverse argument may be used against us, and it will be said, that not only the ancients, as we have just proved, have known as many animals as ourselves, but they have described many which we now have not; that we are too hasty in regarding these animals as fabulous; that we should again search for them, before we decide in exhausting the history of the existing creation; that, indeed, amongst these pretendedly fabulous animals, we shall detect, when we know them better, the originals of our remains of unknown species. Some may even surmise that those different monsters, the essential ornaments of the heroic age amongst nearly all people, are precisely those which it has been necessary to destroy, to admit of the progress and establishment of civilization. Thus Theseus and Bellerophon, who bravely defeated these noxious animals, must have been far more fortunate than the existing race, but have not yet contrived to exterminate any one species, but only to drive them back.

It is easy to reply to this objection, by examining the descriptions of these unknown beings, and searching into their origin.

The most numerous have a source purely mythological, and of that their descriptions bear the undeni-

able impress; for we see in nearly all, only portions of known animals, united by an unrestrained fancy, and in opposition to every law of nature. Those invented or put together by the Greeks are certainly graceful in their composition; like those arabesques which ornament the remains of some ancient edifices, and which the fertile pencil of Raphael has multiplied: forms are there united, totally repugnant to reason, offering to the eye agreeable proportions; these are the light productions of happy dreams; perhaps emblems of the oriental taste, in which they pretended to veil beneath mystic imagery, the refined suggestions of metaphysics and morals. Let us excuse those who endeavour to employ their time in unravelling the wisdom concealed in the Sphynx of Thebes, the Pegasus of Thessaly, the Minotaur of Crete, or the Chimera of Epirus; but let us hope that no one would seriously seek for them in nature: as well might we expect to find the animals of Daniel, or the beasts of the Apocalypse. Let us not attempt to seek for the mythological animals of the Persians, offsprings of a still more heated imagination; the *martichore*, or destroyer of men, which has the head of a man on the body of a lion, terminated by a scorpion's tale,(1) the *griffin*, or treasure-keeper, half eagle half lions:(2) the *cartazonon*,(3) or wild ass, whose head is armed with a long horn.

Ctesias, who has described these as existing animals, has passed with many for an inventor of fables, whilst he only attributed a reality to emble-

(1) Plin. viii. 31; Arist. lib. ii. cap. 11. Phot. Bibl. art. 72. Ctes. Indic. Ælian, Anim. iv. 21.
(2) Ælian, Anim. iv. 37.
(3) Id. xvi. 20; Photius Bibl. art. 72. Ctes. Indic.

matical figures. These fantastic sculptures have been found in the ruins of Persepolis.(1) What is their meaning? Most probably we shall never learn, but they certainly do not represent real creatures.

Agatharchides, another fabricator of animals, probably drew from an analogous source. The monuments of Egypt show us still numerous combinations of the parts of different species: the gods are there often represented with a human body and an animal's head: we see animals with human heads, which have produced the cynocephali, the sphynxes, and the satyrs of ancient naturalists. The custom of depicting in the same painting men of different heights, the king or the conqueror gigantic, the conquered or people three or four times smaller, may have given birth to the fables of the pygmies. It is in some recess of one of these monuments that Agatharchides must have seen his carnivorous bull, whose mouth, cleft to his ears, spared no other animal;(2) but surely natuaralists will not assert that there can be such; for nature never unites either cloven feet or horns with cutting teeth.

There were most probably other figures equally strange, either in those monuments which were not able to withstand the ravages of time, or in those temples of Ethiopia and Arabia which the Mahometans and Abyssinians, in the excess of their religious zeal, have destroyed. Those of India swarm with them; but the combinations are too ex-

(1) See Corneille Lebrun, Voyage en Muscovy, en Perse, et aux Indes, t. ii.; and the German work of M. Heeren on the Commerce of the Ancients.

(2) Photius Bibl. art. 250; Agatharchid. Excerpt. Hist. cap. xxxix.; Ælian, xvii. 35; Plin. viii. 21.

travagant to deceive any one; monsters with a hundred arms, and twenty different heads, are too monstrous to find belief.

It is not the Japanese and Chinese only who have not the imaginary animals, which they represent as real, and even exhibit in their religious books; the Mexicans have them also: it is the custom of all people, either at the time when their idolatry has not become sufficiently refined, or when the meaning of these emblematical combinations have been lost. But who will pretend to find in nature these offsprings of ignorance and superstition?

Certain travellers, however, anxious to establish a character of renown, have asserted that they have seen these fantastic animals, or that, for want of due attention, and deceived by a slight resemblance, they have taken real creatures for them. Large apes have appeared real cynocephali; baboons, as men with tails; and thus St. Augustin said that he had seen a satyr.

Some real animals, scarcely seen, and badly described, may have caused these monstrous ideas, slightly founded on reality. Thus we cannot doubt the existence of the hyena, though this animal has not a neck supported by one single bone,(1) and that he does not change sex every year, as Pliny(2) says;

(1) I have even seen, in the cabinet of the late M. Adrian Camper, a hyena's skeleton, in which many of the vertebra of the neck were soldered together. It is probable that it is some similar individual which has caused this character to be given to all hyenas. This animal must be more subject to this accident than any other, in consequence of the prodigious force of its neck, and the frequent use it makes of it. When the hyena has seized any thing, it is easier to drag it along, than to tear from it what it holds: this is why the Arabs have selected it as the emblem of insuperable obstinacy.

(2) It does not change the sex; but has at the perinæum an

thus perhaps the carnivorous bull is only a rhinoceros with his two horns. M. de Weltheim asserts, that the auriferous ants of Herodotus are *corsacs.*

One of the most famous amongst the animals of the ancients is the *unicorn.* Naturalists were fully bent, even down to our times, on finding it, or at least in seeking arguments in favour of its existence. Three animals are frequently mentioned by the ancients as having only one horn in front. The *oryx of Africa,* which has at the same time cloven feet, the hair reversed,(1) is of great size, equal to the ox,(2) or even the rhinoceros,(3) and which it is agreed approaches sheep or goats in form;(4) the *ass of the Indies,* which is solid footed; and the *monoceros,* properly so called, whose feet are sometimes compared with those of a lion,(5) sometimes with those of an elephant,(6) and consequently cloven-footed. The horse(7) and the unicorn oxen have a mutual relation certainly to the ass of the Indies,(8) for the ox is mentioned as even solid footed. I ask, if these animals existed as distinct species, should we not at least have their horns in our collections? And what single horns have we but those of the rhinoceros and the narwal?

How, after this, can we refer to the coarse figures

orifice which has given rise to the opinion of its being an hermaphrodite.

(1) Arist. Anim. ii. 1. iii. 1; Plin. xl. 46.
(2) Herod. iv. 192.
(3) Oppian Cyneg. ii. vers. 551.
(4) Plin. viii. 53.
(5) Philostorge, iii. 11.
(6) Plin. viii. 21.
(7) Onesicrite, ap. Strab. lib. xv.; Ælian, Anim. xiii. 42.
(8) Plin. viii. 31.

traced by savages on the rocks?(1) Ignorant of perspective, and wishing to present in profile the horned antelope, they could only give it *one* horn, and thus originated the oryx. The oryx of the Egyptian monuments are most probably but the productions of a similarly crude style, which the religion of the country imposed on the artist. Many of the profiles of quadrupeds have only one leg before and one behind; why then should they show two horns? It is possible that individual animals might be taken in the chase, whom accident has despoiled of one horn, as it often happens to chamois and the Scythian antelope (siaga;) and that would suffice to confirm the error which these pictures originally produced. It is thus, probably, that we find anew the unicorn in the mountains of Thibet.

All the ancients, besides, have not reduced the oryx to a single horn; Oppian(2) expressly gives it several; and Ælian mentions some of the oryx who had four.(3) Now if this animal were ruminating and cleft-footed, it certainly had the frontal bone divided in two, and could not, according to the accurate remark of Camper, have had a horn on the suture.

But, we may be asked, what two-horned animal could give the idea of the oryx, and present the features which are given of its confirmation, even in depriving it of its unity of horn? I reply with Pallas, it is the horned antelope, improperly called the *pasan* by Buffon. It inhabits the deserts of Africa, and would have reached the confines of

(1) Barrow, Voyage to the Cape.
(2) Oppian Cyneg. lib. ii. v. 468, and 471.
(3) De An. lib. xv. cap. 14.

Egypt; it is that which the hieroglyphics seem to represent; its figure is nearly that of a stag; its height equals that of the ox; the hair of its back is directed towards the head; its horns are formidable weapons, sharp as darts, hard as iron; its hair is whitish, its countenance has marks and black streaks; and this is all that naturalists have described of it; and, as to the motives of the priests of Egypt, who spread abroad fables concerning it, and adopted it in their hieroglyphics, there is no occasion for their having a foundation in reality. Suppose then that an oryx with only one horn has been seen; that they have taken it for a perfect being, a type of its whole species; suppose that Aristotle, who adopted this error, has been copied by others; it is all possible, and even natural, but proves nothing in favour of the existence of a unicorn species.

As to the ass of the Indies, we have only to read of the anti-poisonous properties attributed to its horn by the ancients, and we shall see that they are precisely similar to those which the orientals of the present day assign to the horn of the rhinoceros. When the horn was first introduced amongst the Greeks, they could not have known the animal which had borne it. Indeed, Aristotle makes no mention of the rhinoceros, and Agatharchides is the first who has described it. In the same manner, the ancients possessed ivory long before they became acquainted with the elephant. Perhaps some traveller may have named the rhinoceros *the ass of the Indies*, with as much justice as the Romans had named the elephant *the bull of Lucania*. All that has been said of the strength, height and ferocity of the wild ass, agrees very well with the

rhinoceros. Moreover, those who best know the rhinoceros, finding in former authors the denomination of *ass of the Indies*, have taken it, without reflection, for that of a peculiar animal; and in fact, from the name, we should conclude that this animal was solid footed. There is a full description of an ass of the Indies by Ctesias,(1) but we have seen above that it was taken from the bas-reliefs of Persepolis; it should not pass for any thing in the actual history of the animal.

When there was also a description still less exact, which mentioned an animal with a single horn with many lines, a third species was made out, with the name of *monoceros*. These sort of twofold accounts are the more common with ancient naturalists, because almost all those whose works remain to us were simple compilers; but even Aristotle himself has frequently mixed facts borrowed from others with those which he himself has observed; so that in fact the art of criticism was as little known then by naturalists as by historians, which is saying a great deal.

After all these reasonings, all these digressions, it results, that all the great animals that are known in the old continent were known to the ancients, and that the animals described by the ancients, and not now known, were fabulous: it also results, that very little time elapsed before all the great animals of the three first known parts of the globe were known by the people who frequented the coasts.

We may thence conclude that we have not even any large species to discover in America. If there were any, there exists no cause why we should not have been acquainted with them; and in fact, for a

(1) Ælian, Anim. iv. 52; Photius, Bibl. p. 154.

hundred and fifty years, none have been discovered. The tapir, the jaguar, the puma, the cabiai, the lama, the vigogne, the red wolf, the buffalo or American bison, the ant-eaters, sloths, and armadilloes, are already in Margrave and in Hernandes. as well as Buffon. We may say that they are there better described, for Buffon has mingled the history of the ant-eaters, misunderstood the jaguar and the red wolf, and confounded the bison of America with the aurochs of Poland. In fact, Pennant is the first naturalist who has properly distinguished the little musk ox, but it had long been pointed out by travellers. The cleft-footed horse of Molina is not described by the first Spanish voyagers; but its existence is more doubtful, and Molina's authority is too dubious to be adopted. It would be possible to characterize better than at present the stags of America and the Indies; but with them, as with the ancients respecting the various antelopes, a good method of description was wanting, (and not opportunities of seeing them,) that they might be better known. We may then say, that the mouflon of the Blue Mountains is now the only quadruped of America of any size, the discovery of which is entirely modern; and perhaps it is only a Siberian goat that has crossed the ice.

How then can we believe that the enormous mastodons, the gigantic megatheria, whose remains have been found under the earth in the two Americas, can still exist on that continent? How could they escape those wandering people who incessantly overrun the country, in every corner of it; and who themselves acknowledge that they no longer exist, since they have imagined a fable about their destruction, saying that they were killed by the

Great Spirit, to prevent them from destroying the human race? But we may see that this fable was occasioned by the discovery of the bones, like that of the inhabitants of Siberia and their mammoth, which they pretend lives under ground like moles; and like all those of the ancients about the tombs of the giants, which they placed wherever they found the bones of elephants.

Thus we may believe, that if, as we shall prove hereafter, any of the great species of quadrupeds now embedded in regularly stony layers, are not found similar to the living species that we are acquainted with,—it is not the effect of chance, nor because these species, of which we have only fossil bones, are hidden in deserts, and have escaped all travellers to the present time; we ought, on the contrary, to regard this phenomenon as tending to general causes; and the study of it as one of the most proper to lead us to the origin and nature of these causes.

THE FOSSIL BONES OF QUADRUPEDS ARE DIFFICULT TO DETERMINE.

But if this study is more satisfactory in its results than that of the fossil remains of other animals, it is also beset with infinitely greater difficulties. The fossil shells generally present themselves entire, and with all the characteristics which admit of their being analogously arranged in collections or works of naturalists; fish even present their skeletons more or less entire; we generally trace the original form of their bodies, and frequently their generic and specific characteristics, which are

drawn from their solid parts. In quadrupeds, on the contrary, although we should meet with the whole skeleton, we should have great difficulty in applying to it the characteristics for the most part derived from the hair, colour, and other marks, which disappear before the incrustation; and it is uncommonly rare to find a fossil skeleton at all perfect; bones isolated and confusedly intermingled, most frequently broken and reduced to fragments; this is all with which our layers furnish us in this class, and is the sole resource of the naturalist. Thus we may say that the majority of observers, frightened at these difficulties, have passed lightly over the fossil bones of quadrupeds; have classed them very vaguely, after superficial resemblances; or have not even hazarded the giving a name to them; so that this part of the fossil history, the most important and instructive of all, is of all others the least cultivated. (1)

PRINCIPLE OF THIS DETERMINATION.

Fortunately, comparative anatomy possesses a principle, which, properly developed, was capable of clearing up all embarrassment: it was that of the natural relation of forms in organized beings, by means of which each sort of creature may by ri-

(1) I do not pretend by this remark, as well as those already made, to detract from the merit of the observations of Messrs. Camper, Pallas, Blumenbach, Sœmmering, Merk, Faugus, Rosenmuller, Home, &c.; but their estimable labours, which have been very useful to me, and which I have cited every where, are only partial, and many of these labours even published after the first editions of this Discourse.

gorous scrutiny, be known by each fragment of each of its parts.

Every organized being forms a whole, a unique, and perfect system, the parts of which mutually correspond, and concur in the same definitive action by a reciprocal reaction. None of these parts can change without the whole changing; and consequently each of them, separately considered, points out and marks all the others.

Thus, as I have before remarked, if the intestines of an animal are so organized as only to digest flesh, and that fresh, it follows that its jaws must be constructed to devour a prey, its claws to seize and tear it, its teeth to cut and divide it, the whole structure of its organs of motion such as to pursue and catch it, its perceptive organs to discern it at a distance; nature must even have placed in its brain the necessary instinct, to know how to conceal itself and lay snares for its victims. Such will be the general conditions of the carnivorous kingdom; every animal of this species will infallibly unite these qualities; for its race could not exist without them. But under these general conditions there are particular ones, relative to the size, species, and haunts of the prey, for which each animal is inclined; and each of these particular conditions result from modifications of the detail in the formations which they derive from the general conditions; thus, not only the class, but the order, the genus, and even the species, are detected in the formation of each part.

For, that the jaw may be enabled to seize, it must have a certain shaped prominence for the articulation, a certain relation between the position of the resisting power and that of the strength employed

with the fulcrum: a certain volume in the temporal muscle, requiring an equivalent extent in the hollow which receives it, and a certain convexity of the zygomatic arch under which it passes: this zygomatic arch must also possess a certain strength, to give strength to the masseter muscle.

That an animal may carry off his prey, a certain strength is requisite in the muscles which raise the head; whence results a determinate formation in the vertebræ or the muscles attached, and in the occiput where they are inserted.

That the teeth may cut the flesh, they must be sharp; and they must be so more or less, according as they will have, more or less exclusively, flesh to cut. Their roots should be the more solid, as they have more and larger bones to break. All these circumstances will in like manner influence the development of all those parts which serve to move the jaw.

That the claws may seize the prey, they must have a certain mobility in the talons, a certain strength in the nails, whence will result determinate formations in all the claws, and the necessary distribution of muscles and tendons; it will be necessary that the fore arm have a certain facility of turning, whence again will result determinate formation in the bones which compose it; but the bone of the fore arm, articulating in the shoulder-bone, cannot change its structure, without this latter also changes. The shoulder-blade will have a certain degree of strength in those animals which employ their legs to seize with, and they will thence obtain peculiar structure. The play of all these parts will require certain properties in all the muscles, and the impression of these muscles so proportioned

will more fully determine the structure of the bones. It may be seen that we could draw equally just conclusions for the hinder quarters, which contribute to the rapidity of the general movements; as to the formation of the body, the shape of the vertebræ, which influence the ease and flexibility of the motions; as to the form of nasal bones, of the socket of the eye, of the ear, whose mutual relation to the perfection of the sense of smelling, seeing, and hearing, are so palpable. In a word, the formation of the tooth bespeaks the structure of the articulation of the jaw, that of the scapula, that of the claws, just as the equation of a curve involves all its properties; and in taking each property separately, as the basis of a particular equation, we shall find again both the ordinary equation and all the other certain properties: so the claw, the scapula, the articulation of the jaw, the thigh bone, and all the other bones separately considered, require the certain tooth, or the tooth requires them reciprocally; and beginning with any one, he who possessed a knowledge of the laws of organic economy, would detect the whole animal.

This principle is sufficiently self-evident, in the usual acceptation, not to require a farther demonstration; but when we come to apply it, there are many cases in which our theoretic knowledge of the mutual relations of the structure would not be sufficient, if it were not supported by observation.

We see, for instance, very plainly, that hoofed animals must all be herbivorous, since they have no means of seizing upon their prey; we see also that, having no other use for their fore-feet than to support their bodies, they have no occasion for so powerfully-framed a shoulder; whence we may account for the absence of the clavicle and the acromion,

and the straightness of the scapula; not having any occasion to turn the fore-leg, their radius will be solidly united to the cubitus, or at least articulated by a hinge-joint, and not by ball and socket, with the shoulder; their herbaceous diet will require teeth with a broad surface, to crush seeds and herbs; this breadth must be irregular, and for this reason, the enamelled parts must alternate with the osseous parts; this sort of surface compelling horizontal motion, for grinding the food to pieces, the articulation of the jaw cannot form a hinge so close as in carnivorous animals; it must be flattened, and correspond with the facing of the temporal bones, more or less flattened; the temporal cavity, which will only contain a very small muscle, will be small and shallow, &c. All these things are necessary deductions one from another, according to their greater or lesser universality; and so that some are essential and exclusively belonging to hoofed animals, and others, although equally necessary to those animals, are not peculiar to them, but are to be found in other animals, where the other general rules of structure admit of these also.

If we descend to the orders or subdivisions of the class of hoofed animals, and examine what modifications the general condition undergo, or rather what peculiar conditions are united to them, according to the character proper to each of these orders, the reasons of these secondary conditions begin to appear less palpable. We soon perceive, in general terms, the necessity of a digestive system more complicated in the species where the dental system is more imperfect; thus we might say that these should rather be ruminating animals, where such and such an order of the teeth is wanting; we may deduce from it a certain form of the œsophagus,

and corresponding formation of the vertebræ, of the teeth, &c. But I doubt whether any one would have guessed, if observation had not suggested it, that ruminating animals would all have cloven feet, and that they alone would have them: I doubt whether any one would have guessed that those only would have horns on the forehead that belong to this class; that those amongst them who have sharp eye-teeth are for the greatest part deficient in horns, &c.

However, since these coincidences are constant, they must have a satisfactory cause; but as we do not know it, we ought to supply the defect of the theory by observation; it serves us to establish suppositious laws, which become almost as certain as the laws of reasoning, when they rest on often-repeated observations; so that now, any one who sees the track of a cleft foot may conclude that the animal who left it is ruminant; and this assertion is as sure as any other in physics or morality. This foot-mark alone gives to the observer both the formation of the teeth, the shape of the jaws, the structure of the vertebræ, and the form of all bones of the legs, thighs, shoulders, and even the frame of the animal which has passed. It is a more certain mark than all those of Zadig.

Whatever secret reasonings there may be in these relations, it is observation which has elicited them, independently of general philosophy.

In fact, when we make an assemblage of these facts, we remark not only a specific consistency, if we may use such a term, between a certain formation of a certain organ, and a certain formation of a different organ; but we perceive also a classified consistency, and a correspondent gradation in the development of these two organs, which evince, al-

most as well as an effective reasoning, their mutual influence.

For example, the dental system of hoofed animals, not ruminant, is usually more perfect than that of cleft-footed animals, or those which ruminate, because the former have either incisores or canine teeth, and generally both in both jaws; and the structure of their foot is more complicated, because they have more toes, or nails which less enclose the phalanges, or more separate bones of the metacarpus and metatarsus, or the bones of the tarsus more numerous, or a more distinct prominence of the tibia, or in fact because they unite all these points. It is impossible to account for these correspondences; but what proves that they are not the effect of chance, is, that whenever a cleft-footed animal shows, in the arrangement of its teeth, any tendency to a similarity with the animals of which we are speaking, it also evinces a similar tendency in the formation of its feet. Thus camels, which have canine teeth, and even two or four incisors in the upper jaw, have a bone more in the tarsus, because their scaphoid is not united with the cuboid, and very small nails corresponding with the phalanges which have nails. The chevrotains, whose canine teeth are much developed, bear a distinct mark along the tibia, whilst other cleft-footed animals have only, instead of the fibula, articulated a small bone along the tibia. There is then a constant harmony between two organs apparently very distinct from each other; and the gradations of their formation correspond without alteration, even in cases where we can assign no cause for the similarity.

But, in thus adopting the method of observation as an additional means when theory forsakes us, we arrive at astonishing results. The least prominence

of the bone, the smallest apophysis, have a determined character, relative to the class, the order, the genus, and even the species to which they belong; so that whenever we have only the extremity of a well-preserved bone, we may, by scrutinizing it, and applying analogical skill and close comparison, determine all these things as certainly as if we had the whole animal. I have often in this way experimented on portions of known animals, before I entirely applied the test to fossils; but it has always had such infallible success, that I have no longer any doubt on the certainty of the results which it has afforded.

It is true that I have been in possession of all the assistance which was necessary for me; and my situation and assiduous search for nearly thirty years* have procured for me skeletons of every genus and kind of quadrupeds, and even of many species in certain genera, and many individuals in certain species. With such means, I have had much ease in multiplying my comparisons, and of verifying, in all their details, the applications that I made of my laws.

We cannot now dwell longer on this method, and are compelled to refer to the larger comparative anatomy which we shall soon produce, and which will contain all these rules. However, an intelligent reader will be still able to derive a vast many from the work on fossil bones, if he will take the trouble to follow all the applications there laid down. He will see that it is by this method alone that we have been guided, and have always found it sufficient to classify each bone with its species, when it was a living species; to its genera, when it was of an unknown

*1825.

species; to its order, when it was of a new genus; and finally, to its class, when it belonged to an order not yet established; and also to assign it, in these last three cases, the proper characteristics to distinguish it from the orders, genera, or species most resembling it. Naturalists before us did no more for entire animals. Thus we have determined and classed the remains of more than one hundred and fifty mammiferous and oviparous quadrupeds.

THE GENERAL RESULTS OF THESE RESEARCHES.

Considered relatively to the species, more than ninety of these animals are certainly unknown to present naturalists; eleven or twelve have so exact a resemblance to known species, that there can scarcely be a doubt of their identity; others present, with the known species, many points of similarity; but the comparison has not been made with sufficient accuracy to remove all scruples.

Considered with regard to genera, amongst the ninety unknown species, there are nearly sixty which belong to new genera; the other species belong to known genera.

It is not unprofitable to consider these animals with relation to the class and orders to which they belong.

Of the hundred and fifty species, about a fourth are oviparous quadrupeds, and all the others are mammiferous. Amongst these, more than half belong to non-ruminating hoofed animals.

It would be premature to establish on these researches any conclusion relative to the theory of the earth; because they have not a necessary relation to the members of the genera or species which may be

embedded in our layers. Thus much has been gathered from those bones of the larger species, which more readily strike the workmen; whilst those of the smaller are usually neglected, unless chance brings them into the hands of a naturalist, or some striking circumstance, such as their abounding in certain places, should draw the attention of the common observer.

RELATIONS OF THE SPECIES WITH THE STRATA.

What is more important, and is even the most essential object of all my toil, and establishes the actual relation with the theory of the earth, is to know in what layers we find a particular species, and if there be any general and relative laws, either relative to zoological subdivisions, or to the greater or lesser resemblance of the species with those of the present day.

The recognised laws in this respect are very remarkable and very clear.

First, it is certain that oviparous quadrupeds appear much more frequently than viviparous; that they are ever more abundant, larger, and more various, in the older layers, than at the actual surface of the globe.

The ichthyosauri, the plesiosauri, many tortoises, many crocodiles, are beneath the chalk in the formations commonly called those of Jura. The monitors of Thuringia would be still more ancient, if, as is the opinion of the school of Werner, the copper slate which includes them, in the midst of so many sorts of fishes which are supposed to be of fresh water origin, is amongst the most ancient beds

of secondary formations. The immense crocodiles and great tortoises of Maestricht are in the chalky layer; but these are marine animals. This first appearance of fossil bones seems then to prove, that there were dry lands and fresh waters before the formation of the chalk; but, neither at that epoch, nor whilst the chalk was forming, nor even long afterwards, was it incrusted with the relics of terrestrial mammifera; or at least the small number of those which it is alleged have been found, form only an exception perfectly inconsequential.

We begin to find the bones of marine mammifera, that is, of lamantins and seals, in the thick shelly limestone, which is above the chalk in the neighbourhood of Paris; but there is no bone of a terrestrial mammiferous animal.

In spite of the most indefatigable researches, I have found it impossible to discover any distinct trace of this class prior to the layers deposited on the coarser limestone; lignites and molasses certainly have them; but I much doubt whether these earths are all, as is believed, anterior to the limestone; the places where they have furnished bones are too limited, too few, but that we may suppose there is some irregularity or some recurrence in their formation. On the contrary, when we reach the deposites immediately above the limestone, the bones of terrestrial animals appear in great numbers.

Thus as it is rational to believe that shells and fishes did not exist at the period of the formation of the primordial layers, we may also believe that the oviparous quadrupeds began with fishes, and from the first production of secondary formations; but that terrestrial quadrupeds have not appeared, at least in considerable numbers, until a long time,

afterwards, and when the limestone which now contains the greater portion of our genera of shells, although different in species from our own, had been deposited.

We must remark, that these coarse limestone strata, which we make use of in Paris for building, are the last banks which denote a long and peaceful flowing of the sea over our own continents. After them we find layers filled with shells and other marine productions; but these consist of shifting layers, sands, marls, sand-stones, soft clays, which rather denote changes more or less sudden, than a quiet settling; and if there be any stony or regular banks of any size beneath or above these moving layers, they generally betray marks of having been deposited from fresh water.

Nearly all the known bones of viviparous quadrupeds are then either in these deposites of fresh water, or in alluvial deposites; and consequently there is reason to believe that these quadrupeds had not begun to exist, or at least, to leave these relics in the layers that we are able to fathom, till after the last retreat but one of the sea, and during that state of things which had preceded its last irruption.

But there is also an order in the arrangement of these bones amongst themselves; and this order bespeaks a very remarkable succession in their species.

First, all the unknown genera, the palæotheria, the anoplotheria, &c. on the relative situation of which we have certain ideas, belong to the oldest of the layers in question; to those which rest immediately above the coarse limestone. It is these, principally, which fill the regular banks, deposited by soft waters or certain shifting beds, very an-

ciently formed, and generally composed of sand and round flints, and which were probably the first alluvial deposites of the ancient world. We find with them certain lost species of known kinds, but in small numbers, and some oviparous quadrupeds and fishes, which all appear in fresh water. The beds which contain them are always more or less covered over by the shifting beds, filled with shells and other marine productions.

The most celebrated of these unknown species, which belong to the known kinds, or to kinds very much resembling those that are known, such as the fossil elephant, the rhinoceros, the hippopotamus, and the mastodons, are not found amongst the more ancient kinds. It is only in the shifting layers that they are discovered, sometimes with sea-shells, sometimes with the shells of fresh water, but never in the regular stony beds. All that is found with these species is either unknown as they are, or at least doubtful.

In fact, the bones of the species which appear the same as ours, only present themselves in the last deposites of alluvions formed on the banks of the rivers, or on the beds of old ponds, or dried marshes, or in the depths of turf layers, or in the clefts and hollows of certain rocks, or finally, at a short distance from the surface, in places where they may have been embedded by casualties or by the hand of man; and their superficial position makes these bones, the most recent of any, almost always in the worst state of preservation. It must not, however, be supposed that this classifying of different relative situations is as clear as that of the species, nor that it can have a demonstrative character equally distinct; there are manifest causes why it cannot be so.

First, all my arrangements of species have been made on the bones themselves, or on good figures; it is necessary, on the other hand, that I should have observed myself all the places where these bones have been discovered. Very often I have been compelled to have recource to vague and ambiguous resemblances, made by persons who do not know themselves what peculiar observations are necessary; and more frequently still, I have not found any hints at all.

Secondly, there must be in this respect infinitely more doubt than with regard to the bones themselves. The same deposite may appear recent in places where it is superficial, and ancient in those where it is covered over by the banks which have succeeded it. Ancient layers may have been transported by partial inundations, and have covered recent bones; they may have been buried beneath them, and have enveloped and mingled them with the productions of the ancient seas which they before contained; ancient bones may have been washed by the waters, and then taken up by recent alluvial deposites; and recent bones may have fallen into the clefts and caverns of the ancient rocks, and then have been enveloped by stalactites or other incrustations. It would be necessary, in every case, to analyze and justly determine on all these circumstances, which may veil from the sight the real origin of the fossils; and persons who have collected bones have very seldom doubted this necessity; whence it follows, that the real circumstances of their geological position have nearly always been neglected or misunderstood.

Thirdly, there are some doubtful species, which would more or less alter the certainty of these results, just as long as clear distinctions with regard

to them were not made out; thus horses and buffaloes, which are found with elephants, have not yet peculiar and specific characters; and geologists who will not adopt my different epochs for fossil bones, will still be able to draw from them, for many years, an opposing argument the more convenient, as it is from my book that they will derive them.

But although it may be said that these epochs are capable of some objections with persons who but slightly consider some particular case, I am no less persuaded that those who will adopt the whole of these phenomena will not be checked by these small and partial difficulties, and will acknowledge with me, that there has been one and probably two successions in the class of quadrupeds, before that which now peoples the surface of our continents.

I here expect another objection; one has been made already.

THE EXTINCT SPECIES ARE NOT VARIETIES OF LIVING SPECIES.

Why, I am asked, should not the present race be modifications of those ancient races which we find among fossils, modifications which would have been produced by local circumstances and change of climate, and brought to this great difference by a long series of years?

This objection must appear very cogent with those who believe in the undefined possibility of the change of forms in organized bodies, and who think that with ages and habits every species may change, one into another, or result from a single one amongst them.

We may answer them in their own way; that if the species has gradually changed, we must find traces of these gradual modifications; that between the palæotheria and the present species we should have discovered some intermediate formation; but to the present time none of these have appeared.

Why have not the bowels of the earth preserved the monuments of so remarkable a genealogy, unless it be that the species of former ages were as constant as our own; or at least because the catastrophe that destroyed them had not left them time to give evidence of the changes?

As to the naturalists who allow that the varieties are confined within certain limits fixed by nature, it is necessary, in order to answer them, that we should examine what may be the extent of these limits—a curious research very interesting in itself in many respects, and yet one which has hitherto excited but very little attention.

This inquiry calls for the definition of a *species*, which may serve as the foundation for the use which is made of the term. A species, then, includes *the individuals which descend from one another, or from common parents, and those which resemble them as strongly as they resemble one another.* Thus we only call the *varieties* of a species, those races, more or less different, which may have proceeded from them by generation. Our observations on the distinctions between ancestors and descendants are consequently our only rational rule; for every other would enter into hypothesis without proofs.

But in thus considering the *variety*, we observe that the differences which constitute it depend on

determinate circumstances, and that their extent increases with the weight of these circumstances.

Thus the most superficial characteristics are the most changeable; colour depends much on light; the thickness of the hair on the heat; the size in great supply of food; but in a wild animal, even these varieties are very much limited by the habits of the animal, which does not willingly leave the places where it finds, in a quantity suited to its wants, all that is necessary for the support of its species: and which does not go far away, but as it may find all its wants as well supplied. Thus, although the wolf and the fox are found from the torrid to the icy zone, we rarely find in this vast space very little other difference than a little more or less beauty in their fur. I have compared the skulls of foxes of the north, and those of Egypt, with those of France, and have only found individual differences.

Those savage animals which are confined to more limited spaces vary still less, particularly those which are carnivorous. A thicker mane makes the only difference between the hyena of Persia, and that of Marocco.

Herbivorous wild animals feel rather more sensibly the influence of climate, because it more affects their food, which thus differs in abundance and quality at various times. Thus elephants will be greater in one forest than in another; they will have tusks larger in those places where the nourishment is more congenial with the formation of the material of ivory; it is the same with rein-deer and stags, according to their woods; but let us take the two most dissimilar elephants, and we shall not discover the least difference in the number or ar-

ticulations of their bones, in the structure of their teeth, &c.

Besides, the herbivorous species, in a wild state, appear more limited in their dispersion than carnivorous animals, because the species of the food unites with the temperature to confine them.

Nature takes care to prevent any alteration of the species which might result from their mixture, by the mutual aversion which she has implanted within them. All the plans and the power of man are called forth to effect these unions, even in the species most alike; and when the productions are fruitful, which is very rare, the fertility does not last beyond a few generations, and would not probably take place without a continuation of the cares which excited them. Thus, we do not find in the wood intermediate individuals between the hare and the rabbit, between the stag and the fallow deer, between the marten and the pole-cat.

But the sovereignty of man alters this order; it developes all the variations of which each species is capable, and derives from the productions what the species, left to themselves, would never have done.

Here the degree of variation is still proportioned to the influence of their cause,—which is slavery. It does not rank very high in the domestic species; as for instance, a cat. Hair of a finer texture, brighter colours, size greater or lesser, is all that it proves, but the skeleton of an Angora cat has no decided or perpetual difference from that of a wild cat.

In domesticated herbivorous animals, which we transport to every kind of climate, which we accustom to every sort of food, and to which we assign labour and nourishment without rule, we ob-

tain greater varieties, but still they are only superficial. A greater or lesser height, horns longer or shorter, or even entirely wanting: a lump of fat more or less developed on their shoulders, form the difference of oxen; and these differences are for a long time kept up, even in those breeds exported from the country in which they were produced, when proper care is taken to prevent the crossing.

Of this kind are the numerous varieties of sheep which are valuable for their wool chiefly, because that is the object which has obtained the greatest attention of mankind; it is still rather less, although distinctly marked in horses.

In general the forms of the bones vary but little; their structure, their articulation, the form of their large grinders never vary.

The small marks of tusks in the domestic pig, the juncture of the hoofs in some of this race, are the extreme difference that we have produced in the herbivorous domestic kind.

The most marked effects of the influence of man is evinced on the animal over which man has obtained the most complete conquest, the dog. This species is so much devoted to us, that even the very individuals seem to have sacrificed themselves to us, with their interests and their feelings. Conveyed by men to all parts of the universe, subjected to every cause capable of influencing their development, joined in their union, according to the taste of their masters, dogs vary so much in colour: in the thickness of their hair, which is sometimes lost; in its breed: in height, which differs as one to five in lineary dimensions, which makes more than a hundred fold in the mass; in the form of the ears, the nose, the tail; as to the relative

length of its legs; as to the progressive development of the brain in the domestic varieties, whence even results the shape of the head; sometimes slender, with a sharp nose, and broad forehead; sometimes with a short nose, and round forehead; as these differences are observable in a mastiff and a water spaniel; in a grayhound and a pug; are more marked than in those of any wild species of a similar natural genus. In fact, and this is the maximum of the difference known at the present time in the animal kingdom, there are breeds of dogs which have an additional toe on the hind leg, with correspondent bones of the tarsus, as there are in the human race some families having six fingers on each hand.

But in all these varieties the relations of the bones remain the same, and the shape of the teeth never undergoes any palpable change; although there are some individuals which have an extra and false grinder, sometimes on one side, sometimes on the other. (1)

There are then, in animals, characteristics which defy all influences, whether natural or human, and this is nothing which proves to us that time will effect any more than climate, and a state of domestication. I know that some naturalists rely much on the thousands of ages which they can accumulate with a stroke of the pen; but in such matters we can only judge of what a length of time would produce, by multiplying in thought what the least time will effect. I have endeavoured to collect the most ancient documents of the forms of animals,

(1) See my brother's (M. Frederic Cuvier) Memoir on the varieties of dogs, inserted in his 'Annales du Museum d'Histoire Naturelle.' This work was done at my request from the skeletons of all varieties of dogs, exprsssly prepared.

and there are no countries which furnish us with older and more abundant specimens than Egypt. It affords us not only the representation of animals, but their bodies themselves embalmed in the catacombs.

I have attentively examined the drawings of animals and birds engraved on the numerous columns brought from Egypt to Rome. All these figures have (taken as a whole, which must be the way in which artists consider them,) a perfect resemblance to those of the same species still existing.

Every one may examine the copies made by Kirker and Zoega; they have given drawings of them, easily recognised, although not precisely similar to the originals. We may easily distinguish the ibis, the vulture, the owl, the falcon, the Egyptian goose, the lapwing, the landrail, the aspic, the cerustes, the Egyptian hare with its long ears, and even the hippopotamus: and in these numerous monuments, engraved in the great work on Egypt, we sometimes have the rarest animals; the algazel, for instance, which was not seen in Europe till within these few years.(1)

My learned colleague, M. Geoffry Saint Hilaire, strongly impressed with the importance of this research, collected with great care, in the tombs and temples of Upper and Lower Egypt, all the mummies of animals which he could obtain. He brought both cats, ibises, birds of prey, dogs, monkeys, crocodiles, and an ox's head embalmed; and we cannot find any more difference between these and those of the present day, than between human mum-

(1) The first representation of it from nature, is in 'La Description de la Menagerie,' by my brother; it is accurately represented in the great work on Egypt. Descr. de l'Egypte, Ant. t. iv. pl. xlix.

mies and human skeletons of the present time. Some difference has been found between the mummies of ibis, and the bird so called by naturalists of the present day; but I have removed all difficulties in an essay on this bird subjoined to this Discourse, in which I have shown that it is at the present time precisely as it was in the time of the Pharaohs. I am aware that I only refer to animals of two or three thousand years, but these are the earliest periods to which we are enabled to revert.

There is nothing then in known facts, which can support in the least the opinion that the new genera which I have discovered or established amongst fossils, as well as those detected by other naturalists, the *palæotheria*, the anoplotheria, the megalonyces, the mastodontes, the pterodactyli, the ichthyosauri, &c., could have been the sources of any animals now existing, which would only differ by the influence of time or climate; and although it should be true (which I am far from believing) that elephants, rhinoceroses, elks, and fossil bears, differ no more from those of the present time, than the race of dogs differ from each other,—we cannot thence determine the identity of the species, because the race of dogs has been subjected to the influence of domestication, to which these other animals have not nor could not have been compelled or induced to submit.

Besides, when I assert that the rocky beds contain the bones of various genera, and the shifting or alluvial strata those of many species which no longer exist, I do not mean to allege that a new creation was necessary to produce the species now existing; I only maintain that they did not exist in the places where we now see them, and they must have been deposited there by some other means.

For instance, let us suppose that a great irruption of the sea, covers, with a mass of sand, or other accumulation, the continent of New Holland; it would bury the carcases of the *kangaroos*, *phasgolomys*, dasyuras, perameles, flying phalanger, echidna, ornithorynchus, and would entirely destroy the species of all these genera, since none of them now exist in any other country.

Suppose that the same revolution were to leave dry the multiplied small straits which separate New Holland from the continent of Asia, it would open a way for the elephant, rhinoceros, buffalo, horse, camel, tiger, and all other Asiatic quadrupeds, which would come and inhabit a land in which they were before unknown.

If a naturalist, after having well studied the living species, were to lay open the soil on which it lives, he would find the remains of very different animals.

What New Holland would become, were this supposition realized, Europe, Siberia, and a great portion of America, really are; and it may one day be discovered in the examination of other countries, and even of New Holland itself, that they have all experienced similar revolutions, I should say nearly all mutual exchanges of productions; for, to carry the supposition still farther, after this transport of Asiatic animals into New Holland, let us allow that a second revolution destroyed Asia, their original country; those who should discover them in New Holland, their second country, would be as much embarrassed to find out whence they came, as we can now be to discover the origin of those which are found in our own countries.

I now proceed to apply this reasoning to the human species.

THERE ARE NO FOSSIL HUMAN BONES.

It is a fact, that as yet no human bones have been discovered amongst fossil remains; it is an additional proof that the fossil races were not varieties of the species, since they could not have been subjected to human influence.

I beg to be clearly understood, when I say that human bones have never been found amongst fossils, to mean fossils properly so called, or in other words, in the regular layers of the surface of the earth; for in turf bogs, in alluvial deposites, as well as in burial grounds, we can as easily disinter human bones, as bones of horses or other common animals; they may also be found in the clefts of rocks, in grottos, where the stalactites would have congealed over them; but in the beds which contain the ancient races, amongst the palæotheria, and even amongst elephants and rhinoceroses, not a particle of human bone has ever been discovered. Many of the workmen in the gypsum quarries, near Paris, think that the bones with which they abound are human; but as I have seen many thousands of these bones, I may be allowed to assert that they have never produced a single bone that ever formed a part of the human frame. I have examined at Pavia the piles of bones collected from the isle of Cerigo, by Spallanzani, and in defiance of the assertion of this celebrated observer, I affirm, in like manner, that there is not one which can be proved to be human. Scheuchzer's *homo diluvii testis* has been placed since my first edition with its real genus, that of the salamanders; and in an examination which I have been since enabled to make at Haarlem, through the kindness

of M. Van Marum, who allowed me to uncover the parts concealed in the stone, I have substantiated satisfactorily what I before asserted. We see amongst the bones found at Cronstadt, the fragment of a jaw, and some articles of human manufacture; but we know that the ground was dug up without care, and that no observation was made of the various depths at which each relic was discovered. Besides, in every instance, the fragments said to be human have been found on examination to be those of some animal, whether they have been examined themselves, or by figures of them.

Very lately a pretended discovery was made at Marseilles, in a quarry, for a long time neglected;(1) but they only proved to be marine productions (*tuyaux marins.*) (2) The real human bones were carcases fallen into clefts of the rock, or left in ancient galleries of mines, or become encrusted; and I extend this assertion even to the human skeletons discovered at Guadaloupe,(3) in a rock formed of a collection of madrepores cast up by the sea, and united by water strongly imbued with a calcareous matter.(4) The human bones found near Koestritz,

(1) See le Journal de Marseilles et des Bouches Du Rhone, des 27 Sep. 25 Oct. and 1er Nov. 1820.

(2) I am convinced of this by the drawings sent by M. Cottard, Professor at the College of Marseilles.

(3) Vide Plate.

(4) These skeletons, more or less mutilated, are found near Pont du Moule, at the north-east coast of the high land of Guadaloupe, in a kind of slope resting on the steep bank of the island, which the water in great measure covers at high tide, and which is only a tufa formed and daily increased by the very small particles of shells and corals which the sea wears away from the rocks, the whole mass of which coheres very firmly in those parts which are most frequently left dry. We find, with the aid of a magnifying glass, that many of these fragments have the same red tint as a portion of the corals contained in the reefs of the island. These sorts of formation are common in all the Archipelago of

and pointed out by M. de Schlotheim, were said to have been extracted from very ancient beds; but this respectable naturalist is desirous of making known

the Antilles, and are called by the negroes *maçonne-bon-dieu*. Their accumulation is the more rapid in proportion as the sea is more violent. They have extended the plain of the Cayes to San Domingo, whose situation is somewhat similar to that of the Plage du Moule, and sometimes fragments of vessels of human workmanship are found at a depth of twenty feet from the surface. A thousand conjectures have been made, and events have even been imagined to account for these skeletons of Guadaloupe; but, after all these circumstances, M. Moreau de Jonnés, corresponding member of the Academy of Science, who has visited the place, and to whom I am indebted for all this detail, is of opinion that they are only the carcases of persons who have been shipwrecked. They were discovered in 1805, by Manuel Cortes y Campomanes, at that time a staff officer in the service of that colony. General Ernouf, the governor, had one extracted with much care. It even had the head and nearly all the upper extremities. It was left at Guadaloupe, with hopes of getting one more complete, and then to send the two to Paris; but when the island was taken by the English, admiral Cochrane, having found this skeleton at head quarters, sent it to the English Admiralty, who presented it to the British Museum. It is now in that collection, and M. Kœnig, keeper of the mineralogical department, described it in the Philosophical Transactions of 1814, and I saw it there in 1818. M. Kœnig remarks, that the stone in which it is embedded has not been cut, but seems to have been simply inserted as a distinct kernel in the surrounding mass. The skeleton is so superficial, that its presence must have been visible from the projection of some of the bones. They still contain *some of the animal matter, and the whole of their phosphate of lime.* The rock, entirely composed of parcels of coral and compact lime-stone, is easily dissolved in nitric acid. M. Kœnig has detected fragments of the *millepora miniacea* of some madrepores and shells, which he compares to the *helix acuta* and *turbopica.* More recently, general Donzelot has extracted another of these skeletons, now in the cabinet of the king, of which we give an engraving. It is a body with bent knees. A portion of the upper jaw is still left, the left half of the lower, nearly all one side of the trunk and pelvis, and a great part of the upper extremity, and the lower left extremities. The rock in which it is embedded is certainly travertin, in which are embed-

how much the assertion is still a matter of doubt. (1) It is the same with articles of human manufacture. The fragments of iron found at Montmartre, are points of the tools which the workmen employ in blasting, and which sometimes break in the stone. (2)

Yet human bones preserve equally well with those of animals under similar circumstances. There is no difference between the human mummies found in Egypt, and those of quadrupeds. I collected, in the excavations made some years since in the old church of St. Genevieve, some human bones interred beneath the first race, which may have belonged to some prince of the family of Clovis, which have still preserved their forms very accurately. (3) We do not find in ancient fields of battle that the skeletons of men are more altered than those of horses, if we allow for the difference of size; and we find among the fossils, animals as small as rats still very perfectly preserved.

All these tend to confirm the assertion, that the human race did not exist in the countries where

ded shells of the neighbouring sea, and land shells still to be found alive in the island, and which are known as the *bulimus Guadaloupensis* of Ferrusac.

(1) See Le Traité des Petrifactions of M. de Schlotheim. Gotha, 1820, page 27; and his letter in the Isis, of 1820; 8th No. Suppl. No. 6.

(2) It is perhaps necessary to make some mention of the fragments of sand-stone, of which some talk was made last year (1824,) in which a man and horse were said to have been found petrified. The very fact of its being a man and horse, with the flesh and skin, which must have been visible, was sufficient to inform the whole world that it was a *lusus naturæ*, and not a real petrifaction.

(3) Fourcroy has given an analysis. Ann. du Museum, tome x. p. 1.

fossil bones are found, at the epoch of the revolutions which buried these bones; for there cannot be assigned any reason why mankind should have escaped such overwhelming catastrophes, nor why human remains should not now be discovered as well as those of other animals; but I do not wish to conclude that man did not exist previously to this epoch. He might have inhabited some confined tract of country, whence he repeopled the world after these terrible events; perhaps the places in which he dwelt have been entirely swallowed up, and his bones buried at the bottom of the present seas, with the exception of the small number of individuals who have propagated the species.

However it may be, the establishment of man in the country where we have said that the fossil remains of land animals are found, that is, in the greatest part of Europe, Asia, and America, is necessarily posterior, not only to the revolutions which have covered these bones, but even to those which have laid open the strata which envelope them, and which are the last which the globe has been subjected to; whence it is clear that we can neither draw from the bones themselves, nor from the more or less considerable masses of rock or earth which cover them, any argument in favour of the antiquity of the human species in these different countries.

PHYSICAL PROOFS OF THE NEWNESS OF THE PRESENT STATE OF THE CONTINENTS.

On the contrary, in closely examining what has taken place on the surface of the globe since it was left dry for the last time, and the continents have hence assumed their present form, at least in the highest parts, we clearly see that the last revolution, and consequently the establishment of present society, cannot be very ancient. It is one of the results, at the same time the most clearly proved, and the least regarded in sound geology; a result the more valuable as it unites, in an unbroken chain, natural and civil history.

In measuring the effects produced in a certain time, by causes still at work, and in comparing them with those which they have produced since the commencement of their operations, we can determine nearly the very moment whence their action may be dated, which is of necessity the same as that when our continents received their present form, or that of the last retreat of the waters.

It is in fact, from this retreat that we must begin to calculate the wearing away of our steep eminences, and the formation of banks of debris at their bases; that our present rivers began to flow and to deposite their alluvial spoils; that our present vegetation began to extend itself and to produce mould; that our present cliffs have begun to be worn away by the sea; that our present downs have begun to be accumulated by the wind; as also from this epoch must we calculate that colonies of the human race commenced or recommenced to spread themselves abroad, and to form establish-

ments in places which nature has assigned to them. I do not speak of volcanoes, not only because of their irregular irruptions, but because nothing proves that they could have existed beneath the sea, and therefore they are no service in proving what lapse of time has occurred since the last retreat of the sea.

LANDS GAINED BY THE PERPETUAL DEPOSITE OF ALLUVIAL MATTER BY RIVERS.

MM. Deluc and Dolomieu have most attentively examined the progress of the lands formed by the deposites of the rivers; and although at issue on a great number of the points of their theory of the earth, they agree in this: these alluvial accumulations increase very rapidly, and must have augmented much more quickly at first, when the mountains afforded more materials for the streams, and yet their extent is but very limited.

The memoir of Dolomieu on Egypt,(1) tends to prove that, in the time of Homer, the tongue of land on which Alexander built his city was not then in existence; and that they were able to navigate from the island of Pharos, into the gulf, and since called, lake Mareotis; and that this gulf was then from fifteen to twenty leagues long, as stated by Menelaus. The nine centuries then between Homer and Strabo were sufficient to bring matters to the state described by the latter, and to reduce this gulf to the form of a lake six leagues long. It is still even true, that since that period things have

(1) Journal de Physique, tome xlii. p. 40, &c.

undergone a still greater change. The sands thrown up by the sea and the wind have formed between the isle of Pharos and the ancient city, a tongue of land, of two hundred fathoms in breadth, on which the modern city has been built. It has blocked up the nearest mouth of the Nile, and diminished the lake Mareotis to nearly nothing. During this period the alluvial deposites of the Nile have been left on the banks, and very much increased their extent.

The ancients were acquainted with these alterations. Herodotus says, that the priests of Egypt looked on their country as the gift of the river Nile. It is only a short time, he says, that in a manner the Delta has appeared.(1) Aristotle observes, that Homer speaks of Thebes, as if it were the only city of Egypt, and makes no mention of Memphis.(2) The Canopian and Pelusian mouths of the Nile were formerly the principal ones; and the coast extended in a direct line from one to the other; it appears so in the charts of Ptolemy: since his time, however, the water has been cast into the Bolbitian and Phatnitic mouths; and at these entrances the most extensive formations of accumulated alluvial deposites have been made, which have given a semicircular contour to the coast. The cities of Rosetta and Damietta, built on the sea shores at these mouths, less than a thousand years since, are now two leagues distant from it. According to Demaillet, it would only have required twenty-six years to form a cape half a league in length in front of Rosetta.(3)

(1) Herod. Euterpe, v. and xv.
(2) Arist. Méteor. lib. i. cap. xiv.
(3) Demaillet Descr. de de l'Egypte, p. 102 and 103.

The height of the soil of Egypt is produced at the same time as the extension of its surface; and the bottom of the bed of the river is elevated in proportion to the adjacent plains, whence the inundation of every succeeding century much exceeds the height of the marks it left of its preceding ones. According to Herodotus, a lapse of nine hundred years was enough to establish a difference in the level of seven or eight cubits (ten or twelve feet;) (1) at Elephantia, the inundation now reaches seven feet higher than during the reign of Septimus Severus, at the beginning of the third century. At Cairo, before it is deemed sufficient for the purpose of irrigating the lands, it must attain a height of three feet and a half more than was requisite in the ninth century. The ancient monuments of this country are all more or less enveloped in the soil. The mud left by the river even covers the small artificial hills on which the ancient cities were founded, to a depth of several feet. (2)

The Delta of the Rhone is no less remarkable for its accumulations. Astruc details them in his history of Languedoc; and by a careful comparison of the descriptions of Mela, Strabo and Pliny, with the state of the places as they were at the commencement of the eighteenth century, he proves, by the aid of many writers of the middle ages, that the arms of the Rhone have extended them-

(1) Herod. Euterpe, xiii.

(2) See the Observations on the valley of Egypt, and on the regular increase of the soil which covers it, by M. Girard, in the great work on Egypt, and Mod. Mem. v. 2, p. 363. On which we may remark that Dolomieu, Shaw, and other good authors, estimate these accumulations much higher than M. Girard. It is to be regretted, that the thickness of these layers have been no where examined, either on the primitive soil or the natural rock.

selves three leagues during eighteen centuries; that the alluvial accumulations of a similar kind have been formed to the west of the Rhone, and that many places situated six or eight centuries since on the bank of the sea shore, or large pools, are now many miles inland.

Any person may observe in Holland and Italy, how rapidly the Rhine, the Po, and the Arno, now that they are confined within dykes, raise their bed; how their mouths approach the sea by forming long promontories at their sides, and can judge by these facts how few centuries these waves have employed in depositing the flat plains which they at present traverse.

Many cities which at well known periods of history were flourishing sea ports, are now several leagues inland; many have even been ruined in consequence of this change of situation. Venice can scarcely preserve the *lagoons* which separate her from the continent; and in spite of every exertion she will one day become united to the mainland. (1)

We learn from Strabo, that in the time of Augustus, Ravenna was amongst lagoons, as Venice now is; and now Ravenna is a league from the shore. Spina was founded by the Greeks on the sea shore; yet in Strabo's time it was ninety stadia from it, and it is now destroyed. Adria in Lombardy, which conferred its title on the sea, and of which it formed upwards of twenty centuries and more the principal port, is now six leagues distant from it. Fortis, has even reckoned it probable that

(1) See the Memoir of M. Forfait on the lagoons of Venice, with Mem. de la Classe Phys. de l'Inst. vol. v. p. 213.

at a period still more remote the Euganian mountains may have been islands.

My learned brother of the Institute, M. de Prony, inspector general of the bridges and roads, has communicated to me his valuable researches explanatory of these changes in the shores of the Adriatic.

EXTRACT FROM THE RESEARCHES OF M. DE PRONY, ON THE HYDRAULIC SYSTEM OF ITALY.

"*Account of the displacement of that portion of the banks of the Adriatic sea, which is occupied by the mouths of the Po.*

"That part of the coast of the Adriatic, contained within the southern extremities of the lake, or rather the lagoons (*lagunes,*) of Comachio, and the lagoons of Venice, has undergone since early times vast changes, attested by many veracious authors, and which is borne out by the present state of the soil in the districts on the coast; but it is impossible to detail with precision the successive progress of these changes, and particularly the exact measures previously to the twelfth century of our era.

"We are however sure that the city of Atria, now Adria, was formerly situated on the sea-coast; and this gives us a decided and known point of the primitive shore, whence the shortest distance to the present shore, taken from the mouth of the Adige, is 25,000 metres,* (15½ miles and upwards.) The

* We shall find that the farther extremity of the alluvial promontory formed by the Po, has advanced into the sea farther by ten thousand metres (6¼ miles nearly) than the mouth of the Adige.

inhabitants of the city have formed very exaggerated notions, in many instances, on the antiquity of this city; but it cannot be denied that it is one of the most ancient in Italy; it gave name to the city which washed its walls. By some excavations made there, and in the vicinity, a stratum mixed with relics of Etruscan pottery has been discovered, in which there is no mixture of Roman workmanship; the Etruscan and Roman are found mingled in an upper stratum, above which the vestiges of a theatre have been found. Both layers are very much below the present soil. I have seen in Adria curious collections, in which the relics that they contain are arranged separately. The prince viceroy, to whom I observed how interesting it would be to history and geology, if a research were made into all the excavations of Adria, as well in the primitive soil, as in the successive alluvial deposites, seemed much struck with my suggestions, but I am not aware if they were carried into effect.

"On leaving Atria, which was seated at the bottom of a small gulf, we find, in following the line of coast, to the south, a branch of the Athesis (Adige) and the Fossa Philistina, of which the remaining trace corresponds with what might have been the re-union of the Mincio and Tartaro, if the Po still flowed southward of Ferraro. Afterwards we come to the Delta Venetum, which appears to have occupied the place now the site of the lake or lagoon of Comachio. This Delta was traversed by seven branches of the Eridanus, or Vadis Padus, Podincus or Po, as it was variously called, which had on its left bank, at the various ramifications of these mouths, the city of Trigopolis (Trigoboli) whose site could not be very distant from Ferraro. The seven lakes of the Delta were called Septem Maria, and Hatria

is sometimes called Urbs Septem Marium, or the city of the seven seas or lakes.

"Pursuing the line of coast more north from Hatria, we reach the principal embouchure of the mouth of the Athesis, called also Fossa Philistina, and Æstuarium Altini, an inland sea, separated from the ocean by a chain of islets, in the midst of which is a small archipelago of other islands, called Rialtum, on which cluster Venice now stands. The Æstuarium Altini is the lagoon of Venice, which only communicates with the sea by five passages; the small islands which have been united to form a continuous dyke.

"Eastward of the lagoons, and northward of the city of Este, are the Euganian mountains, forming in the midst of a vast alluvial plain, a singular and isolated group of conical hills, near which the ancients fixed the spot of the celebrated fall of Phæton. Some writers assert that this fable originated from the vast masses of inflamed materials, cast by the volcanic eruptions into the mouths of the Po. It is certain that a great quanty of volcanic productions are found in the vicinity of Padua and Verona.

"The earliest information which I have attained respecting the situation of coast of the Adriatic, at the mouths of the Po, has, from the twelfth century some exactness. At this period all the waters of the Po flowed southward of Ferraro, in the Po di Volano, and the Po di Primaro, ramifications which then flowed over what is now occupied by the lagoon of Commachio. The two mouths with which the Po afterwards made an irruption northward of Ferraro, were called respectively, the river of Corbola, Longola, or Mazorno; and the river of Toi. The former, which was most northward, the Tartaro

or Canal Bianco, near the sea; the latter was increased at Ariano by a branch of the Po, called the river Goro.

"The coast of the sea was possibly inclined from south to north, at a distance of ten or twelve thousand metres (between six and eight English miles) from the meridian of Adria; it then passed the western angle of Mesola; and Lorea, north of Mesola, was only distant about two thousand metres (more than a mile.)

"About the middle of the twelfth century, the great waters of the Po passed across the dykes which restrained them on the left side of the coast, near the small city of Ficarolo, situated 19,000 metres (nearly twelve miles) north-west of Ferrara, and spreading themselves over the northern territory of Ferrara, and the Polesine of Rovigo, flowed into the two above-mentioned canals of Mazzorno and Toi. It is well known that the labour of man has had much to do in effecting this diversion of the waters of the Po; and historians who have mentioned this remarkable fact, only differ in the detail. The tendency of the river to follow the new tracks made for it, becoming daily more and more powerful, the two branches of the Volano and the Primaro rapidly decreased, and were in less than a century reduced nearly to the state in which they now are, and the main channel of the river was formed between the mouth of the Adige, and the place now called Porto di Goro. The two canals becoming inadequate, new ones were dug; and at the beginning of the seventeenth century, its principal mouth, called Bocco Tramontana, having approached too nearly to the mouth of the Adige, it greatly alarmed the Venetians, who in 1604, dug the new bed called Taglio de Porto Viro, or Po delle Fornaci, by means of

which the Bocco Maestra was diverted from the Adige towards the south.

During the four hundred years which elapsed from the end of the twelfth to the end of the sixteenth century, the alluvial deposites of the Po gained considerably on the sea. The northern mouth which flowed in past the situation of the canal of Mazzorno, and formed the Ramo Tramontana, was, in 1600, twenty thousand metres (twelve miles) from the meridian of Adria; and the southern mouth, which had taken the place of the canal of Toi, was at the same period seventeen thousand metres (ten miles) from that meridian; thus the coast had become enlarged nine or ten thousand metres (five or six miles) to the north, and six or seven thousand metres (between three and four miles) to the south. Between the two mouths of which I have spoken, was part of the coast which receded a little, called Sacca di Goro.

"It was during the same interval, between the thirteenth and seventeenth centuries, that the great works of the embankments of the Po were made, and a considerable portion of the western declivities of the Alps were cleared away and cultivated.

"The canal called Taglio di Porto Viro, determines the progress of the alluvial deposites in the great promontory formed by the mouth of the Po. In proportion as their entrances into the sea are distant the annual quantity of deposites increase in an alarming degree, as well from the diminution of the inclination of the waters (the necessary consequence of the extent of the bed of the river) as from the confinement of these waters within dykes, and by the facilities which the recently cultivated sloping lands afforded of carrying the soil of the mountains into the plains. Thus the bay of Sacca di Goro was choked up, and the two promontories formed by the

two first mouths united into one, the present extremity of which is thirty-two or thirty-three thousand metres (nineteen to twenty miles) from the meridian of Adria. Thus, in two centuries, the mouths of the Po have gained fourteen thousand metres (nearly nine miles) on the sea.

"Of this hasty sketch these are the results:

"1st. That at an early period, the precise date of which cannot be ascertained, the Adriatic sea washed the walls of Adria.

"2dly. That in the twelfth century, before a passage had been opened at Ficarolo, for the waters of the Po, on the left bank, the sea-shore was removed nine or ten thousand metres (six miles) from Adria.

3dly. That the extremities of the promontories formed by the two principal mouths of the Po, were, in 1600, before the formation of the canal of Taglio di Porto Viro, at a mean distance of eighteen thousand five hundred metres (twelve miles) from Adria; which, since the year 1200, gives an extent of alluvial deposite of twenty-five metres (twenty-seven yards one foot and a fraction, English admeasurement.*)

"4thly. That the extremity of the single promontory, formed by the present mouths, is thirty-two or thirty-three thousand metres (nineteen to twenty miles) from the meridian of Adria; whence we may conclude the mean progress of the alluvial deposites to be about seventy metres (upwards of seventy-six yards) per annum for the last two centuries, which is a rapidity greater than that of preceding ages.

"De Prony."

* The *metre* was a measure adopted during the French revolution, of about 39½ inches English measure.—*Translator.*

M. de Prony having been employed by the government to examine what remedies could be applied to the devastations occasioned by the floods of the Po, ascertained that this river, since the time when dykes enclosed it, has elevated its bed so greatly, that the surface of its waters is now higher than the roofs of the houses of Ferrara; at the same time its alluvial deposites have advanced to the sea with so much rapidity, that on a comparison between the ancient charts and the present state, we find that the shore has gained more than six thousand fathoms since 1604, which is an average of one hundred and fifty or one hundred and eighty, and in some places, two hundred feet per annum. The Adige and Po are now more elevated than all the land which lies between them; and it is only by opening again new channels in the low lands which they formerly deposited, that we can avert the disasters with which they now threaten us.

The same causes have produced the same effects along the branches of the Rhine and the Meuse; and thus the richest districts of Holland have perpetually before them the frightful sight of their waters suspended above their soil at a height of twenty or thirty feet.

M. Wiebeking, director of the bridges and roads in the kingdom of Bavaria, has written a memoir on this progress of things, so important to be well understood by the people and the government, in which he shows that this property of elevating their beds belong more or less to all rivers.

The accumulations along the coasts of the North Sea are not less quickly formed than in Italy. We can easily trace them in Friesland and in Groningen, where the first dykes were constructed by the

Spanish governor, Gaspar Robles, in 1570. A century afterwards land had been formed in some places three quarters of a league beyond these dykes; and the city of Groningen itself, partly built on the ancient soil, on a limestone which does not belong to the present sea, and in which we find the same shells as in our coarse limestone in the neighbourhood of Paris, is only six leagues from the sea. Having visited these places, I can myself testify other well-known facts, the greater portion of which M. Deluc has already ably explained.(1) The same phenomenon may be observed, and with the same exactitude, along the coasts of East Friesland, and the countries of Bremen and Holstein, because the parts are known where the new lands were enclosed for the first time, and thence we can measure what has since been gained.

This alluvial plain, so very fertile, formed by the rivers and the sea, is in this country a gift the more valuable, as the ancient soil, covered with heath and turf-bogs (*tourbières*) is incapable of being made to produce vegetation; the alluvial deposites alone supply the means of subsistence to the inhabited cities established along this coast since the middle age, and which would not have reached their present opulent state without the rich lands which the rivers produced for them, and which they are continually augmenting.

If the extent which Herodotus assigns to the sea of Azof, which he makes nearly equal to that of the Euxine,(2) was expressed in less ambiguous terms, and if we clearly knew what he meant by the Gerr-

(1) In various parts of the two last volumes of his Letters to the Queen of England.

(2) Melpom, lxxxvi.

hus(1) we should find there also strong proofs of the changes produced by the rivers and the rapidity with which they are effected, for the alluvial deposites of the river could alone(2) during this epoch, that is, for two thousand two or three hundred years, have reduced the sea of Azof to its present size, have closed the course of the Gerrhus, or that branch of the Dnieper which would have united with the Hypacyris, and with that river have thrown its waters into the gulph Carcinites or Olu-Deignitz, and have reduced the Hypacyris itself to nearly nothing.(3) We should have proof no less powerful if it were ascertained that the Oxus or Sihoun, which now disembogues itself into the lake Aral, fell once into the Caspian sea; but we have close at hand proofs sufficiently convincing without being compelled to have recourse to any in the least ambiguous, or to make the geographical ignorance

(1) Ibid, lvi.

(2) This supposed diminution of the Black sea and the sea of Azof has been attributed to the breaking up of the Bosphorus, which happened at the pretended epoch of the deluge of Deucalion; and yet, to establish the fact, recourse is had to the successive diminutions of the extent assigned to these seas in Herodotus, Strabo, &c. But, it is quite plain that if this diminution had arisen from the rupture of the Bosphorus, it must have been completed long before the time of Herodotus, and even the period called that of Deucalion.

(3) See Rennel's Geography of Herodotus, p. 56, &c. and a part of M. Dureau de Lamalle's work, called 'The physical Geography of the Black Sea,' &c. At present there is only the very small river of Kamennoipost, which can represent the Gerrhus or Hypacyris of Herodotus.

M. Dureau, p. 170, attributes to Herodotus the making the Borysthenes and Hypanis discharge their waters into the Palus Mœotis; but Herodotus only says (Melp. liii.) that these two rivers flow together on to the same lake, that is, Liman, as at present. He does not carry the Gerrhus and Hypacyris farther.

of the ancients any grounds for our physical proposition. (1)

PROGRESS OF THE DOWNS.

We have already spoken of the downs, or those sand heaps which the sea throws on flat shores when its bottom is sandy. Whenever the industry of man has failed in confining them, these downs advance inland as irresistibly as the alluvial deposites of rivers advance towards the sea; they drive before them pools formed by the rainwater of the lands in their vicinity, whose progress towards the sea they intercept, and their advance in many places is made with alarming rapidity. Forests, buildings, cultivated fields, are overwhelmed by them. Those of the Bay of Biscay (2) have already covered a number of villages mentioned in the accounts of the middle ages, and at this time, in the single depart-

(1) For instance, M. Dureau de Lamalle, in his 'Physical Geography of the Black sea,' quotes Aristotle (Meteor, lib. 1. c. 13) as "telling us that in his time there were many ancients, periods and peripli, proving that there was a canal leading from the Caspian sea to the Palus Mœotis." But Aristotle says in the passage in question, (ed. de Duval, i. p. 545,) "From the Paropamisus, amongst other rivers, descend the Bactrus, the Choaspes, and Araxes, whence the Tanais, a branch of it, takes its rise into the Palus Mœotis." Who cannot see that this blunder, founded neither on periods nor peripli, was only the wild ideas of Alexander's soldiery, who took the Jaxartes or Tanais of the Transoxian for the Don or Tanais of Scythia? Arrian and Pliny distinguish them; but this was not the case in Aristotle's time. How then can geological arguments be derived from such geographers?

(2) See the Report of the Downs of the Bay of Biscay by M. Tassin, Mont de Marsan, an X.

ment of Landes, they are threatening to advance with inevitable destruction. One of these villages, that of Mimisan, has struggled against them for twenty years, and a down more than sixty feet high is perceptibly approaching it.

In 1802 the pools overflowed five fine farms in the village of St. Julien.(1) They have long since covered an ancient Roman road leading from Bourdeaux to Bayonne, and which could be seen forty years ago when the waters were low.(2) The Adour, which was known to have formerly passed Old Boucaut, and flowed into the sea at Cape Breton, is now turned from it more than a thousand fathoms.

The late M. Bremontier, inspector of bridges and roads, who made great researches on downs, calculated their progress at sixty feet annually, and in some places at seventy-two. According to his calculations, they will reach Bourdeax in two thousand years; and from their present size, rather more than four thousand years must have elapsed since their accumulation commenced.(3) The overwhelming of the cultivated lands of Egypt by the steril sands of Libya, which the west wind casts on them, is a phenomenon similar to that of the downs. These sands have buried a number of cities and villages, whose ruins may still be seen; and that since the conquest of the country by the Mahometans, since the tops of mosques and the pinnacles of minarets are to be seen projecting through the sand.(4) Advancing so rapidly, they would doubtlessly have

(1) Memoirs of M. Bremontier of the fixing of Downs.
(2) Tassin loc. Cit.
(3) See Bremontier's Memoir.
(4) Denon—Voyage en Egypte.

filled the narrow defiles of the valley if so many ages had elapsed since they began to be cast there.(1) There would be nothing left between the Libyan chain and the Nile. It is then a chronometer, the measure of which it would be as easy as interesting to obtain.

TURF BOGS AND SLIPS.

The turf bogs, so generally produced in the north of Europe by the accumulation of the remains of sphagna and other aquatic mosses, also give us a measure of time. They increase in proportion determined with regard to each place; they thus envolope the small mounds of earth on which they are formed. Many of these mounds have been covered within the memory of man. In other places the turf-bog descends along the valleys; it advances like the glaciers, but the glaciers melt at the base, whilst the turf-bog is impeded by nothing. By sounding it down to the solid soil, we judge of its antiquity; and we find with turf bogs as with downs, that they cannot have commenced at an indefinite and very remote epoch. It is the same with slips, which are made with vast rapidity at the base of steep rocks, and which are still very far from having covered them. But, as no precise measurements have yet been applied to these two operations, we shall not expatiate on them farther.(2)

(1) We may here refer to all travellers who have traversed the western parts of Egypt.

(2) These phenomena are well discussed in the Letters of M. Deluc to the Queen of England, where he treats of the turf

We see that wherever nature addresses us, she always uses the same language—every where informs us that the present state of things has not commenced at a very remote period; and, what is not a little singular, we hear every where echoes of the voice of nature, whether we consult the authentic traditions of nations, or examine their moral and political condition, and the intellectual development which they had reached at the moment whence their authentic remains take date.

THE HISTORY OF NATIONS CONFIRMS THE NEWNESS OF THE CONTINENTS.

Although, at the first glance, the traditions of some ancient nations, who extend their origin for so many thousands of years, may seem to contradict very powerfully the newness of the present world, yet, when we examine these traditions more carefully, we are not long in concluding that they are not founded in history; on the contrary, we are soon convinced that the real history, and all that it has

mosses of Westphalia; and in his Letters to Lametherie, inserted in the Journal de Physique of 1791, &c. as well as those addressed by him to M. Blumenbach, 1798. We may add the interesting details given in his Geologic Voyage, vol. i., on the isles of the west coast of the duchy of Sleswic, and the manner of their union, either with themselves or with the continent, by alluvial deposites and turf bogs; as well as respecting the irruptions which have from time to time destroyed or separated some of their parts.

As to the slips, Mr. Jameson, in a note to his English translation of this Discourse, cites a remarkable instance taken from the steep rocks near Edinburgh, called Salisbury Crags. Although of a trifling height, the abrupt and vertical face is not yet concealed by the mass of debris accumulated at their feet, and which yet annually increases.

transmitted to us of positive proofs of the early establishment of nations, confirms what the natural records had declared.

The chronology of none of the nations of the west can be traced unbroken farther back than three thousand years. None of them can produce before this epoch, nor even for two or three centuries afterwards, a succession of events united by a semblance of truth. The north of Europe has no history previous to its conversion to Christianity; the history of Spain, of Gaul, of England, has no earlier date than the conquest by the Romans; that of northern Italy, previously to the foundation of Rome, is now almost unknown. The Greeks confess that they did not know the art of writing until they were taught by the Phœnicians, about thirty-three or thirty-four centuries ago. For a long period subsequently, their history is full of fables; and they are unable to go farther back than three centuries earlier, for the first traces of their union as a body. We have, in the history of western Asia, but a few contradictory extracts, which only reach, with very slight connexion, to twenty-five centuries back;(1) and, admitting the few historical details which refer to periods more remote, we can scarcely exceed the date of forty centuries.(2)

Herodotus, the earliest profane writer whose works are left to us, lived one thousand three hundred years ago.(3) The earliest historians before

(1) To Cyrus, about 650 years before Christ.

(2) To Nisus, about 2348 years before Christ, according to Ctesias and those who have followed him; but only to 1250, according to Volney, who follow Herodotus.

(3) Herodotus lived B. C. 440.

him, whom he consulted, were only one hundred years old.(1)

We may judge how far they are to be depended on, by their extravagant tales, which are handed down to us in the extracts from Aristæus of Proconnesus, and others.

Before them there were only poets; and the most ancient of those whose works have been preserved, Homer, the master and perpetual model of all the west, has only preceded our own times by two thousand seven hundred, or two thousand eight hundred years.

When these early historians mention ancient events, either of their own nation or of those near them, they only cite oral traditions, and not public records.

It was long after this, that pretended extracts from Egyptian, Phœnician, and Babylonian annals were given. Berosus only wrote during the reign of Seleucus Nicator, Hieronymus during that of Antiochus Soter, and Manetho under the government of Ptolemy Philadelphus. These three were only three centuries earlier than the coming of Jesus Christ.

Sanchoniatho may be a real or fictitious author; but nothing was known of him until Philo of Byblos published a translation of his work in the second century after Jesus Christ; and when it was made known, there was only discovered, as in all other authors of his kind, a childish theogony, or metaphysics, so blended with allegories, as not to be distinguishable.

(1) Cadmus, Pherecydes, Aristæus of Proconnesus, Acuitlaus, Hecateus of Miletus, Charon of Lampsacus, &c.—Vide Vossius de Hist. Græc. lib. i. and particularly his fourth book.

Only one people, the Jews, have preserved prose records of an earlier date than the time of Cyrus.

That part of the Old Testament called the Pentateuch exists, in its original state, at least since the dispersion of the ten tribes under Jeroboam; for the Samaritans had it as well as the Jews; and its antiquity may be confidently reckoned at more than two thousand eight hundred years.

There is no reason to doubt but that the book of Genesis was composed by Moses himself, which would give it a still farther antiquity of five hundred years, namely, thirty-three centuries: and it is sufficient to read it to perceive that it was composed partly of fragments of former works. There is, however, no doubt of its being the most ancient writing which the world is in possession of.

But this work, and all those written subsequently, however unaquainted their authors were with Moses and his people, describe the nations of the banks of the Mediterranean as newly formed; they mention them as half savages some centuries after; moreover, they all allude to a universal catastrophe, of an irruption of the waters, which occasioned an almost entire regeneration of the human race; and they do not go very remotely into antiquity to decide the epoch of this event.

The texts of the Pentateuch, which place this catastrophe the farthest back, do not go more remotely than twenty centuries before Moses, nor consequently more than five thousand four hundred years before our time. (1)

The poetical traditions of the Greeks, the source

(1) The Septuagint, 5345 years: the Samaritan text, 4869: the Hebrew text, 4174.

of all our profane history which refers to these early periods, have nothing which contradicts the Jewish records; on the contrary, they agree very harmoniously as to the epoch which they assign to the Egyptian and Phœnician colonies, which gave to Greece the first germs of civilization: we see, besides, that about the same period at which the Israelitish tribes departed from Egypt to carry into Palestine the sublime doctrine of the unity of God, other colonies left the same country, to carry into Greece a more gross religion, at least with respect to exterior form, whatever might be the secrets which it reserved for the initiated; and others again came from Phœnicia, and taught the Greeks the art of writing, and all that relates to navigation and commerce. (1)

Certainly we have not had a continuous and connected history since that time, as we find, very long after these founders of colonies, a multitude of mythological events and adventures, in which gods and heroes are introduced; and these chieftains are connected with real history by genealogies evidently fictitious;(2) but what is still more certain is, that

(1) We know that chronologists differ many years concerning each of these events; but these migrations do not the less form remarkable events, and give a peculiar character to the fifteenth and sixteenth centuries before Jesus Christ.

In the following calculation of Usserius, Cecrops came from Egypt to Athens about 1556 before Christ; Deucalion settled on Parnassus about 1548; Cadmus arrived from Phœnicia at Thebes about 1493; Danaus arrived at Argos about 1485; Dardanus was established on the Hellespont about 1449. All these founders of nations must have been nearly contemporary with Moses, whose migration occurred in 1491. See, moreover, on the synchronysm of Moses, Danaus, and Cadmus, Diod. lib. xi. and Photius, page 1152.

(2) Every body knows the genealogies of Apollodorus, and the arguments on which Clavier endeavoured to establish a kind

all which preceded their arrival could only have been preserved in very confused traditions, and could have been only supplied by unfounded inventions, similar to those of the monks of the middle age concerning the origin of the nations of Europe.

Thus, not only we should not be astonished that, even in ancient times, there should have existed many doubts and contradictions on the epochs of Cecrops, Deucalion, Cadmus, and Danaus; not only would it be childish to attach the least importance to any one opinion concerning the precise dates of Inachus(1) or Ogyges;(2) but, if any thing could surprise us, it is that these personages have not been made from remote antiquity. There must have been some weight in the received traditions which the inventors of fables could not do away with. One of the dates assigned to the deluge of Ogyges agrees so accurately with one that had been mentioned as the period of the deluge of Noah, that it is almost impossible but that it must have been derived from some source by which this latter deluge must have been intended.(3)

of primitive history of Greece; but when we read of the genealogies of the Arabians and Tartars, and all that the monkish chronologists have invented for the different European monarchs, and some in particular,—we easily comprehend that the Greek writers must have done for the early time of their nation what has been done at all other epochs, when criticism had not given its lights to history.

(1) 1856 or 1823 before Christ, and other dates, have been fixed; but always about 350 years before the principal Phœnician or Egyptian colonies.

(2) The common date of Ogyges, according to Acusilaus and Eusebius, is 1796 years before Christ, consequently many years after Inachus.

(3) Varro placed the deluge of Ogyges, which he calls the first

As to Deucalion, whether we consider him as a real or feigned personage, however lightly we credit the manner of his deluge, as described in the Greek poems, and the multifarious details with which it became successively enriched, it is plain that it is only a tradition of the great cataclysm, altered and placed by the Hellenians at the epoch in which they also placed Deucalion, because he was considered as the founder of their nation; and his history was confounded with that of all the chieftains of the renewed nations.(1)

deluge, 400 years before Inachus—(*à priore cataclismo quem Ogygium dicunt, ad Inachi regnum*)—and consequently 1600 years before the first Olympiad, which would place it at 2376 years before Christ; and the deluge of Noah, according to the Hebrew text, is 2349, only twenty-seven years difference. This testimony of Varro is substantiated by Censorinus *de Die Natali*, cap. xxi. In fact, Censorinus wrote only 238 years after Christ; and it appears from Julius Africanus, ap. Euseb. præp. cv. that Aucusilaiis, the first author who placed the deluge in the time of Ogyges, made this prince contemporary of Phoronæus, which would have brought him very near to the first Olympiad. Julius Africanus only makes an interval of 1020 years between the two epochs; and Censorinus has a passage confirming this opinion. But some read, in the passage of Varro above cited from Censorinus, *Ærogitium* instead of *Ogygium*. But this would only be an Erogitian cataclysm, of which who ever heard!

(1) Homer and Hesiod knew nothing of the deluge of Deucalion, nor that of Ogyges.

The first author (whose works are extant,) who alludes to it, is Pindar, (Od. Olymp. ix.) He mentions Deucalion as arriving on Parnassus, and establishing himself in the city of Protogenia (*first birth or production,*) and recreating a population with stones; in a word, he recounts, only applying it to a single nation, the fable afterwards generalized by Ovid, and applied to the whole of mankind.

The historians who followed Pindar (Herodotus, Thucydides, and Xenophon,) do not mention any deluge, either in the time of Ogyges, or in that of Deucalion, although they speak of this latter as one of the first kings of the Hellenians.

Plato, in his 'Timæus,' says but a few words about the deluge,

Every Greek colony which had preserved any isolated traditions, began then with their own particular deluge, because each of them had some recol-

as well as of Deucalion and Pyrrha, as a commencement of the account of the great catastrophe, which, according to the priests of Sais, destroyed the Atalantis; but in this brief mention, he speaks of the deluge in the singular number, as if it was one only; and even expressly says, a little farther on, that the Greeks knew but of one. He places the name of Deucalion immediately after that of Phoronæus, the first man, without even adverting to Ogyges; thus, to the extent of his knowledge, it was a general event, a completely universal deluge, and the only one that occurred. He looked upon it as identical with that of Ogyges. Aristotle (Meteor. i. 14,) seems to have been the first who considered this deluge as only a partial inundation, which he placed near Dodona and the river Achelous, but this was the Achelous and Dodona of Thessaly.

Apollodorus (Bibl. i. § 7,) gives to the deluge of Deucalion all its magnitude and mythological character: it happened at the epoch of the interval between the age of brass and the iron age. Deucalion is made the son of the Titan Prometheus, the fabricator of man: he recreates the human race with stones; and yet Atlas, his uncle, Phoroneus, who lived before him, and many other antecedent personages, leave large posterities.

The nearer we come down to more recent authors, the more facts and details do we meet with coinciding with the Mosaic account of the deluge. Thus Apollodorus gives Deucalion a chest as his means of safety; Plutarch mentions the pigeons by which he endeavoured to ascertain the abatement of the waters; and Lucian alludes to the animals of every species which he had embarked with him, &c.

As to the coincidences of traditions and hypotheses, by which it has recently been sought to prove that the rupture of the Thracian Bosphorus was the cause of the deluge of Deucalion, and even of the opening of the Pillars of Hercules, by causing the Euxine sea to discharge its waters into the Archipelago, which were, prior to this event, much higher and more extended than they have since been, it is needless to occupy ourselves in detailing; since it has been ascertained by the observations of M. Olivier, that if the Black sea had been as high as is supposed, there would have been many channels for its waters, by hills and plains not so high as the present shores of the Bosphorus; and by those of M. le Comte Andreossy, that had it fallen any day by this new

lection of the universal deluge, which had been common to all; and when, in the sequel, they wished to bring their different traditions to one common epoch, different events were supposed to have happened, because dates quite uncertain, and perhaps entirely incorrect, but each in its own colony regarded as authentic, did not coincide with one another. Thus, in the same way that the Hellenians had a deluge of Deucalion, because they regarded him as their first parent, the Autochtones of Attica had a deluge of Ogyges, because it was from him that they derived their origin. The Pelasgi of Arcadia had that which, according to later authors, compelled Dardanus to betake himself towards the Hellespont. (1) The isle of Samothracia, one in which a succession of priests was the earliest established, and also a more regular form of worship and connected traditions, had also its deluge, which was thought the most ancient of all,(2) and which they attributed to the rupture of the Bosphorus and Hellespont. They preserved the idea of some similar event in Asia Minor,(3) and in

opening, in the manner of a cascade, the small quantity of water which could flow at one time through so confined an opening, would not only be spread over the vast extent of the Mediterranean, without causing a tide of a few fathoms, but that the simple, natural inclination necessary for the flowing of the waters, would have reduced to nothing the excess of height above the banks of Attica.

For other particulars on this subject, see a note that I have published at the head of the third volume of Ovid, in M. Lemaire's collection.

(1) Dion. Halicar. Antiq. Rom. lib. i. cap. lxi.

(2) Diodor. Sicul. lib. v. cap. 47.

(3) Stephen of Byzantium Iconium; Zenodotus, Prov. cent, vi. No. 10, and Suidas Nannacus.

Syria,(1) and eventually the Greeks gave the name of Deucalion to the whole of them.(2)

But none of these traditions places this cataclysm very remote; none of them is incapable of explanation, either as to its date or any other circumstances, by the changes which tradition must undergo, to which no precise date has been assigned by any written document.

THE VERY REMOTE ANTIQUITY ATTRIBUTED TO SOME NATIONS IS NOT HISTORICALLY TRUE.

Those who are desirous of assigning a very remote antiquity to the continents and the establishment of nations, are compelled to have recourse to the Indians, to the Chaldeans, and the Egyptians, three people who in fact appear the most anciently civilized of the Caucasian race; but three people singularly resembling each other, not only in temperament, through the climate and the nature of the soil which they inhabit, but still more so in the political and religious constitution which they had framed, but whose testimony this very similarity of constitution must render equally suspicious.(3)

(1) Lucian de Deâ Syrâ.

(2) Arnobus contra Gent. lib. v. from 158, speaks of a rock in Phrygia, whence he pretends that Deucalion and Pyrrha took their stones.

(3) This similarity of institutions goes to so great an extent, that it is quite natural to suppose that they had a common origin. We must not forget that many ancient authors have thought that the Egyptian institutions came from Ethiopia; and that Lyn-

With all three an hereditary caste was exclusively charged with the care of religion, law, and science; with all three, this caste had its allegorical language and its secret doctrines; to all three was reserved the privilege of reading and explaining the sacred books in which all the doctrines had been revealed by the gods themselves.

We may easily divine what history would become in such hands; but without any great efforts of reason, we may learn it from the fact itself, in examining what has occurred amongst the only one of the three nations now existing, namely, the Indians.

In truth, they have no history remaining. Amidst the voluminous records of mystic theology, or abstract metaphysics, which the Brahmins are possessed of, and which the indefatigable perseverance of English industry has made known to us, there is nothing which throws any light over the origin of the nation or the changes of their society. They even pretend that their religion forbids them to preserve the remembrance of the present age, the age of misfortune.(1)

According to the Vedas, the first revealed works, and the foundation of all the Hindoo religion, the literature of this people, like that of the Greeks, began by two epochs, the 'Ramaian' and the 'Mahabarat,' a thousand times more marvellous than the 'Iliad' and 'Odyssey,' although we perceive in them some outlines of a metaphysical nature, of the kind usually termed sublime. The other poems, which,

cellus, p. 151, positively says that the Ethiopians came from the borders of the Indus in the time of King Amenophis.

(1) See Polier, Mythology of the Hindoos, vol. i. pp. 89—91.

with these two, form the great body of the Pouranas, are only romances or versified legends, written at various periods, by various authors, and not less wild in their fictions than the great works mentioned. It has been thought that in some of these writings, deeds, or the names of men somewhat resembling those mentioned by the Greeks and Latins, may be traced; and it is principally from the similarity of names that M. Wilfort has endeavoured to derive from these Pouranas a sort of concordance with our ancient western chronology,—a concordance which unfolds, at every line, the hypothetical nature of its foundation; and which, besides, can only be admitted by entirely rejecting the dates given by the Pouranas themselves. (1)

The lists of kings which the pundits, or Indian doctors, have pretended to compile from these Pouranas, are only plain catalogues without details, or decked with absurd ones, little short of the Chaldeans or Egyptians; or those which were framed for the nations of the north, by Trithemus and Saxo the grammarian. (2) These lists are far from coinciding; none of them supposes either a history, registers, or records; their very foundation has probably no other source than the fictitious work of the poets, from whose compositions they may have derived their

(1) See the great work of M. Wilfort on the Chronology of the Kings of Magadha and the Indian Emperors, and on the epochs of Vicramaditjia (or Bikermadjit) and Salivahanna. Mem. de Calcutta, tome ix. p. 82, 8vo. edit.

(2) Sir William Jones on Hindoo Chronology, Mem. de Calcutta, vol. ii. p. 111; 8vo. edit. French translation, p. 164. See also M. Wilfort on the same subject, ibid. vol. v. p. 241; and the lists which he gives in his work mentioned above, vol. ix. p. 116.

origin. One of the Indian pundits, who supplied M. Wilfort with these, confessed that he filled up at his pleasure, with imaginary names, the spaces that occurred between celebrated kings;(1) and he added, that his predecessors had done the same. If this be true of the lists which the English now obtain, why should it not be so with reference to those which Abou-Fazel has given as extracts from the annals of Cachemere,(2) and which, besides, though filled with fiction, only refer to 4300 years back, of which more than 1200 are filled with the names of princes, the extent of whose reigns are not determined.

The very era whence the Indians now calculate their years, beginning fifty-seven years before Christ, and which bears the name of a prince called Vicramaditjia, or Bickermadjit, bears it only by a kind of convention; for we find, according to the synchronisms attributed to Vicramaditjia, that there were three, and perhaps eight or nine, princes of this name, who have all had similar legends, and who have all been at war with a prince called Saliwahanna; and what is more, they do not accurately know if this fifty-seventh year before Christ be that of the birth, the reign, or the death of Vicramaditjia, whose name it bears.(3)

Again, the most authentic of the Indian records contradict, by intrinsic and very obvious characters, the antiquity which these people attribute to them.

(1) Wilfort, Mem. de Calcutta, in 8vo. vol. ix. p. 133.

(2) In the Ayeen-Acbery, vol. ii. p. 138 of the English translation. See also Heeren, Commerce of the Ancients, 1st vol. part ii. page 329.

(3) See Bentley on the Hindoo Astronomical Systems, and their Unison with History, Mem. de Calcutta, vol. viii. page 243 of the 8vo. edition.

Their vedas or sacred books, revealed, as they say, by Brahma himself, at the beginning of the world, and arranged by Viasa (a name which only signifies a collector) at the beginning of the present age, and—if we may judge of them by the calendar which is annexed, and to which they refer, as well as by the position of the colours which this calendar points out,—may go as far back as 3200 years. which would closely approach the epoch of Moses. (1) Perhaps even those who have faith in the assertion of Megasthenes, (2) that in his times the Indians were ignorant of the art of writing; those who will reflect that none of the ancients have made mention of the superb temples, the immense pagodas, those remarkable monuments of the religion of the Brahmins; those who know that the epochs of their astronomical tables have been subsequently calculated, and inaccurately done; and that their treatises on astronomy are modern and antedated, will be inclined to discredit still farther this pretended antiquity of the Vedas.

Yet in the midst of all the Brahminical fables, there occur points of coincidence with the historical monuments in the more western nations, which must astonish us. Thus their mythology determines the successive deluges which the surface of the globe has experienced, and is yet fated to experience; and it is only from a period rather less than 5000 years that they derive that which last occurred. (3) One of these revolutions, which they

(1) See the Mem. of Mr. Colebrooke on the Vedas, Mem. de Calcutta, vol. viii. of the 8vo. edition, p. 493.

(2) Megasthenes, apud Strabo, lib. xv. p. 709. Almel.

(3) That which produced the present age or *cali-yug* (the earth's age) is made 4927 years or 3102 years before Christ.

in reality place much more remote, is described in terms precisely corresponding with the Mosaic account.(1)

M. Wilfort even assures us that in another event of this mythology, a person figured very much resembling Deucalion in origin, name, adventures, and even in the name and adventures of his father.(2)

It is equally worthy of remark, that in these lists of kings, barren and doubtful as they are, the Indians place the commencement of their terrestrial sovereigns (those of the race of the sun and moon) at an epoch nearly the same as that which Ctesias, in a list of a precisely similar kind, makes the com-

(1825.) See Legentil, Voyage to India, v. i. p. 235. Bentley, Mem. de Calcutta, v. 8. ed. 8vo. p. 212. According to the Samaritan text, the deluge of Noah was only fifty-nine years more remote.

(1) The person named Satyavrata plays the same part as Noah, and saves himself with seven couples of holy persons. See Sir William Jones, Mem. de Calcutta, v. i. p. 230, 8vo. ed. and in the Bagvadam (or Bagvata) translated by de Fouché d'Obsonville, p. 212.

(2) Cala Javana, or in the common language, cal-yun, to whom his partisans may have given the epithet of *divi*, deo, or god, having attacked Crishna, the Indian Apollo, at the head of the northern nations (the Scythians, whence sprung Deucalion, according to Lucian) was driven back with fire and water. His father Garga, was called also Paramathesa (Prometheus;) and, according to another legend, was devoured by the eagle Garuda. These details were extracted by Wilfort (in his Mem. on Mount Caucasus, Calcutta Mem. v. 6. 8vo. edit. p. 507.) from the sacred drama, called Hari-Vansa. M. Charles Ritter, in his Vestibule of European History before Herodotus, concludes that the fable of Deucalion was of foreign derivation, and brought into Greece with the other legends of that part of the Greek worship which had come from the north, and which had preceded the Egyptian and Phœnician colonies. But if it be true

mencement of his kings of Assyria, about 4000 years before the present time.(1)

This wretched state of historical knowledge is owing to the subjection of the people to an hereditary priesthood, who enforced a worship monstrous in its external form, and cruel in most of its precepts, and who alone had the privilege of writing, of preserving, and explaining the books. Any absurd tale, invented to give fame to a shrine of pilgrimage, legends calculated to inspire a deeper homage for their caste, was of more importance to them than all the facts of authentic history. With respect to the sciences, they might have cultivated astronomy, which gave them a reputation as astrologers; mechanics, which assisted them in elevating monuments, signs of their power, and the objects of the most superstitious veneration with the people; geometry, the basis of astronomy as well as of mechanics, and an important auxiliary to agriculture in those vast alluvial plains which could only be made salutary and fruitful by means of numerous canals; they might encourage the mechanical or chemical arts which nourish their commerce, and contributed to their luxury and the splendour of their temples; but they would look with dread on history, which would inform mankind of their mutual relations.

What we observe in India, we might expect to find in every country in which a priesthood, con-

that the constellations of the Indian sphere have also the names of Grecian personages; that we have Andromeda under the name of Antarmadia, Cepheus under that of Capiia, &c., we may be tempted with M. Wilfort, to draw a different conclusion. Unfortunately the records adduced by this writer have been doubted by the learned.

(1) Bentley, Mem. de Calcutta, v. 8. p. 226. ed. 8vo.—note.

stituted like that of the Brahmins, established in similar countries, assumed a similar control over, the mass of the people. The same causes produce the same results; and in fact, however we reflect on the fragments of Egyptian and Chaldean traditions which are left to us, we perceive that they were not more historical than those of the Indians.

To judge of the nature of the chronicles which the Egyptian priests pretended to possess, it is sufficient to review the extracts which they have given themselves at different times and to different persons.

Those of Sais, for instance, told Solon about 550 years before Christ, that Egypt, not being subject to deluges, they had not only preserved their own annals, but those of other people; that the city of Athens and that of Sais were both built by Minerva, the former 9000 years before, the other only 8000; and to those dates he added the well-known fable concerning the Atlantis, and respecting the resistance which the ancient Athenians opposed to their conquests, as well as all the romantic accounts of the Atlantis;(1) in which are to be found facts and genealogies similar to those of all mythological romances.

A century later, about 450 years before Christ, the priests of Memphis gave a different account to Herodotus.(2) Menes, the first king of Egypt, as they said, had built Memphis and confined the Nile with banks, as if such operations could have been done by the first king of any country. Since then they had had 330 other kings, down to Mœris, who reigned, as they asserted, 900 years before the

(1) See Plato's Timæus and Critias.
(2) Euterpe, chap. xcix. et seq.

epoch in which this statement was made (1350 before Christ.)

After these kings came Sesostris, who carried his conquests even to Colchis;(1) and in all, there were to Sethos 341 kings and 341 high priests, in 341 generations, during 11,340 years; and in this space, as if to corroborate their genealogy, these priests asserted that the sun had risen twice where he sets, without effecting any change in their climate or the productions of the country; and previously to them no deity had appeared or reigned in Egypt.

To this improbability, which, in spite of all the explanations which have been given, proves so gross an ignorance of astronomy, they add concerning Sesostris, Phero, Helenus, and Rhampsinitus, the kings who built the pyramids, and an Ethiopian conqueror, named Sabacos, tales equally preposterous.

The Theban priests did better; they pointed out to Herodotus, and had previously shown to Hecateus, 345 wooden colossal figures representing 345 high priests, who had succeeded father to son, all men, all born one from the other, who had been preceded by gods.(2)

Other Egyptians told him that they had correct registers, not only of the reign of men, but of that of the gods. They reckoned 17,000 years from Hercules to Amases, and 15,000 from Bacchus. Pan was even earlier than Hercules.(3)

These people evidently mistook for history some

(1) Herodotus thought that he had detected similarities of figure and colour between the Colchians; but it is infinitely more probable that the black Colchians of whom he speaks, were an Indian colony attracted by the commerce anciently established between India and Europe by the Oxus, the Caspian, and the Phasis. See Ritter, Vestibule, chap. i.

(2) Euterpe, chap. cxliii. (3) Ibid. cxliv.

allegory relative to pantheistic metaphysics, which formed, although they knew it not, the basis of their mythology.

It is only from Sethos that Herodotus begins a history at all credible; and it is important to note that this history begins with a fact agreeing with the Hebrew annals, namely, the destruction of the army of Sennacherib, king of Assyria;(1) and this agreement continues under Necho(2) and under Hophra or Apries.

Two centuries after Herodotus (about 260 years before Christ) Ptolemy Philadelphus, a prince of a foreign race, was desirous of knowing the history of a country which circumstances had called him to govern. A priest, called Manetho, undertook to write it for him. It was not from records or archives that he pretended to have drawn his information, but from the sacred book of Agathodæmon, son of the second Hermes, and father of Tat, who had copied it upon pillars or columns, erected before the deluge by Tat, or the first Hermes in the Seriadic land;(3) and this second Hermes, this Agathedæmon, this Tat, are personages of whom no one had ever before spoken, nor even of this Seriadic land, nor of these columns. This deluge is itself a fact entirely unknown to the Egyptians of early times, and of which Manetho points out nothing in what remains to us of his dynasties.

The production resembles the source; not only is the whole filled with absurdities, but they are peculiar absurdities, and such as it is impossible to recon-

(1) Euterpe, cxli.
(2) Ibid. clix., and in the 4th book of Kings, chap. xix., or in the 2nd of Paral. chap. xxxii.
(3) Syncell. p. 40.

cile with those which the more ancient priests had related to Solon and Herodotus.

Vulcan is the first of the divine kings. He reigns 9000 years; the gods and demi-gods reign 1985 years. Neither the names, nor the successions, nor the dates of Manetho, coincide with what was published before or after him; and his accounts must have been as obscure and confused in themselves as they were with the statements of other authors, if we may credit the extracts of Josephus, Julius Africanus, and Eusebius. They do not even agree about the total of years of his human kings. According to Julius Africanus, they reached 5101; and according to Eusebius, to 4723; according to Syncellus, to 3555. We may believe that the differences of names and figures was made by copyists; but Josephus cites at length a passage, the details of which are manifestly contradictory to the extracts of his successors.

A record, called the Antique,(1) and which some call anterior and others posterior to Manetho, gives other calculations; the whole duration of the kings is 36,525 years, of which the sun reigned 30,000, the other gods 3,984, the demi-gods 217, only leaving for the human race 2,339 years; which gives only 113 generations, instead of the 340 of Herodotus. The astronomer Eratosthenes, a learned man of an order different from that of Manetho, discovered and published under Ptolomœus Evergetes, about 240 years before Christ, a particular list of thirty-eight kings of Thebes, beginning with Menes, and continuing for 1024 years. Of this we have

(1) Syncell. p. 51.

an extract copied by Syncellus in Apollodorus.(1) Scarcely any of the names which are there correspond with the other lists.

Diodorus went to Egypt under Ptolomœus Auletes, about sixty years before Christ, and consequently two centuries after Manetho, and four after Herodotus. He also gleaned from the priests themselves the history of the country, and he obtained it again in an entirely new form.(2)

It was not now Menes who built Memphis, but Uchoreus; and long before his time Busiris II. had built Thebes. The eighth ancestor of Uchoreus, Osymandyas, obtained possession of Bactria, and subdued revolts there. Long afterwards, Sesostris made still more extended conquests; he reached to the Ganges, and returned thence through Scythia and the Tanais. Unfortunately these names of kings are unknown to all previous historians, and no people that they had conquered preserved the least remembrance of them. As to the gods and heroes, according to Diodorus, they reigned 18,000 years, and the human sovereigns 15,000; four hundred and seventy were Egyptians, four Ethiopians, without counting Persians and Macedonians. The tales with which the whole is intermingled do not otherwise yield in childishness to those of Herodotus.

In the eighteenth year of Christ, Germanicus, nephew of Tiberius, attracted by a desire of knowing the antiquities of this celebrated country, went to Egypt, at the risk of displeasing a prince as suspicious as his uncle. He ascended the Nile as far as Thebes. It was not Sesostris nor Osymandyas

(1) Ibid. p. 91. et seq. (2) Diodorus Sic. lib. i. sect. 2.

of whom the priests told him as of a conqueror, but of Rhameses, who with an army of 700,000 men had invaded Lybia, Ethiopia, Media, Persia, Bactria, Scythia, Asia Minor, and Syria.(1)

Finally, in the famous article of Pliny on the Obelisks,(2) we find names of kings mentioned nowhere else: Sothies, Mnevis, Zmarreus, Eraphius, Mestires, or Semenpserteus, contemporary of Pythagoras, &c. A Ramises, who may be the same as Rhameses, is there made contemporary with the siege of Troy.

I am aware that it is attempted to reconcile these lists, by supposing that the kings have had other names. To me, considering not only the contradiction of these different accounts, but particularly the mixture of facts attested by vast monuments and childish extravagancies, it seems much more natural to conclude that the Egyptian priests had no history; that, inferior even to the Indians, they had not congruous and connected fables; that they only kept lists, more or less defective, of their kings, and some recollections of the chief amongst them, of those in particular who had taken care to inscribe their names on their temples and other large monuments which adorned the country; but these recollections were confused, and were only founded on the traditional explanations which they gave to the representations paint-

(1) Tacit. Annal. lib. 2. chap. lx.

N. B. According to the interpretation of Ammianus, lib. xvii. chap. vi., by the hieroglyphics of the Obelisk of Thebes now at Rome in the place of St. John Lateran, it appears that a Rhamestes was styled in the eastern manner, "lord of the habitable world," and that the inscription given to Germanicus was only a commentary on this.

(2) Pliny, lib. xxxvi. c. 8, 9, 10, 11.

ed or engraved on their monuments; explanations founded only on the hieroglyphics, conceived like those which have been transmitted to us in any general terms,(1) and which, passing from mouth to mouth, were altered as to details according to the fancy of those who communicated them to strangers, and consequently it is impossible to rest any proposition relative to the antiquity of the present continents on the fragments of these traditions, so incomplete even in their own times, and rendered utterly unintelligible by the pens of those who have handed them down to us.

If this assertion needed farther proof, it might be found in the list of the sacred work of Hermes, which the Egyptian priests carried in their solemn procession. Clemens Alexandrinus(2) enumerates them, in number forty-two; and there is not amongst them, as with the Brahmins, one epic, or one book which has the pretension of being a narrative, or of fixing in any way any great action or any event.

The learned researches of M. Champollion, junior, and his astonishing discoveries concerning the language of hieroglyphics(3) confirm rather than destroy these surmises. This ingenious antiquary has read in a series of hieroglyphical pictures of the temple of Abydos(4) the prænomina of a certain number of kings placed in order, one after the other; and a portion of these prænomina (the ten last)

(1) That of Rhamestes in Ammian. loc. cit.

(2) Stromat. lib. vi. p. 633.

(3) See the 'Précis du Système Hieroglyphic des anciens Egyptiéns,' par M. Champollion le jeune, page 245; and his 'Lettre à M. le Duc de Blacas,' p. 15 et seq.

(4) This important bas-relief is engraved in the 'Voyage à Meroè,' by M. Caillaud, v. 2, plate xxxii.

being found on many other monuments, accompanied with proper names, he concludes that they are those of kings, who bore those proper names, which has given him nearly the same kings, and in the same order, as those of which Manetho composed his eighteenth dynasty, that which drove out the pastoral kings or shepherds. The concordance, however, is not complete: in the painting of Abydos, six of the names found in Manetho's list are wanting; there are others which do not resemble them; and, unfortunately, there is a break before the most remarkable of all—the Rhameses, who appears the same as the king represented on so many of the finest monuments, with the attributes of a great conqueror. It should be, according to M. Champollion in Manetho's list, the Sethos, chief of the nineteenth dynasty, who, in fact, is pointed out as potent in ships and horsemen, and as having carried his arms into Cyprus, Media and Persia. M. Champollion thinks, with Marsham and many others, that it is Rhameses or this Sethos, who is the Sesostris or Sesoosis of the Greeks; and this supposition is probable, in the sense that the representations of the victories of Rhameses, obtained probably over the wandering tribes near Egypt, or at farthest, over Scythia, have given rise to the fabulous tales of the vast conquests, attributed by some confusion, to a Sesoostris; but in Manetho it is in the twelfth dynasty, and not in the eighteenth, which has a prince named Sesostris, marked as the conqueror of Asia and Thrace.(1) Marsham pretends that this twelfth(2) dynasty and the eighteenth form only one. Manetho could not then have comprehended

(1) Syncell. p. 59. (2) Canon. p. 353.

the lists which he copied. In fact, if we entirely receive both the historical truth of this bas-relief of Abydos and its accordance, either with the portion of the lists of Manetho which appears to correspond with it, or with the other hieroglyphical inscription, this consequence would arise, that the pretended eighteenth dynasty, the first with which the ancient chronologists can make any agreement, is also the first which has left out on the monuments any trace of its existence. Manetho may have consulted this and similar documents; but it is not the less apparent that a list, a series of names or of portraits, which every where occurs, is very far from being history.

May we not then assume of the inhabitants of the valleys of the Euphrates and the Tigris, what we have proved and known with regard to the Indians, and is made so probable respecting the people of the valley of the Nile? Established as the Indians(1) and Egyptians are, on a fine commercial situation,—in extensive plains which they have been compelled to intersect with various canals--instructed like them by an hereditary priesthood, the pretended depositaries of secret books, the privileged possessors of the sciences, astrologers, constructors of pyramids, and other vast monuments(2)—should they not also have a mutual resemblance in other essential points? May not their history be similarly reduced to mere legends? I venture to say, that it

(1) All the ancient mythology of the Brahmins relates to the plains through which the Ganges flows, and it is evidently there that their first establishments were formed.

(2) The descriptions of the ancient Chaldean monuments are very similar to those of the Indians and Egyptians; but these monuments are not similarly preserved, because they were only made of sun-dried bricks.

is not only probable, but that it is demonstrated by fact.

Neither Moses nor Homer makes any mention of a great kingdom in Upper Asia. Herodotus(1) only assigns to the supremacy of the Assyrians five hundred and twenty years of duration, and makes its origin about eight centuries before his own time. After visiting Babylon, and having consulted the priests, he did not even learn the name of Ninus, as king of the Assyrians, and only mentions him as the father of Asron,(2) first Lydian King of the race of the Heraclidæ. Nevertheless, he makes him son of Belus, so much confusion had then occurred in the oral traditions. If he speaks of Semiramis as one of the queens who has left great monuments in Babylon, he only places her seven generations before Cyrus.

Hellanicus, contemporary with Herodotus, far from allowing that Semiramis built any thing at Babylon, attributes the founding of that city to(3) Chaldæus, fourteenth in order from Ninus.

Berosus, a Babylonian and a priest, who wrote scarcely one hundred and twenty years after Herodotus, gives an alarming antiquity to Babylon; but it is to Nebuchadnezzar, a prince of comparatively recent date, that he attributes the principal monuments.(4)

As far as regards Cyrus, that remarkable prince, and whose history should be so well known, so common, Herodotus, who only lived a century after him, confesses that there were three different opinions; and, in fact, sixty years later, Xenophon gives us a

(1) Clio, cap. xcv. (2) Clio, cap. vii.
(3) Stephen of Byzantium, at the word Chaldæi.
(4) Josephus (contra App.) lib. 1, cap. xix.

biography of this prince entirely different from that of Herodotus.

Ctesias, nearly contemporary with Xenophon, pretends to have drawn from the archives of the Medes, a chronology which renders the origin of the Assyrian monarchy more remote by eight hundred years, placing at the head of its kings the same Ninus, the son of Belus, whom Herodotus had made one of the Heraclidæ; and at the same time he attributes to Ninus and Semiramis, conquests towards the west, of an extent absolutely incompatible with the Jewish and Egyptian history of this period.(1)

According to Megasthenes, it was Nebuchadnezzar who made these incredible conquests. He carried them through Libya to Spain.(2) We see that, from the time of Alexander, Nebuchadnezzar had entirely usurped the reputation which Semiramis had had from the time of Artaxerxes. But, we must certainly suppose, that Semiramis and Nebuchadnezzar had conquered Ethiopia and Libya, nearly in the same manner as the Egyptians attributed the conquests of India and Bactria to Sesostris or Osymandias.

It would avail us nothing, if we now entered into an examination of the different traditions of Sardanapalus, in which a celebrated learned man has imagined that he has discerned proof of the existence of three princes of that name, all victims of similar misfortunes:(3) and in the same way, another learned man finds in the Indies, at least three

(1) Diod. Sicul. lib. 2.

(2) Josephus (contra App.) lib. i. ch. vi., and Strabo, lib. xv. p. 687.

(3) See the Memoir of Freret, on the History of the Assyrians, in the Memoirs of the Academy of Belles Lettres, vol. v.

Vicramaditjia, equally the heroes of precisely similar adventures.

It was doubtlessly from the disagreement of all these narratives, that Strabo was induced to say that the authority of Herodotus and Ctesias was not equal to that of Hesiod or Homer.(1) Ctesias has not been more fortunate in copyists than Manetho; and it is now very difficult to reconcile the extracts given us from his works by Diodorus, Eusebius and the Syncellus.

If so great a state of uncertainty existed in the fifth century before Christ, how can we imagine that Berosus could clear them up in the third? And can we give more credence to 430,000 years which he puts before the deluge,—to 35,000 years which he places between the deluge and Semiramis,—than in records of 150,000 years which he boasts of having consulted?(2)

Mention has been made of works raised in distant provinces, and which bore the name of Semiramis; they pretend also to have seen in Asia Minor and in Thrace columns erected by Sesostris.(3) But, as in Persia at the present day, the ancient monuments, perhaps even some of these, bear the name of Roustan; and in Egypt or Arabia they have those of Joseph or Solomon: a custom appertaining to the Orientalists of all ages, and, most probably, to all ignorant nations. The peasantry of our

(1) Strabo, lib. xi. p. 507.
(2) Syncellus, p. 38 and 39.
(3) N. B. It is remarkable, that Herodotus says nothing of having seen any monuments of Sesostris but in Palestine, and only mentions those in Ionia from hearsay, adding, that Sesostris is not named in the inscriptions, and that those who have seen these monuments attribute them to Memnon.—Euterpe, chap. cvi.

country call all ancient Roman intrenchments the camp of Cæsar.

In a word, the more I reflect on the subject, the more I am persuaded that there was no more an ancient history of Babylon or Ecbatana than of Egypt or the Indies; and instead of explaining mythology historically, as Evhemere or Bannier, it is my opinion that a great portion of history should be considered as mythology.

It is only from the epoch commonly called that of the second kingdom of Assyria, that the history of the Assyrians and Chaldeans begins to be at all clear; at the same time in which that of the Egyptians also becomes intelligible; when the kings of Nineveh, Babylon and Egypt, began to meet and fight on the theatre of Syria and Palestine.

It appears, however, that the writers of these countries, or those who had consulted its traditions, Berosus, Hieronymus, and Nicholas de Damas, agree in mentioning a deluge. Berosus even describes it with circumstances so similar to that of Genesis, which it is scarcely possible but that he must have derived his information from the same sources, although he makes its epoch many centuries earlier; that is, if we may judge from the confused extracts which Josephus, Eusebius and Syncellus, have preserved of his writings. But we must remark,—and with this observation we shall terminate our mention of the Babylonians,—that these numerous ages, and this long list of kings, placed between the deluge and Semiramis, is a new thing, entirely originating from Berosus, and of which Ctesias, and those who followed him, had not the least idea, and which has not even been adopted by any profane author after Berosus. Jus-

tin and Velleius considered Ninus as the first of the conquerors; and those who, against all probability, place him highest, only make him forty centuries anterior to the present time. (1)

The Armenian writers of the middle age agree very nearly with one of the texts of Genesis, when they date the deluge as 4916 years anterior to their own time; and it might be imagined, that having collected the old traditions, and perhaps extracted the old chronicles of their country, they form an additional authority in favour of the newness of nations. But when we reflect, that their historical literature is only dated from the fifth century, and that they were acquainted with Eusebius, we may understand that they accommodated themselves to his chronology and that of the Bible. Moses of Chorene expressly professes to have followed the Greeks, and we may perceive that his ancient history is formed on that of Ctesias. (2)

It is, however, certain, that the tradition of the deluge existed in Armenia, even before the conversion of the inhabitants to Christianity; and the city which, according to Josephus, was called the Place of the Descent, still exists, at the foot of mount Ararat, and bears the name of Nachidchevan, which has the same meaning. (3)

By Armenians, we mean, the Arabs, Persians, Turks, Mongolians and Abyssians, of the present day. Their ancient books, if they ever had any, exist no longer. They have no other ancient history than that which they have recently made, and

(1) Justin, lib. 1, c. 1; Velleius Paterculus, lib. 1, c. vii.
(2) See Moses Chorenensis. Hist. Armen. lib. 1, c. 1.
(3) See the Preface of the two Whistons on Moses of Chorene, p. 4.

which they modelled on the Bible. Thus what they say of the deluge is borrowed from Genesis, and adds no testimony to that book.

It is curious to learn the opinion of the ancient Persians on this subject, before it was modified by Christian and Mahometan creeds. We find it deposited in their Boundehesh or Cosmogony, a work of the prince of the Sassanides, but evidently extracted or translated from more ancient works, and which Anguetil du Perron found among the Parsees of India. The whole duration of the world it states to be only 12,000 years, therefore it cannot yet be very old. The appearance of the Cayoumortz (the bullman, the first man) is preceded by the creation of a great water. (1)

For the rest, it would be useless to ask from the Parsees a serious history, as from the other oriental nations. The Magi have left no more than the Brahmins or Chaldeans: I ask no other proof than the uncertainties concerning the epoch of Zoroaster. It is even pretended, that the little history that they might have had which related to the Achemenides, the successors of Cyrus to the time of Alexander, has been expressly altered, and by the official command of one of the kings, Sossanides. (2)

To discover the authentic dates of the commencement of empires, and traces of the universal deluge (grand cataclisme) we must go beyond the vast deserts of Tartary. Towards the east and north is another race, whose institutions and modes of life differ from ours as much as their formation and tem-

(1) Zendavesta d'Anquetil, v. 2. p. 354.
(2) Mezoudi ap Sacy. Manuscripts of the king's library, vol. viii. p. 161.

perament. Their language is monosyllabic,—their writing is arbitrary hieroglyphics,—they have only a political morality, without religion, for the superstitions of Fo were brought to them from the Indians. Their yellow complexion, projecting cheek-bones, their narrow and oblique eyes, and scanty beard, render them so different from us, that we are tempted to believe that their ancestors and ours escaped at the great catastrophe by different sides; but, however that may be, they date their deluge from nearly the same epoch as our own.

The most ancient book of the Chinese, is called the Chou-King,(1) which is said to have been compiled by Confucius, from the fragments of former works, about 2255 years ago. Two centuries later, they say, was the persecution of letters, and the destruction of the books, under the emperor Chi-Hoangti, who wanted to destroy the traces of the feudal government, established under a dynasty previous to his own. Forty years afterwards, under the dynasty which had overthrown that to which Chi-Hoangti belonged, a part of the Chou-King was restored from memory by an old sage, and another was found in a tomb; but nearly half of it was utterly lost. But this book, the most authentic of China, begins the history of this country with Yao, an emperor so named, who it represents to us as occupied in making the waters pass away, *which being raised as high as heaven, were still laving the feet of the loftiest mountains, covering the hills that were less elevated,* and rendered the

(1) See the preface of the edition of Chou-King, by M. de Guignes.

plains impassible.(1) The date of Yao is, by some fixed 4163 years before the present time; according to others, at 3943 years. The variety of opinions on this epoch extends even to 284 years.

Some pages farther on we find Yu, a minister and engineer, re-establishing the course of the waters, forming dykes, digging canals, and regulating the taxes of every province in China, that is to say, in an empire of six hundred leagues in every direction. The impossibility of such operations, after such events, shows that the whole is but a moral or political romance.(2)

More modern historians have added a series of emperors before Yao, but with a great many fabulous circumstances, without venturing to assign fixed dates to them, varying incessantly one with the other, even in number and names, and not being approved of by many of their countrymen. Fouhi with his serpent's body, his bull's head, and tortoise's teeth, and his successors not less monstrous, are as absurd, and have had no more reality than Enceladus and Briareus.

Is it possible that mere chance gave a result so striking as to make the traditional origin of the Assyrian, Indian, and Chinese monarchies agree in being as remote as 4000 years back? Would the ideas of nations, who have had so little communication with each other, whose language, religion and laws, have nothing in common, agree on this point, if they were not founded on truth?

We will not ask for precise dates from the Ame-

(1) Chou-King. French translation, p. 9.
(2) It is the Yu-King, or chap. 1, of the 2nd part of the Chou-King, pp. 43—60.

ricans, who had no real writing, and whose most ancient traditions go no farther back than to some few centuries before the arrival of the Spaniards; and yet we still imagine that we can detect traces of the deluge in their rough hieroglyphics. They have their Noah, or their Deucalion, like the Indians, the Babylonians, and the Greeks. (1)

The negroes, the most degraded of human beings, whose forms are the nearest to those of brutes, and whose intellect has no where expanded so greatly as to attain a regular government, nor to the least semblance of connected information, have preserved no records, no traditions. They cannot then afford us any information concerning our inquiry, although all their characters clearly show that they escaped from the great catastrophe by some other point than the Caucasian and Altaic races, from whom they were probably separated long before this catastrophe happened.

But, it is said, if the ancient races have not left us any history, their long existence as nations is not the less attested by the progress which they made in astronomy; by observations which are easily dated, and even by the monuments still existing and which themselves bear their dates.

Thus the length of the year, such as the Egyptians are supposed to have determined it, according to the heliacal rising of Sirius, is correct for a period comprised between the year 3000 and the year 1000 before Christ, a period to which the traditions of their conquests, and the great prosperity of their empire also have reference. This accuracy

(1) See the admirable and splendid work of M. de Humboldt on the Mountains of Mexico.

proves to what an exact pitch they had carried their observations, and makes it evident that they had devoted themselves for a long time to such studies.

To appreciate this reasoning, it is necessary that we enter into some explanation.

The solstice is that moment of the year, at which the rising of the Nile begins, and which the Egyptians must have observed with very great attention. Having, in the beginning, formed a civil or sacred year, of exactly three hundred and sixty-five days, from imperfect observations, they would preserve it from superstitious motives, even after they had discovered that it did not coincide with the natural or tropical year, and that the seasons did not revert on the same days. (1) However, it was the tropical year, which it most behoved them to mark, for directions in their agricultural operations. They would then seek in the heavens for some apparent sign of its return, and they imagined that they had found it when the sun returned to the same position, with relation to a certain remarkable star. Thus they applied themselves, like nearly all nations who begin a similar inquiry, to the examination of the heliacal rising and setting of the stars. We know that they particularly fixed on the heliacal rising of Sirius; at first doubtless because of the splendour of this star; and above all, because in ancient times this rising of Sirius, nearly coinciding with the solstice, announcing the inundation, was to them a phenomenon of the most important na-

(1) Geminus, a contemporary with Cicero, explains these notions at length. See M. Halma's edition, at the end of Ptolomæus, p. 43.

ture. Hence it was, that Sirius, under the name of Sothis, played a prominent part in all their mythology, and their religious rites. Supposing then that the recurrence of the heliacal rising of Sirius and the tropical year were of the same duration, and believing that they had at length discovered that this duration was three hundred and sixty-five days and a quarter, they imagined a period, after which the tropical year, the ancient year, the year of three hundred and sixty-five days only, would revert to the same day; a period which, according to these incorrect data, was necessarily 1461 sacred years, and 1460 of those perfected years, to which they gave the name of the years of Sirius.

They took as the point of departure of this period, which they called the sothaic or great year, a civil year; the first day of which was, or had been also that of the soliacal rising of Sirius; and we learn from the positive testimony of Censorinus, that one of these great years terminated in the year 138 before Christ.(1) Consequently it began 1322 years before Christ, and that which preceded it, 2782 years previously. In fact, from calculations of M. Ideler, we learn that Sirius rose heliacally on the 20th July, in the Julian year 139, a day which corresponds to the first of Thot, or the first day of the sacred Egyptian year.(2)

But not only the sun's position, with relation to the stars of the ecliptic or the sidereal year, is not the same as the tropical year, because of the preci-

(1) All this system is developed by Censorius, de Die Natali, cap. xviii. and xxi.

(2) Ideler. Hist. Researches on the Astronomical Observations of the Ancients. Halma's translation at the end of his Canon of Ptolemæus, p. 32. et seq.

sion of the equinoxes. The heliacal year of a star, or the period of its heliacal rising, especially when it is distant from the ecliptic, differs also from the sidereal year, and differs variously, according to their latitudes in the places of observation. Yet what is singular enough, and what Bainbridge,(1) and father Petau,(2) have remarked,(3) is, that it happens by a remarkable concurrence in the positions, that in the latitude of upper Egypt, at a certain epoch, and during a certain number of centuries, the year of Sirius, was really within very little of three hundred and sixty-five days and a quarter; so that the heliacal of this star returned, in fact, to the same day of the Julian year, on the 20th of July, in 1322 years before, and 138 after Christ.(4)

From this positive coincidence, at a period so remote, M. Fourier, who has determined all these coincidences by great labour and new calculations, concludes, that since the length of the year of Sirius was so perfectly known to the Egyptians, they must have determined it by observations made during a long series of years, and with much exactness; observations as remote as 2500 years before

(1) Bainbridge, Canicul.

(2) Petau, Var. Diss. lib. v. c. vi. p. 108.

(3) See La Nauze, on the Egyptian year. Acad. de Bell. Lett. v. xiv. p. 346, and the memoir of Fourier, in the great work on Egypt, Mem. v. i. p. 803.

(4) Petau, loc. cit. M. Ideler affirms that this coincidence of the heliacal rising of Sirius, took place also 2782 years before Christ. (Rech. Hist. in the Ptolemæus of M. Halma, v. iv. p. 37.) But with respect to the Julian year, 1598 after Christ, which is also the last of a great year, Father Petau and M. Ideler differ. The latter places the heliacal rising of Sirius, on the 22nd of July, the former on the 19th or 20th of August.

our era, and could not have been made either much before or much after this interval of time.(1)

Certainly, this result would be very striking if the length of the year of Sirius had been directly decided by observations made on Sirius itself. But experimental astronomers affirm, that it is impossible that the heliacal rising of a star could serve as the basis of these exact observations on such a subject, particularly in a climate where *the circumference of the horizon is always so much loaded with vapours, that on fine nights, stars of the second and third magnitude are never seen within a few degrees of the edge of the horizon, and that the sun itself, at its rising and setting, is entirely obscured.*(2) They maintain, that if the length of the year had not been discovered by some other means, they would have been mistaken in one or two days (3) They do not doubt then that this duration of three hundred and sixty-five days and a quarter, is that of the tropical year, inaccurately determined by the observation of the shadow, or by that of the point where the sun rose daily, and ignorantly identified with the heliacal year of Sirius; so that it would be mere chance which determined with so much accuracy the duration of the latter for the epoch in question.(4)

(1) See the great work on Egypt. Antiq. Mem. v. i. p. 803; the ingenious Memoir of M. Fourier, entitled, 'Recherches sur les Sciences et le Gouvernement de l'Egypte.'

(2) These are the words of the late M. Nouet, astronomer to the expedition to Egypt. See Volney's 'Recherches Nouvelles sur l'Histoire Ancienne,' v. iii.

(3) Delambre Abrégé d'Astronomie, p. 217, and in his note on the Paranatellons. Hist. de l'Astr. du Moyen Age, p. 52.

(4) Deambre's Report on M. de Paravey's Memoir concerning the Sphere, in the 8th vol. of the New Annals of Voyages.

We shall also perhaps conclude, that men capable of such accurate observations, and who made them for so long a period, would not have assigned so much importance as to worship him; for they would have seen that the coincidence of his rising with the tropical year, and the inundation of the Nile are only temporary, and only took place in a determinate latitude. In fact, according to the calculations of M. Ideler, 2782 years before Christ, Sirius appeared in Upper Egypt, the second day after the Solstice; in 1322, the thirteenth; and in one hundred and thirty-nine after Christ, the twenty-sixth. (1)

At the present day it does not rise heliacally till more than a month after the solstice. The Egyptians would have had a decided preference in finding an epoch which would afford a coincidence between the commencement of the sacred year, with that of the actual tropical year; and then they would discover that their great period should be 1508 sacred years, and not 1461. (2) We certainly do not find any trace of this period of 1508 years in antiquity.

Can we, generally speaking, defend ourselves with the idea that if the Egyptians had such long series of observations, and exact observations, their disciple Eudoxus, who studied amongst them for thirteen years, would have carried a more perfect system of astronomy, maps of the heavens less inaccurate, and even congruous in their different parts? (3)

(1) Ideler, loc. cit. p. 38.

(2) See Laplace, Systême du Monde, 3rd edit. p. 17, and Annuaire of 1818.

(3) See M. Delambre, on the inaccuracy of the determina-

How was it that the precession of the equinoxes was not known to the Greeks but from the works of Hipparchus, if it had been inserted in the registers of the Egyptians, and written in such manifest characters on the ceilings of their temples?

How is it that Ptolemæus, who wrote in Egypt, did not deign to make use of any of the observations of the Egyptians?(1)

Besides, Herodotus, who dwelt with them so long, says nothing of these six hours which they added to the sacred year, nor of that great sothaic period which resulted from it. He, on the contrary, positively says, that the Egyptians making their years three hundred and sixty-five days, the seasons return at the same periods; so that at his time there was no appearance that they had as yet suspected the necessity of this quarter of a day.(2) Thales, who had visited the priests of Egypt less than a century before Herodotus, in like manner did not make known to his fellow-countrymen any other than the year of three hundred and sixty-five days only;(3) and, if we reflect that the colonies that went from Egypt, fourteen or fifteen centuries before Christ, the Jews, and the Athenians carried with them the lunar year; we may perhaps judge that the year of three hundred and sixty-five days itself, did not exist in Egypt at a period so remote.

I know that Macrobius(4) attributes a solar year

tion of the Sphere, by Eudoxus, in the 1st vol. of his History of Ancient Astronomy, p. 120, et seq.

(1) See M. Delambre's Preliminary Discourse on the History of the Astronomy of the Middle Age, p. 8, et seq.

(2) Euterpe, ch. iv.

(3) Diog. Laerte. lib. 1., in Thalet.

(4) Saturnal, lib. 1, ch. xv.

of three hundred and sixty-five days and a quarter, to the Egyptians. But this author, comparatively modern, and who lived long after the fixed year of Alexandria, may have confounded the epochs. Diodorus(1) and Stabro(2) only give a similar year to the Thebans; they do not say that it was generally adopted, and they lived long after Herodotus.

Thus the sothaic year, the great year, may have been but a modern invention, since it results from a comparison of the civil year with this pretended heliac year of Sirius; and that accounts for its not being spoken of before the writings of the second and third century after Christ,(3) and that Syncellus alone, in the ninth century, seems to quote Manetho, as having mentioned it.

Whatever may be said on the subject, we have the same ideas of the astronomical science of the Chaldeans. That a people inhabiting vast plains, under a sky always serene, may have been led to observe the course of the stars, even from the times when they were wandering tribes, and when the stars alone could guide them at night, is natural. But since what period did they become astronomers, and how far have they carried the science of astronomy? That is the question. It is agreed that Callisthenes sent Aristotle observations made by them, which went as far back as 2200 years before Christ. But this is stated only by Simplicius,(4) according

(1) Bibl. lib. i. p. 46.

(2) Geogr. p. 102.

(3) See the admirable dissertation of M. Biot, on the probable newness of this period, in his researches on many points of Egyptian Astronomy, p. 148, et seq.

(4) See M. Delambre's Hist. d'Astro. v. 1, p. 212. See also his Analysis of Geminus, ib. p. 211. Compare with them the

to the authority of Porphyry, and six hundred years after Aristotle. Aristotle himself makes no mention of it; no accredited astronomer speaks of it. Ptolemæus relates and makes use of ten observations on eclipses really made by the Chaldeans; but it only goes back to Nebuchadnezzar (721 years before Christ;) they are incorrect, the time is only expressed in hours and half-hours, and the obscuration only in half or quarter diameters. However, as they had certain dates, the Chaldeans must have had some knowledge of the accurate length of the year, and some method of measuring time. They appear to have known the period of eighteen years which brings back the eclipses of the moon in the same order, and which the mere inspection of their registers would have informed them quickly; but it is certain that they neither knew how to explain, nor foretell the eclipses of the sun.

Cassini and Bailey, having misunderstood a passage in Josephus, have asserted that they had discovered in it a luni-solar period of six-hundred years, which must have been known to the early patriarchs.(1)

Thus all confirms the idea that the great reputation of the Chaldeans were given to them in more modern times, by their unworthy successors, who, under the same name, sold throughout the Roman empire, horoscopes and predictions; and who, to gain more credit, attributed to their rude ancestors the honour of the discoveries of the Greeks.

Memoirs of M. Ideler, on the Astronomy of the Chaldeans, 4th vol. of Halma's Ptolemy, p. 166.

(1) See Bailey's Hist. of Ancient Astronomy, and M. Delambre's work on the same subject, v. 1, p. 3.

As to the Indians, it is well known that Bailly, thinking that the epoch which is used as a period of departure in some of their astronomical tables, had been really observed, has attempted thence to deduce a proof of the remote antiquity of this science amongst this people, or at least in the nation which had bequeathed its knowledge to them. But the whole of this system so laboriously conceived, falls to the ground of itself, now that it is proved that this epoch was subsequently adopted on calculations made backwards, and the result of which was incorrect.(1)

M. Bentley has discovered that the tables of Tirvalour, on which, particularly, the assertion of Bailly was founded, must have been calculated about 1281 after Christ (540 years since;) and that the Surya-Siddhanta, which the Brahmins regard as the most ancient and scientific treatise on astronomy, and which they pretend was revealed more than twenty millions of years ago, could not have been composed until about 760 years since.(2)

The solstices and equinoxes marked in the Pouranas, and calculated, according to the positions which were assigned to them in the signs of the Indian zodiac, have had a very remote antiquity assigned to them. A more exact study of these signs or nacchatrons, has lately shown M. de Paravey, that reference is only made to solstices of twelve centuries before Christ. This writer, at the same

(1) See Laplace's Exposé du Systeme du Monde, p. 330; and the Memoir of M. Davis on the Astronomical Calculations of the Indians. Mem. de Calcutta, v. 2, p. 225, 8vo. edit.

(2) See Mem. of Bentley, on the Antiquity of Surya-Siddhanta. Mem. de Calcutta, v. vi. p. 540; and on the Astronomical Systems of the Indians, ib. v. viii. p. 165, of the 8vo. edit.

time, states that the place of these solstices is so indefinitely fixed, that we cannot decide on it nearer than two or three hundred years. Those of Eudoxus and Tcheou-Kong are the same.(1) It is confidently asserted that the Indians do not make observations, and have no instruments necessary for that purpose. M. Delambre agrees with Bailly and Legentil, that they have processes of calculations which, without proving the antiquity of their astronomy, at least show its originality;(2) and this conclusion cannot be extended to their sphere, for independently of their twenty-seven nacchatrons, or lunar houses, which are very similar to those of the Arabs, they have in their zodiac the same twelve constellations as the Egyptians, Chaldeans, and Greeks;(3) and if we refer to M. Wilfort, their extra-zodiacal constellations were the same as those of the Greeks, and had names which differ very slightly from the Greek names.(4)

The introduction of astronomy in China, is attributed to Yao, who sent, says the Chou-King, astronomers towards the four cardinal points of his empire to examine what stars presided at the four seasons, and to regulate what was to be done at each

(1) Manuscript Memoirs of M. de Paravey, on the Sphere of Upper Asia.

(2) See the profound treatise on the Astronomy of the Indians, in the History of Ancient Astronomy, by M. Delambre, v. 1, p. 400—556.

(3) See Sir W. Jones' Memoir on the Antiquity of the Indian Zodiac. Mem. of Calcutta, v. ii. p. 289, 8vo. edit. and in the French translation, v. ii. p. 332.

(4) We subjoin M. Wilfort's own words from his Memoir on the Testimonies of the Ancient Hindoo books, concerning Egypt and the Nile. Mem. de Calcutta, v. iii. p. 433, of the 8vo. edit.

"Having requested my pundit, who is a learned astronomer,

season of the year.(1) As if it was necessary to send them to different parts to effect this. About two centuries later, the Chou-King mentions a solar eclipse, but with absurd circumstances, as in all the fables of this kind; for a general, and the whole Chinese army is made to march against the astronomers, because they had not properly predicted it:(2) and it is known that for more than two thousand years afterwards the Chinese astronomers had no means of predicting the eclipses of the sun with precision. In 1629, of our era, at the time of their dispute with the Jesuits, they did not even know how to calculate the obscurations.

The real eclipses, recorded by Confucius in his chronicle of the kingdom of Lou, do not begin until 1400 years after this, in 776 before Christ, and scarcely fifty years earlier than those of the Chaldeans recorded by Ptolemæus. So true it is, those nations which escaped at the same period from the universal catastrophe, have, under similar circumstances, reached a similar degree of civilization about the same period. But we should believe, by

to point out to me in the heavens the constellation of Antarmada, he immediately directed me to Andromeda, which I had taken care not to show him as a constellation that I knew. He then produced a very scarce and curious book, in Sancrit, in which was a particular chapter on the Upanacshatras, or extra zodiacal constellations, with figures of Capeya, and of Casyape sitting, holding a lotus flower in her hand, of Antarmada, chained with the fish near her, and of Parasica, holding the head of a slain monster dripping with blood, and with snakes for hair."

Who does not here recognise Perseus, Cepheus and Cassiopea? But let us not forget that this pundit of M. Wilfort, has been much doubted.

(1) Chou-King, pp. 6—7.

(2) Chou-King, pp. 66, et seq.

the identity of the name of the Chinese astronomers under different reigns (they appear, according to the Chou-King, to be called *Hi* and *Ho*,) that at this remote epoch their profession was hereditary, as in India, Egypt, and Babylon.

The only more ancient Chinese observation, which does not bear in itself the proof of its own falsity, is that of the observation calculated by Tcheou-Kong, about 1100 before Christ, and even that is incorrect.(1)

Our readers may thus judge that the inferences drawn from the high perfection of the astronomy of ancient people are not more conclusive in favour of the excessive antiquity of these people than the testimonies which they have adduced in their own favour.

But what would this astronomy prove if it were even more perfect? Have we calculated the progress which a science could make in the bosom of nations which, in some sort, had no other; when the serenity of the sky, the wants of a pastoral or agricultural life, and superstition made the stars an object of universal contemplation; when colleges of the most respected men were charged with keeping a register of interesting phenomena, and of transmitting their memory of them; where the inheritance of the profession caused children to be brought up from the cradle in the knowledge acquired by their fathers? If amongst the multitude of persons solely occupied with astronomy, there were one or

(1) See in 'La Connoissance des Temps,' of 1809, p. 382, and M. Delambre's 'History of Ancient Astronomy,' v. i. p. 391, extracted from a Memoir of P. Gaubil, on the observations of the Chinese.

two expert geometricians, even then all that these people knew might have been discovered in a few centuries.

We may learn, that since the Chaldeans, real astronomy has had only two epochs, that of the Alexandrian school, which lasted four hundred years, and our own, which has not lasted so long. The age of the Arabs scarcely added any thing to it. The other ages have been mere nullities with respect to it. Only three hundred years have intervened between Copernicus and the author of La Mécanique Celeste (Laplace,) and yet did the Indians require thousands of years to arrive at their crude theories. (1)

THE ASTRONOMICAL MONUMENTS LEFT BY THE ANCIENTS HAVE NOT THE EXCESSIVELY REMOTE DATES GENERALLY ATTRIBUTED TO THEM.

Recourse has been had to another species of argument. It is pretended, that, independently of the knowledge which these nations might have attained, they have left monuments which bear, by the state of the heavens which they represent, a certain and remote date; and the zodiacs engraved in two temples of Upper Egypt, have appeared for some years to afford, on this point, most perfectly conclusive proofs. They present the same zodiacal

(1) The English translator of this Discourse (Jameson) quotes, on this point, the example of the celebrated James Ferguson, who was a shepherd in his youth, and who, whilst watching his flocks at night, had conceived the idea of a chart of the heavens, and drew it, perhaps, more correctly than any Chaldean astronomer. A similar account is given of Jamerey Duval.

figures that we now use, but arranged in a peculiar manner. It has been thought that this distribution represents the state of the heavens at the moment when these monuments were delineated, and that it would be possible thence to decide on the date of the building of the edifices which contain them.(1)

(1) Thus, at Dendera (the ancient Tentyris,) a city above Thebes, in the portico of the great temple which faces the north,* there are on the ceiling the signs of the zodiac marching in two bands, one of which is along the east side, and the other on the opposite side; they are each held in the embrace of a female figure of similar length, whose feet are towards the entrance, the head and arms towards the bottom of the portico, and consequently the feet are towards the north, and the head towards the south.

The Lion heads the band which is in the western side; he is directing his course towards the north, or the feet of the female figure, and his feet are towards the eastern wall. The Virgin, the Balance, the Scorpion, the Archer, and the Capricorn, follow in the same line. This latter is towards the bottom of the portico, and near the hands and head of the large female figure. The signs of the eastern band begin at that extremity when those of the other band finish, and are consequently directed towards the bottom of the portico, or towards the arms of the tall figure. They have their feet towards the lateral wall of their own side, and the heads in the contrary direction to the opposite band. The Aquarius (Verseau,) is advancing foremost, followed by the Fishes, the Ram, the Bull, and the twins. The last of the series, which is the Cancer, or rather Scarabæus (or beetle,) for this insect is substituted for the Cancer of the Greeks in the zodiacs of Egypt, is thrown on one side on the legs of the great figure. The place it should occupy is filled by a globe placed on the apex of a pyramid composed of small triangles which represent a kind of rays, and in front of its base is a large female head, with two small horns. A second Scarabæus is placed sideways and across on the first band in the angle which the feet of the large figure form with the body, and in front of the space where the Lion is advancing, which is rather behind. At the other end of the same band, the Capricorn is very near the bottom, or the

* See the great work on Egypt. Antiq. v. iv. pl. xx.

But, to reach the remote antiquity which is pretended to be deduced from them, we must first suppose that their division had a decided relation to a

arms of the great figure, and on the band at the left the Aquarius is at some distance from it, but the Capricorn is not repeated like the Cancer. The division of this zodiac, from the entrance, is then between the Lion and the Cancer, where, if he thought that the repetition of these Scarabæus marks the division of a sign, it takes place in the Cancer itself; but that at the bottom is between the Capricorn and Aquarius.

In one of the inner halls of the same temple there was a circular planisphere inscribed in a square, which has been brought to Paris by M. Lelorrain, and is now in the king's library. There are there also the signs of the zodiac, amongst many other figures which appear to represent constellations.*

The Lion there corresponds with one of the diagonals of the square; the Virgin who follows him corresponds with a perpendicular line directed eastward; the outer signs advance in their known order to Cancer, which, instead of completing the chain by corresponding to the level of the Lion, is placed above him nearer the centre of the circle; so that the signs are in a line rather spiral.

The Cancer, or rather Scarabæus, advances in a contrary direction to the other signs. The Twins correspond with the north; the Sagittary with the south; and the fishes with the east, but not exactly. On the eastern side of this planisphere is a large female figure, with her head in a southerly direction, and her feet towards the north, like the rest in the portico. A doubt might then be raised as to what point of this second zodiac should be taken as the commencement of the signs. If we take one of the perpendiculars, or one of the diagonals, or the point where one part of the series passes over the other part, we should divide it at the Lion, or between the Lion and the Cancer, or, lastly, at the Twins.

At Esne (the ancient Latopolis,) a city below Thebes, there are zodiacs on the ceilings of two different temples.

That of the great temple, whose entrance is eastward, is on two bands contiguous to, and parallel with the length of the south side of the ceiling.†

* See the great work on Egypt. Antiq. v. iv. p. 21.
† Id. v. i. pl. lxxix.

certain state of the sky dependent on the precession of the equinoxes, which causes the colours to make the tour of the zodiac in twenty-six thousand years;

The female figures who embrace them are not placed lengthwise, but in the breadth of the bands; so that one is across near the eastern entrance; the head and arms towards the north, and the feet towards the lateral wall, or southward, and the other is at the bottom of the portico, also across and facing the first.

The nearest band to the axis of the portico, or north, first presents, on the side of the entrance, or eastward, and towards the head of the female figure, the Lion, placed a little backwards and going towards the bottom, the feet towards the lateral wall; behind the Lion, at the commencement of the band, are two smaller Lions; before it is the Scarabæus, and then the Twins advancing in the same direction; then the Bull, the Ram, and the Fishes, close to each other, placed across the middle of the band. The Bull with his head towards the lateral wall, the Ram towards the axis. The Aquarius is farther off, and takes the same direction towards the bottom as the three first signs.

On the band nearest to the lateral wall and the north, we see at first, but at some distance from the bottom or west, the Capricorn, which is going in an opposite direction to the Aquarius, and directs his course eastward, or towards the entrance of the portico with the feet turned towards the lateral wall. Close to it is the Sagittary, corresponding with the Fishes and the Ram. He advances towards the entrance, but his feet are turned towards the axis in an opposite direction to those of the Capricorn.

At a certain distance in front, and near each other are the Scorpion and a female holding a balance; finally, a little more in front, but still sufficiently distant from the anterior, or eastern extremity, is the Virgin, who is preceded by a Sphynx. The Virgin and the female who holds the balance have their feet towards the wall, so that the Sagittary is the only sign which is placed with its head differently to those of the other signs.

Northward of Esne, is a small isolated temple, equally directed towards the east, and whose portico has also a zodiac:* it is on two lateral and separated bands. That which is along the south side begins with the Lion, who is advancing towards the bottom, or westward; the feet turned towards the wall, or south-

* See the great work on Egypt. Antiq. v. i. pl. lxxxvii.

that it pointed out, for example, the position of the solstitial point; and, secondly, that the state of the heavens represented, was precisely that which took place at the epoch when this monument was constructed; two suppositions, which of themselves evidently suppose many others.

In fact, are the figures of these zodiacs constellations, the real groups of stars which now bear the same name, or simply what astronomers call signs;

ward; the Scarabæus precedes it, and this latter is headed by the Twins marching in the same direction. The Bull, on the contrary, meets them, going in an easterly direction; but the Ram and the Fishes take the direction towards the bottom, or towards the west.

At the band on the northern side, the Aquarius is near the bottom, or the west, advancing towards the entrance, or the east, their feet turned towards the wall, preceded by the Capricorn and the Sagittary, which are going in opposite directions. The other signs are lost; but, it is evident that the Virgin should go at the head of this band on the side of the entrance.

Amongst the accessory figures of this small zodiac, we must remark two winged Rams, placed crosswise, the one between the Bull and the Twins; the other between the Scorpion and the Sagittary; and each nearly in the middle of its band, the second, however, rather more advanced towards the entrance.

It was thought, at first, that in the great zodiac of Esne, the division at the entrance was made between the Virgin and the Lion, and that of the bottom between the Fish and the Aquarius.

But Mr. Hamilton, and MM. de Jallois and Villiers have imagined that they discovered in the Sphynx, which preceded the Virgin, a repetition of the Lion, analogous to that of the Cancer in the great zodiac of Dendera; so that, according to them, the division should be made in the Lion. In fact, without this explanation, there would be only five signs on one side, and seven on the other.

As to the small zodiac at the north of Esne, we cannot tell if there be any emblem analogous to the Sphynx, because this part is destroyed.*

* British Review, February, 1827, p. 136; and the end of the Critical Letter on Zodiacomania, p. 33.

that is to say, divisions of the zodiacs, proceeding from one of the colures, whatever place this colure occupies?

Is the point at which these zodiacs have been divided into two bands necessarily that of a solstice?

Is the division of the side next the entrance necessarily that of the summer solstice?

Does this division indicate, even in a general sense, a phenomenon dependent on the precession of the equinoxes?

Does it not rather relate to some epoch whose rotation would be less; for example, to the moment of the tropical year, when such or such of the sacred years of the Egyptians began, which being shorter than the real tropical year, by nearly six hours, made the circuit of the zodiac in 1508 years. Finally, whatever meaning it may have had, has it been intended thereby to mark the time when the zodiac was engraved, or that when the temple was built? Was there no contemplation of recalling a previous state of the heavens at some interesting epoch for religion, whether by observation at the time, or concluded on by posterior calculations?

From the mere statement of such questions, we may perceive how complicated they were, and how any solution that might be adopted must be subject to dispute, and how little susceptible of positive proof in solving any other problem, such as the antiquity of the Egyptian nations. Thus we may say, that amongst those who endeavoured to draw a date from these data, that there are as many opinions as there have been writers on the subject.

M. Burkard, the learned astronomer, according to a first examination, judged that at Dendera, the solstice is in the Lion, and consequently two signs

earlier than at the present day, and that the temple had stood at least 4000 years.(1)

He, at the same time, assigned an antiquity of 7000 years to that of Esne, although it is not known how he meant to make these numbers agree with what was known of the precession of the equinoxes.

The late Lalande, seeing that the Crab was repeated on the two bands, imagined that the solstice passed through this constellation; but as it was so in the sphere of Eudoxus, he concluded that some Greek might have represented this sphere on the ceiling of an Egyptian temple, without knowing that he was depicting a state of the heavens which had for a long time ceased to exist.(2) It was, as we may perceive, a very different inference from that of M. Burkard.

Dupuis was the first who deemed it necessary to seek for confirmation of this idea, and he in some sort confidently adopted, that it was the solstice that was denoted; he found them, for the great zodiac of Dendera, in the globe at the apex of the pyramid, and in many emblems placed near different signs, and which sometimes, according to the ancient authors, such as Plutarch, Horus Apollo, or Clemens Alexandrinus; sometimes, according to his own conjectures, he imagined to represent phenomena which could have really been those of the seasons affected at each sign.

Besides, he maintained that this state of the heavens gives the date of the monument, and that they had, at Dendera, the original, and not a copy of the

(1) M. Grobert's Description of the Pyramids of Geza, p. 117.
(2) Connaissance des Temps, for the year XIV.

sphere of Eudoxus, which would relate to 1468 years before Christ, in the reign of Sesostris.

But the number of nineteen boats placed under each band gave him the idea that the solstice might have been in the nineteenth degree of the sign, which would make an addition of 288 years. (1)

Mr. Hamilton, (2) having remarked, that at Dendera, the Scarabæus on the side of the ascending signs is smaller than that on the other side, an English author(3) has thence concluded that the solstice may have been nearer the actual point than the middle of Cancer, which would take us back to a period of 1000 or 1200 years before Christ.

The late Nouet, judging that this globe, the rays, and the horned head or Isis, represent the heliacal rising of Sirius, pretended that they intended to denote an epoch of the sothaic period, but that they intended to mark it by the place of the solstice; but, in the last but one of these periods, that which elapsed from 2782 years to 1322 before Christ, the solstice has passed from thirty degrees forty-eight minutes of the constellation of the Lion, to thirty degrees thirty-four minutes of the Cancer; at the middle of this period then it was at twenty-three degrees thirty-four minutes of the Cancer; the heliacal rising of Sirius then occurred some days after the solstice. This, according to Nouet, was indicated by the repetition of the Scarabæus, and by the image of Sirius in the rays of the sun placed at the commencement of the band on the right. According

(1) Observation on the Zodiac of Dendera, in the Philosophical and Literary Review, in 1806, 2d Division, p. 257, et seq.

(2) Ægyptiaca, p. 212.

(3) See British Review, Feb. 1817, p. 136, et seq. Article vi. on the Origin and Antiquity of the Zodiac. It is translated at the end of Swartz's Critical Letters on Zodiacomania.

to this calculation, he concludes that this temple is 2052 years before Christ, and that of Esne 4600.(1)

All these calculations, even admitting that the division marks the solstice, must still be susceptible of many modifications; and it appears at first that their authors have supposed the constellations to be all like the signs, of thirty degrees, and have not reflected that they must be more, at least as they are now drawn, and as the Greeks have transmitted them to us, that they may thus be equal amongst themselves. In reality, the solstice which is now on this side of the first stars of the constellation of the Twins could only have left the first stars of the constellation of Cancer, 45 years after Christ. It only quitted the constellation of the Lion 1260 years before the same era.

My colleague, the celebrated and learned M. Delambre, has kindly supplied me with the subjoined tables, which with the remarks that follow, elucidate what has been just remarked.

(1) See the Memoir of Nouet, in the New Researches on the Ancient History of Volney, v. iii. p. 328—336.

TABLE of the Extent of the ZODIACAL CONSTELLATIONS, as they are drawn on our Globes, and of the Times which the Colures employ in traversing them.

Stars.	Longitudes in 1800.				Year of the Equinox.	Year of the Solstice.
					ARIES.	
γ	1s	0°	23′	40″	—389	—6869
β	1	1	10	40	—441	—6921
α	1	4	52	0	—710	—7190
η	1	5	18	50	—742	—7222
2 θ	1	6	14	16	—810	—7290
ζ	1	19	8	50	—1739	—8219
2 τ tail	1	20	51	0	—1862	—2342
Duration		20	27	20	1473	1473
					TAURUS.	
ξ	1s	19°	6′	0″	—1735	—8215
η	1	27	12	0	—2318	—8798
α	2	6	59	40	—3024	—9504
β	2	19	47	0	—3944	—10424
ζ	2	22	0	0	—4104	—10584
A Coch.	2	24	42	40	—4300	—10780
Duration		35	36	40	2565	2565
					GEMINI.	
Propus	2s	28°	9′	20″	—4547	—11027
η	3	0	39	0	—4727	—11207
γ	3	6	18	40	—5134	—11614
δ	3	15	44	0	—5813	—12293
Castor	3	17	27	30	—5937	—12417
Pollux	3	20	28	9	—6154	—12634
φ	3	22	27	10	—6926	—12776
Duration		24	17	40	1749	1749

Stars.	Longitudes in 1800.	Year of the Equinox.	Year of the Solstice.
	CANCER.		
1 ω	3s 24° 21′ 55″	—6475	+ 45
ζ	3 28 32 0	—6734	—254
β	4 1 28 20	—6906	—426
γ	4 4 45 0	—7182	—702
1 α	4 10 18 50	—7583	—1103
2 α	4 10 50 50	—7621	—1141
κ	4 13 23 0	—7804	—1324
Duration	19 1 5	1369	1369
	LEO.		
κ	4s 12° 30′ 0″	—7740	—1260
α	4 27 3 10	—8788	—1908
δ	5 8 50 0	—9612	—3132
β	5 18 50 55	—10357	—3877
,,	,, ,, ,, ,,	,,	,,
,,	,, ,, ,, ,,	,,	,,
Duration	36 29 55	2617	2617
	VIRGO.		
ω	5s 19° 2′ 22″	—10371	—3891
β	5 24 19 0	—10750	—4271
η	6 2 2 40	—11307	—4827
δ	6 8 41 40	—11786	—5306
α	6 21 3 15	—12676	—6196
γ	7 4 9 50	—13620	—7140
μ	7 7 17 40	—13845	—7365
Duration	48 15 18	3474	3474
Mean Duration	30 0 0	2160	

Stars.	Longitudes in 1800.				Year of the Equinox.	Year of the Solstice.
	LIBRA.					
1 α	7s	11°	0′	44″	—14113	—7633
2 α	7	12	18	0	—14246	—7926
β	7	16	35	0	—14514	—8034
γ	7	22	20	34	—14929	—8449
γ scorp.	7	27	41	0	—15312	—8832
ξ	7	28	30	15	—15372	—8892
,,		,,	,,	,,	,,	,,
Duration		17	29	31	1259	1259
	SCORPIO.					
1 A	7s	28°	50′	6″	—15396	—8916
β	8	0	23	48	—15508	—9028
α	8	6	57	38	—15980	—9500
ζ	8	12	35	30	—16387	—9907
λ	8	21	47	27	—17049	105569
,,		,,	,,	,,	,,	,,
Duration		22	57	21	1653	1653
	SAGITTARIUS.					
γ	8s	28°	28′	20″	—17530	—11050
λ	9	3	32	56	—17895	—11415
ζ	9	10	50	28	—18421	—11941
ψ	9	14	15	15	—18667	—12187
π	9	23	2	19	—19299	—12819
g	9	25	39	25	—19487	—13007
,,		,,	,,	,,	,,	,,
Duration		27	11	50	1957	1957

Stars.	Longitudes in 1800.				Year of the Equinox.	Year of the Solstice.
	CAPRICORNUS.					
1	9s	29°	39′	15″	—19775	—13295
2 α	10	1	3	58	—19877	—13397
β	10	1	15	30	—19891	—13411
ι	10	14	53	30	—20872	—14392
γ	10	18	59	28	—21166	—14586
μ	10	23	1	12	—21458	—14978
,,		,,	,,	,,	,,	,,
Duration		23	21	17	1683	1683
	AQUARIUS.					
ε	10s	8°	56′	0″	—20444	—13964
β	10	20	36	30	—21285	—14805
α	11	0	34	0	—22001	—15521
ζ	11	6	7	0	—22400	—15920
2 ψ	11	13	56	12	—22963	—16483
5 λ	11	18	3	28	—23260	—16780
Duration		39	7	28	281 6	3816
	PISCES.					
β	11s	15°	49′	0″	—23095	—16615
λ	11	23	49	0	—23675	—17195
δ	12	11	22	0	—24939	—18459
σ	12	24	26	0	—25879	—19399
α	12	26	34	58	—26034	—19554
,,		,,	,,	,,	,,	,,
,,		,,	,,	,,	,,	,,
Duration		40	45	58	2939	2939
					0°	270s
Sirius	3	11	20	10	—5487	—1847

CONSTRUCTION AND USE OF THE TABLE.

"The longitude of the stars for 1800, have been taken from the Berlin Tables, as calculated by Lacaille, Bradley, or Flamstead.

"The first and last of each constellation, and some of the most brilliant intermediate stars have been taken. The third column indicates the year when the longitude of the star was 0; that is, the year when the star was in the equinoctial colure of spring. The last column marks the year when the star was in the solstitial colure, either of winter or summer.

"For the Ram, the Bull and the Twins, the winter solstice has been chosen; for the other constellations, the summer solstice has been chosen, that the extreme might be avoided of going too remotely into antiquity, or approaching too closely to modern times. Besides, it will be easy to find the opposite solstice, by adding the semi-period of 12,960 years. The same rule applies for finding the time when a star has been or will be at the autumnal equinox.

"The sign — indicates the years before our era; the sign + the year of our era; and the last line at the end of each sign under the name of 'Duration,' gives the extent of the constellation in degrees, and the time that the equinox or the solstice employs in traversing the constellation from one end to the other.

"Fifty seconds per annum have been taken as the precession, as it is given by a comparison of the catalogue of Hipparchus with modern cata-

logues. This gave the convenience of round numbers, and an exactness that may be depended on. Thus the entire period is 25,920 years; the half period 12,960 years; the quarter 6480 years; the twelfth, or a sign, 2160 years.

We must observe that the constellations leave spaces between, and that sometimes they infringe on each other. Thus, between the last star of Scorpio, and the first of Sagittarius there is an interval of six degrees and two-thirds; on the contrary, the last of Capricornus is more advanced by fourteen degrees of longitude than the first of Aquarius.

"Independently of the inequality of the motion of the sun, the constellations would give a very unequal and faulty measurement of the year and months. The signs of thirty degrees afford a more convenient and less defective method. But the signs are only a geometric supposition; we can neither distinguish nor observe them; they are continually changing their places by the retrogradation of the equinoctial point.

"We have always been able to calculate roughly the equinoxes and solstices; and we have remarked, that the spectacle of the heavens during the night was not any longer exactly the same as it had been anciently at the times of the equinoxes and solstices. We have never been able to observe accurately the heliacal rising of a star; we must be a few days out of the calculation, and thus we often speak without having a positive period from which we could reckon. Before Hipparchus we do not find, either from books or traditions any thing whence we may calculate, and this has caused a multiplicity of systems. We have disputed without having a knowledge of the subject. Those who are not astronomers may form

their own ideas of the science of the Chaldeans, the Egyptians, &c. &c.; no real inconvenience will result. We may assign to these people the intelligence and wisdom of the moderns, but we can borrow nothing from them; for either they had nothing to leave, or have left nothing. Astronomers will never draw from the ancients any thing of the smallest utility. Let us then leave to the learned vain conjectures, and confess our positive ignorance of things useless in themselves, and of which there is not a single existing record.

"The limits of the constellations vary according to the authors that we consult. We see these limits expand or contract where they impress, from Hipparchus to Tycho, from Tycho to Hevelius, from Hevelius to Flamstead, Lacaille, Bradley, or Piazzi.

"I have said elsewhere, that the constellations were of no use, only that at best they enable us more easily to find out the stars, whilst the stars themselves point out particularly the fixed points whence we may refer the motions of the colures or the planets. Astronomy only began at the period when Hipparchus made the first catalogue of stars, measured the revolution of the sun, the moon, and their principal inequalities. All the rest is involved in darkness, uncertainty, and gross errors. It would be lost time to endeavour to explain or search into the chaos.

"Excepting a few particulars, I have said all that I think on the subject. I do not pretend to make converts: it is of little consequence who may or may not adopt my opinions; but if my arguments be compared with the speculations of Newton, Herschel, Bailly, and many others, it is not impossible

that in time these chimeras, more or less brilliant, may not be relished.

"I have endeavoured to determine the extent of the constellations after the catasterisms of the false Eratosthenes. The thing is really impossible. It would be still worse if Hyginus, and particularly Firmicus, are consulted. I subjoin what I have extracted from Eratosthenes.

Constellations.	Duration.	
Aries	1747 Years.	
Taurus	1826	
Gemini	1636	
Cancer	1204	
Leo	2617	
Virgo	3307	
The Talons . .	. . . .	1089*
Scorpio	1823	
Sagittarius . . .	2138	
Capricornus . .	1416	
Aquarius	1196	
Pisces	2936	

"As to the Chaldeans, Egyptians, Chinese, and Indians, we must not think of them. We can, in fact, get nothing from them. My opinion is expressed in the preliminary discourse of my History of the Astronomy of the Middle Age, pp. 17 and18.

* Eratosthenes makes only one constellation of Scorpio and the Talons. He makes the commencement of the latter without fixing the end; and, as he gives 1823 years to Scorpio, properly so called, there would remain 1089 years for the Talons, supposing that there was no space between the two constellations.

"See also the note added to the Report on the Memoirs of M. de Paravey, vol. viii. of the New Annals of Voyages, and re-published by M. de Paravey in his Summary of his Memoirs on the Origin of the Sphere, pp. 24, and from 31 to 36. See also the Analysis of the Mathematical Labours of the Academy in 1820, pp. 78 and 79. "DELAMBRE."

We should still have to ascertain when they ceased to place the constellation in which the sun entered after the solstice, at the head of the descending signs, and whether that took place immediately that the solstice had retrograded, so as to touch the preceding constellation.

Thus, MM. Jollois and Devilliers, to whose unremitting ardour we are indebted for our knowledge of these famous monuments, always taking the division towards the entrance of the vestibule as the solstice, and judging that Virgo must have been the first of the descending constellations, considering that the solstice had not receded at least as far as to the middle of the constellation of Leo; and thinking, moreover, as we have observed, that Leo is divided in the great zodiac of Esne, only make the zodiac as remote as 2610 years before Christ. (1)

Mr. Hamilton, the first who observed the division of the sign of Leo in the zodiac of Esne, reduced the distance of the period of the solstice there to 1400 years before Christ.

Many other systems on this subject have appeared. Mr. Rhode, for instance, proposed two. The first made the date of the zodiac of the portico

(1) See the great work on Egypt. Ant. Mem. vol. i. p. 486.

at Dendera, 591 years before Christ, the second fixes it at 1290.(1) M. Latreille assumed the epoch of this zodiac at 670 years before Christ; that of the planisphere at 550; that of the zodiac of the great temple of Esne at 2550; and that of the smaller at 1760.

But there was a vital difficulty in all these dates, which set out on the twofold supposition that the division marks the solstice, and that the position of the solstice marks the epoch of the monument. The unavoidable result is, that the zodiac of Esna must be at least 2000, and perhaps 3000(2) years more ancient than that of Dendera, a consequence which evidently destroys the supposition; for no man, with the slightest knowledge of the history of the arts, can believe that two edifices so so strikingly similar in their architecture have been built at periods so widely remote from each other.

The feeling of this impossibility, united with the belief that this division of the zodiacs marks a date, give rise to the conjecture, that it was intended to mark the period of the sacred years of the Egyptians, when the monument was constructed. These years only lasting three hundred and sixty-five days, if the sun, at the commencement of one, was at the commencement of a constellation, he would be six hours backward at the same time in the commencement of the following year, and after one hundred and twenty-one years, he would have

(1) Rhode's Essay on the Age of the Zodiac, and Origin of Constellations, in German, 1809, p. 78.

(2) According to the tables given above, the solstice remained 3474, or at least 3307 years in the constellation Virgo, which occupies the greatest space in the zodiac; and 2617 in that of Leo.

retrogaded to the commencement of the preceding sign.

It seems probable enough that the builders of a temple would have wished to indicate as nearly as possible in what period of the great year, or sothaic year, it was erected; and the indication of the sign which then commenced the sacred year, was the best possible means of effecting this. We should thus find that one hundred and twenty or one hundred and fifty years had elapsed between the building of the temple at Esne, and that at Dendera.

But, by this view of the case, it still remained to be determined, in which of the great years these erections took place; in that which finished one hundred and thirty-eight years after; or in that which terminated 1322 years before Christ, or in some other.

Visconti, the author of this hypothesis, taking the sacred year, whose commencement corresponded with the sign of Leo, and judging from the similarity of these signs, that they had been represented at an epoch when the opinions of the Greeks were not unknown in Egypt, could only choose the end of the last great year, or the space that elapsed between the year twelve, and the year one hundred and thirty-eight after Christ,(1) which seemed to him to agree with the Greek inscription, of which however he knew but little, but had heard that it made some mention of one of the Cæsars.

M. Testa, seeking the dates of the monument by another train of reasoning, supposed, that as Virgo is at Esne at the head of the zodiac, it was intended to depict the era of the battle of Actium, as it was

(1) Translation of Herodotus, by Larcher, v. ii. p. 570.

established in Egypt, by a decree of the senate, cited by Dion Cassius, and which began in the month of September, or the day on which Augustus took Alexandria.(1)

M. de Paravey considered these zodiacs in a novel point of view, which embraces at once both the revolution of the equinoxes, and those of the great year. Supposing that the circular planisphere of Dendera must have been placed towards the east, and that the axis from north to south is the line of the solstices, he found the summer solstice at the second of Gemini; that of the winter solstice at the tail of Sagittarius; and the line of the equinoxes would have passed through Pisces and Virgo, which would give him the first century of our era for a date.

By this method, the division of the zodiac of the portico could no longer have any relation to the colures, and it would be necessary to seek elsewhere for the mark of the solstice. M. de Paravey, having remarked that between all the signs there were female figures bearing a star on their heads, and going in the same direction; and noticing that the female only who follows Gemini is turned in a contrary direction to the others, judged that she marks the tropic, or *conversion* of the sun, and that this zodiac thus agrees with the planisphere.

By applying the idea of the easting (*orientement*) to the small zodiac of Esne, we should find the solstices between Gemini and Taurus, and between Scorpio and Sagittarius. They would be even

(1) See the dissertation of the Abbé Dominique Testa. "Sopra due Zodiaci novellamente scoperte nell' Egitto." Rome, 1802, p. 34.

marked by the change of direction of Taurus, and by the winged Rams placed across in these two places. In the great zodiac of the same city, the marks would be the position across of the Bull and the reverse situation of Sagittarius. There would then only be one portion of the constellation elapsed between the dates of Esne, and those of Dendera, a space however still too long for edifices so similar in construction.

The late M. Delambre appeared to confirm these conjectures concerning their more modern construction by an experiment on the circular planisphere; for on placing the stars upon Hipparchus's projection, according to the theory of this astronomer, and the positions which he had assigned them in his catalogue, increasing all the longitudes that thus the solstice would pass through the second of Gemini, he nearly reproduced this planisphere; and he says "this similarity would have been still more close if he had adopted the longitudes which are laid down in the catalogue of Ptolemæus, for the year of our era one hundred and twenty-three. On the contrary, on referring back twenty-five or twenty-six centuries, the right ascensions and declinations will be greatly changed, and the projections will have taken an entirely different figure. (1) All these calculations," adds the great astronomer, "lead us to the conclusion, that the sculptures are subsequent to the epoch of Alexander."

In fact, the circular planisphere having been brought to Paris, by MM. Saunier and Lelorrain, M.

(1) Delambre. Note at the end of the report of the Memoir of M. de Paravey. This report is printed in the new Annals of Voyages, v. viii.

Biot, in a work(1) founded on accurate measures, and calculations replete with sagacity, has determined that it represents, according to an exact geometrical projection, the state of the heavens as it was 700 years before Christ; but he is extremely cautious in not coming to any conclusion that it was sculptured at this period.

In fact, all these efforts of genius and knowledge, in so much as they affect the epoch of the monuments, have been rendered superfluous, since terminating where they should naturally have begun (if the first observer had not been blinded by prejudice,) pains have been taken to copy and restore the Greek inscriptions engraved on these monuments; and particularly, since M. Champollion has attained the art of deciphering those expressed in hieroglyphics.

It is now certain, and the Greek inscriptions agree with the hieroglyphics in proving, that the temple in which the zodiacs have been ensculptured were built whilst the country was under the domination of Rome. The portico of the temple of Dendera, according to the Greek inscription on its entablature, was dedicated to the health of Tiberius.(2)

On the planisphere of the same temple we read the title of *Autocrator* in hieroglyphic characters;(3) and it is probable that it refers to Nero. The small temple of Esne, the origin of which is placed at latest between 2700 or 3000 years before

(1) See M. Biot's work, Researches on many points of Egyptian Astronomy applied to the astronomical monuments found in Egypt. Paris, 1823, in 8vo.

(2) Letronne. Researches into the History of Egypt, during the domination of the Greeks and Romans, p. 180.

(3) Letronne. Researches, p. 38.

Christ, has a column engraven and painted in the tenth year of Antoninus, one hundred and forty-seven years after Christ, and sculptured and painted in the same style as the zodiac, which is near it.(1)

Besides, we have a proof that this division of the zodiac in such or such a sign, has no reference to the precession of the equinoxes, nor to the displacing of the solstice. A mummy case lately brought from Thebes by M. Caillaud (and containing, according to a very legible Greek inscription, the body of a young man who died in the nineteenth year of Trajan, one hundred and sixteen years after Christ,) (2) has on it a zodiac divided at the same point as those of Dendera;(3) and, according to all appearances, this division marks some astrological scheme relative to this individual, a conclusion which may probably be applied to the division of the zodiacs of the temples. It either denotes the astrological theme of the moment of their erection; that of the prince for whose safety they were devoted; or some similar epoch relative to which the position of the sun would have appeared of some particular importance to be noted.

Thus are for ever dissipated the conclusions that have been drawn from some incorrectly explained monuments, against the newness of the continents and nations, and we might have dispensed with so much detail on this point, if they were not so recently broached, and had they not made sufficient impres-

(1) Letronne. Researches, pp. 456—457.

(2) Letronne. Observations, critical and archæological, on the Zodiacal Remains of Antiquity, occasioned by an Ægyptian Zodiac, painted in a mummy case, bearing a Greek inscription of the time of Trajan. Paris, 1824, in 8vo. p. 30.

(3) Letronne, pp. 48—49.

sion to preserve their influence on the opinions of many persons.

THE ZODIAC IS FAR FROM BEARING IN ITSELF AN ASSURED AND VERY REMOTE DATE.

But there are writers who have asserted that the zodiac bears in itself the date of its invention, in as much as the names and the figures given to its constellations are an index to the position of the colures at the time of its invention; and this date, according to many, is so evident, and so remote, that it becomes a matter of indifference whether the representations which we possess of this circle are more or less ancient.

They pay no attention to the fact of this sort of argument involving in itself three suppositions equally uncertain. The country in which they admit that the zodiac was invented; the meaning which is supposed to have been given to the constellations which occupy it; and the position in which the colures were, relative to each constellation, when this meaning was given to it.

By the explanation given to other allegories, or as these allegories are allowed to have relation to the constellation of which the sun occupied the first degrees, or to that of which it occupied the middle, or to that which it was on the point of entering; that is to say, of which it occupied the last degrees, or finally to that which was opposite to it, and which rose in the evening; or, according as the invention of these allegories was assigned to another climate, so must we change the date of the zodiac. The possible variations in this respect may include as much as half

of the revolution of the fixed stars, that is, 13,000 years, and even more.

Thus Pluche, generalizing some indications of the ancients, has thought that Aries announces the beginning of the sun's elevation and the vernal equinox; that Cancer announces his retrogradation to the summer solstice; that Libra, the emblem of the equality, marks the autumnal equinox;(1) and that Capricornus, a climbing animal, denotes the winter solstice; after which, the sun returns to us. In this manner, by placing the inventors of the zodiac in a temperate climate, we should have rains under Aquarius; the birth of lambs and kids under Gemini; violent heats under Leo; harvests under the Virgin; hunting under Sagittarius, &c.; and these emblems are perfectly appropriate. By placing the colures at the commencement of the constellations, or at least, the equinox at the first stars of Aries, we should only arrive in the first instance at 389 years before Christ, an epoch evidently too modern, and which would render it necessary to refer to an entire equinoctial period, or 26,000 years. But if it be supposed that the equinox passed through the middle of the constellation, we should reach nearly 1000 or 1200 years more remote to 1600 or 1700 years before Christ; and this is the epoch which many celebrated men have thought really to be that of the invention of the zodiac, the honour of which, on very slight grounds, they have assigned to Chiron.

But Dupuis, who needed for the origin which he pretended to attribute to all religions, that astrono-

(1) Varro de Ling. Lat. lib. vi. Signa quod aliquid significent, at Libra æquinoctium, Mabroc. Sat. lib. 1, c. cxxi. Capricornus ab infernis partibus ad superas solem reducens Capræ naturam videtur imitari.

my, and particularly the figures of the zodiac, should in some sort have preceded all other human institutions, has sought another climate, to find other explanations for the emblems, and to deduce for them another epoch. If, taking Libra always as the equinoctial sign, but suppressing it at the vernal equinox, it be asserted that the zodiac was invented in Egypt, we shall find other proofs equally plausible for the climate of this country.(1) Capricornus, or the animal with a fish's tail, will mark the commencement of the elevation of the Nile at the summer solstice; Aquarius and Pisces the increase and decrease of the inundation; Taurus, the period of labour; Virgo, the gathering in of the harvest; and they will mark them at the precise seasons when these operations actually did take place. According to this hypothesis, the zodiac would have 15,000(2) years for a sun supposed at the first degree of each sign; more than 16,000 for the middle; and only 4000, in supposing that the emblem was given to the sign, opposite to which the sun was.(3) Dupuis has attached himself to 15,000 years, and on this date has founded the whole system of his celebrated work.

There were not wanting, however, persons who, admitting that the zodiac was invented in Egypt, have imagined allegories applicable to subsequent periods. Thus, according to Mr. Hamilton, Virgo would represent the land of Egypt when it is not

(1) See the Memoir on the Origin of the Constellations, in Dupuis' Origin of Worships, vol. iii. pp. 324, et seq.

(2) See the Memoir referred to in the note above, vol. iii. p. 267.

(3) Dupuis himself suggested this second hypothesis, ibid. p. 340.

fertilized by the inundation; the Leo, the season when this land is most infested by wild beasts, &c.(1)

The remote antiquity of 15,000 years would besides involve this absurd consequence, that the Egyptians, men who represented every thing by emblems, and who attached a vast importance to the conformity of those emblems with the ideas which they intended to portray, must have preserved the signs of the zodiac for thousands of years after they had ceased in any manner to correspond with the original signification.

The late Remi Raige endeavoured to support Dupuis' opinion by an entirely novel argument.(2) Having observed that we may find, in explaining the Egyptian days of the month by the oriental languages, meanings more or less analogous to the figures of the zodiacal signs, and finding from Ptolemæus that *epifi*, which signifies Capricornus, begins on the twentieth of June, and consequently immediately follows the summer solstice; he draws the conclusion, that at the beginning Capricornus himself was at the summer solstice, and thus of the other signs, as Dupuis had done before him.

But, independently of all conjecture of these etymologies, Raige did not observe that it was merely chance, that five years after the battle of Actium, in the year 25 before Christ, at the establishing of the fixed Alexandrian year, the first day of Thoth was

(1) Ægyptiaca, page 215.

(2) See the great work on Egypt. Ant. Mem. v. 1, the Memoir of M. Remi Raige, on the 'Nominal and Primitive Zodiac of the Ancient Egyptians.' See also the table of the Greek, Roman, and Alexandrian months, in the Ptolemæus of Halma, vol. iii.

was found to correspond with the twenty-ninth of August of the Julian year, and continued ever since to correspond. It is only from this epoch that the Egyptian months began from fixed days of the Julian year, at Alexandria only; and Ptolemæus himself did not discontinue to employ in his Almagest the ancient Egyptian year, with its indefinite months.(1)

Why may not, at some epoch, the names of the signs, have been given to the months, or the names of the months to the signs in as arbitrary a manner as the Indians have given to their twenty-seven months twelve names, chosen from amongst those of their lunar houses, for reasons now impossible to ascertain or account for?(2)

The absurdity of preserving for fifteen thousand years in the constellations, the figures and symbolic names which no longer bore any relation to their respective situations, would have been much more evident if it had been carried so far as to preserve to the months those same names which were incessantly in the mouths of the people, and the irrelevancy of which would be perceptible at every instant.

What then would become of all those other systems, if the figures and names of the zodiacal constellations had been given to them, without at all relating to the course of the sun, as their inequality, the extent of many of them beyond the zodiac, and

(1) See Ideler's 'Researches on the Astronomical Observations of the Ancients,' a translation of which has been inserted by M. Halma, in the third volume of his Ptolemæus; and particularly the Memoir of Freret on the opinion of Lanauze, relative to the establishing of the Alexandrian year, in the Memoir of the Academy of Belles Lettres, vol. xvi. p. 308.

(2) See Sir William Jones's Memoir on the Antiquity of the Indian Zodiac, Mem. de Calcutta, vol. ii.

their manifest connexion with neighbouring constellations, seem to demonstrate?(1)

What would be the consequence, if, as Macrobius distinctly says,(2) "each sign should be considered as an emblem of the sun, considered in some one of his effects or general phenomena, and without any reference to the months through which he passes, either into the sign or into its opposite?"

Finally, how would it be if names had been given in an abstract manner to the divisions of space or time, as they are now assigned by astronomers to what they call the signs, and had not been applied to the constellations or groups of stars but at an epoch determined by chance, so that we could conclude nothing farther from their signification?(3)

Here are, doubtless, sufficient arguments to deter an ingenuous mind from seeking into astronomy for proofs of the antiquity of nations; but even if these pretended proofs were as certain as they are vague and destitute of convincing results, what conclusion could we thence draw against the great catastrophe of which we have so many other indisputable demonstrations? We can only allow that, as some modern writers have said, astronomy was amongst the sciences preserved by those persons whom this catastrophe spared.

(1) See the Zodiac Explained, or Researches on the Origin and Signification of the Constellations of the Greek Sphere, translated from the Swedish by M. Swartz. Paris, 1809.

(2) Saturnal. l. 1, c. 21, sub fin. *Nec solus Leo, sed signa quoque universa Zodiaci ad naturam solis jure referunter*, &c. It is only in this explanation of Leo and Capricornus, that he has recourse to any phenomena relative to the seasons; Cancer even is explained under a general point of view, and with relation to the obliquity of the progress of the sun.

(3) See M. de Guignes' Memoir on the Zodiacs of the Eastern Nations, Academie des Belles Lettres, vol. xlvii.

EXAGGERATIONS WITH RESPECT TO CERTAIN OPERATIONS IN MINES.

The antiquity of certain mining operations has been greatly exaggerated. A modern author asserts, that the mines of the island of Elba, judging from the heaps of rubbish excavated from them, must have been worked for more than forty thousand years; but another author, who has also examined these rubbish heaps with care, reduces this period to rather more than five thousand years,(1) and then, in supposing that the ancients only excavated annually but a quarter of the quantity now extracted. But why should we believe that the Romans, who consumed so much iron in their military arrangements, should draw so little from these mines? Besides, if these mines had been worked for four thousand years only, how should iron have been known in days of such remote antiquity.

GENERAL CONCLUSION CONCERNING THE EPOCH OF THE LAST REVOLUTION.

I concur, then, with the opinion of MM. Deluc and Dolomieu, that if there be any thing determined in geology, it is, that the surface of our globe has been subjected to a vast and sudden revolution, not farther back than from five to six thousand years: that this revolution has buried and caused to disappear the countries formerly inhabited by man, and the species of animals now most known; that contrariwise it has left the bottom of the former sea

(1) See M. de Fortia d'Urban's History of China before the Deluge of Oxyges, p. 33.

dry, and has formed on it the countries now inhabited; that since the revolution, those few individuals whom it spared have been spread and propagated over the lands newly left dry, and consequently it is only since this epoch that our societies have assumed a progressive march, have formed establishments, raised monuments, collected natural facts, and combined scientific systems.

But the countries now inhabited, and which the last revolution left dry, had been before inhabited, if not by mankind, at least by land animals; consequently, one preceding revolution, at least, had overwhelmed them with water; and if we may judge by the different orders of animals whose remains we find therein, they had, perhaps, undergone two or three irruptions of the sea.

IDEAS OF RESEARCHES TO BE STILL FARTHER MADE IN GEOLOGY.

These are the alternatives which now appear to me to form the most important geologic problem which requires solving, or rather, properly defining, or accurately limiting; for, to solve it entirely, it would be requisite to discover the cause of these events, an undertaking of a very different nature.

I repeat, we see very clearly what is passing on the surface of the continents in their present state; we have very fairly ascertained the uniform march and regular succession of the primitive formations, but the study of secondary formations has scarcely yet commenced; that wonderful series of unknown zoophytes, and marine mollusca, followed by reptiles and fresh-water fish equally unknown, and these in their turn replaced by zoophytes and mollusca, more

a-kin to those of the present day; those land animals and mollusca, and other fresh-water animals, also unknown, which next occupy the places, to be again displaced, but by mollusca, and other animals similar to those of our own seas; the relations of these various beings with the plants, whose remains accompany theirs; the relations of these two kingdoms with the mineral layers which contain them; the more or less their uniformity with one another in different basins; all these are a series of phenomena which appears to me to call imperiously for the profound attention of philosophers.

Made interesting by the variety of the productions of the partial or universal revolutions of this epoch, and by the abundance of the various species which alternately figure on the stage, this study is divested of the dryness of that of the primordial formations, and does not, like it, plunge itself into hypotheses. The facts are so close, so curious, and so evident, that they suffice in a measure for the most ardent imagination; and the conclusions which they arrive at from time to time, however scrupulous the observer may be, not having any thing indefinite, at the same time have nothing arbitrary. Finally, it is in the events which are nearer to our times that we can hope to find any traces of the more ancient events and their causes, if it be indeed allowed, after so many trials, to flatter ourselves with such a hope.

These ideas have beset, I may say, have tormented me, whilst I have been engaged in making researches amongst fossil bones, the results of which I have lately made public; researches which only comprise so small a portion of these phenomena of the last age but one of the earth, and which, notwithstanding, are united to all the others in an intimate

manner. It was nearly impossible that the desire of studying the generality of these phenomena should not arise, at least, in a limited space around us. My excellent friend, M. Brongniart, in whom other studies had excited similar desires, desired me to associate with him, and thus we have laid the first foundations of our researches in the vicinity of Paris; but this work, although it bears my name, is nearly all that of my friend, from the infinite pains he has bestowed from the commencement of our plan, and, since our journeys, on the profound investigation of the objects, and in classifying the whole. I have, by consent of M. Brongniart, placed it in the second part of my Researches, in that in which I have treated of the fossil remains of our neighbourhood. Although relating, apparently, to a limited country, it affords numerous results applicable to geology generally, and in this light may be considered as an integral part of the present Discourse, at the same time that it is most assuredly one of the finest ornaments of my work. (1)

We have there the history of the most recent changes that have taken place in a particular basin, and it leads us to the chalk formation, whose extent over the globe is infinitely greater than that of the materials of the basin of Paris. The chalk, which has been considered as modern, is thus found to have a remote origin in the ages which preceded the last catastrophe. It forms a kind of boundary between the most recent formations, those to which the name of *Tertiary* may be applied; and the formations which are called *Secondary*, those which were de-

(1) Separate copies have been printed, entitled, "Description Geologique des Environs de Paris," par MM. G. Cuvier and Al. Brongniart, second edition, Paris, 1822, in 4to.

posited before the chalk, but after the primitive formations and those termed Transition.

The recent observations of many geologists who have followed up our views, such as MM. Buckland, Webster, Constant-Prevost, and those of M. Brongniart himself, have proved that these formations, posterior to the chalk, have been reproduced in many other basins besides that of Paris, although with some variations; so that it has been possible to constitute an order of succession, many of the stages of which extend to nearly all countries that have been examined.

RECAPITULATION OF THE OBSERVATIONS ON THE SUCCESSION OF FORMATIONS.

The most superficial strata, those deposites of mud and clayey sand mixed with round flints transported from distant countries, and filled with fossil remains of land animals for the most part unknown, or at least foreign to the country, seem principally to have covered all the plains, filled the bottoms of all caverns, choked up all the clefts of rocks which have been in their way. Described with great care by M. Buckland, under the name of *diluvium*, and very different from other beds consisting of matter deposited incessantly by torrents and rivers, which contain only relics of the animals of the country, and which M. Buckland distinguishes by the name of *alluvium;* they form at present, in the eyes of all geologists, the most evident proof of the immense inundation which was the last catastrophe of this globe. (1)

(1) See Professor Buckland's great work, called 'Reliquæ Di-

Between this diluvium and the chalk, are formations alternately filled with the productions of fresh water and salt water, which mark the irruptions and retreats of the sea, to which, since the deposition of the chalk layer, this portion of the globe has been subjected; first, marls and mill stones and hollow silex, filled with fresh water shells like those of our marshes and pools; under them are marls, sand stones, and limestone, all the shells of which are marine; oysters, &c.

Still deeper are fresh water formations of a much more remote period, and particularly those famous gypsum deposites in the vicinity of Paris, which have afforded the means of adorning the edifices of this fine city with so much facility, and where we have discovered entire genera of land animals, of which no traces have been elswhere detected.

They rest on those equally remarkable beds of limestone, of which our capital is built, and in the more or less close composition of which the patience and sagacity of the savans of France have already detected more than eight hundred species of shells, all marine, but the greater part unknown in the seas now existing. They also contain bones of fishes, of cetaceous and other marine mammiferous animals.

Under the marine limestone is another fresh water deposite, formed of clay, in which are interposed great layers of lignite (brown coal,) or that fossil coal of more recent origin than the common coal. Amongst the shells always of fresh water, there are also some bones; but it is remarkable that they are bones of reptiles and not of mammifera. It is filled

luvianæ, London 1823,' in 4to. pp. 185, et seq.; and the article 'EAU' by M. Brongniart, in the 14th volume of the Dictionary of Natural Sciences.

with crocodiles and tortoises; but the genera of extinct mammifera, which are deposited in the gypsum, are not there to be found. They did not as yet exist in that country when these clays and lignites were formed.

This fresh water formation, the most ancient that has been with certainty detected in our neighbourhood, and which supports all the formations which we have just enumerated, is itself supported and environed entirely by chalk, a formation, vast from its thickness and by its extent, which shows itself in very distant countries, such as Pomerania and Poland; but which, in our environs, pervades with a sort of continuity Berri, Champagne, Picardy, Upper Normandy and a part of England, and also forms a great circle, or rather basin, in which the formations of which we have been speaking are contained, but the borders of which they also cover in those places where they were less elevated.

In fact, it is not in our basin alone that these kinds of formations are deposited. In other countries, where the surface of the chalk offered similar cavities; in those even where there was no chalk, and where the most ancient formations alone offered themselves as supporters, circumstances often brought deposites more or less like our own, and containing similar organic bodies.

Our fresh water shell formations of the second stage have been found in England, Spain, and even to the confines of Poland.

The marine shells placed between them have been discovered along the whole chain of the Appenines.

Some of the quadrupeds of our gypsum deposites, the palæotheria for instance, have also left some of the remains in the gypseous formations of Velai, and in the molasse quarries of the south of France.

Thus the partial revolutions which took place in our environs, between the epoch of the chalk and that of the general deluge, and during which the sea was thrown upon our districts or retired from them, occurred also in a multitude of other countries. The globe underwent a long series of variations and changes, probably very rapid, since the deposites they have left no where show much thickness or solidity. The chalk was produced by a sea more tranquil and uninterrupted; it contains only marine productions, amongst which there are however *some* vertebrated animals of most peculiar kinds; but the *whole* class of reptiles and fishes; great tortoises, enormous lizards, and similar animals.

The formations previous to the chalk, and in the hollow of which it is deposited, as the layers of our neighbourhood are, form a great part of Germany and England; and the efforts recently made by the learned of these two countries, similar to ours, and by employing the same principles, united to those which had been previously tried by the school of Werner, will soon leave nothing to be desired in addition to our knowledge of them. MM. Humboldt and de Bonnard in France and Germany; Messrs. Buckland and Conybeare in England, have given us the most perfect and complete tables of them.

The table annexed, which was kindly drawn out for me by M. de Humboldt, to adorn my work, not only has the secondary formations, but the whole series of strata arranged, from the most ancient that are known, to the most recent and superficial. It is in a manner the summary of the labours of all geologists.

TABLE OF GEOLOGICAL FORMATIONS IN THE ORDER OF THEIR SUPERPOSITION. BY M. AL. DE HUMBOLDT.

Tertiary formations.

Alluvial deposites.

Limestone formation, with millstone (meulières.)

Sandstone and sand of Fontainebleau.

Gypsum with bones. Siliceous Limestone.

Coarse limestone.
(Clay of London.)

Tertiary sandstone, with lignites (brown coal.)

(Plastic clay.) Molasse. Nagelfluhe.

Secondary Formations.

white.
Chalk, soft (tuffeau.) *Ananchites.*
chloritic.

Green sand,
Wead clay. Secondary sandstone with *lignites.*
Ferruginous sand.

Ammonites. Limestone of Jura.
Planulites.

Quadersandstein, or white sandstone, sometimes above the lias.

Muschelkalk.
Ammonites nodosus.

Slaty beds with fish and crustacea.
Coral rag.
Dive clay.
Oolites and Caen limestone.
Marly or calcareous lias. with *gryphœa arcuata.*

Marls with fibrous gypsum. Saliferous variegated sandstone.
Arenaceous layers.

Product. aculeat. (Alpine limestone.)
Magnesian Limestone. Zechstein.
Coppery slate.

Quartziferous porphyry. | Co-ordinate formations of porphyry, red sandstone, and coal.

Intermediary Formations.

Transition formations.
Slates with Lydian stone, greywacke, diorites, euphotides.
Limestone with *orthoceratites, trilobites, and evomphalites.*

Primitive Formations.

Primitive formations.
Clayey slates (Thonschiefer.)
Mica slates.
Gneiss.
Granites.

Beneath the chalk are green sands, the lower layers of which have some organic remains. Still deeper are ferruginous sands. In many countries, both these are strongly marked with sand-stone layers, in which are also found lignites, amber, and relics of animals.

Under this, is the vast mass of strata composing the chain of Jura and the mountains which form its continuation into Swabia and Franconia; the main ridge of the Appenines, and a vast many beds in France and England. It consists of calcareous slates rich in fish and crustaceous animals; extensive beds of oolites, or of a granular limestone: marl, gray limestone, having pyrites characterised by the presence of ammonites; oysters with bent valves, termed gryphææ; and of reptiles more and more singular in construction and character.

Extensive layers of sand and sandstone, often bearing vegetable impressions, support all these beds of Jura, and are themselves supported by a layer of limestone, which is so replete with numerous shells and zoophytes, that Werner has called it by the too common name of *shelly lime-stone*, and which other sandstone strata, of the sort called variegated sandstone, separate from a limestone still more ancient, not less incorrectly called *alpine limestone*; because it composes the high Alps of the Tyrol, but which in fact is found in our eastern provinces, and throughout the whole south of Germany.

It is in this limestone, termed shelly, that the vast masses of gypsum and rich layers of salt are deposited; and beneath it are thin layers of coppery slates, very rich in fish, and amongst which are also found fresh-water reptiles. The coppery slate is supported by a red sandstone of the period when

those famous layers of coal were deposited, the resource whence the present generation is supplied, and the remains of the earliest vegetable productions which ornamented the face of the globe. We find, from the trunks of ferns, whose impressions they have preserved, how much these ancient forests differed from the present.

We next arrive at those transitive formations in which primæval nature, a nature inanimate and solely mineral, seemed still to contend for empire with animated nature. Black limestone, and slates which only present crustacea and shells and species now extinct, are presented alternately with the remains of primitive formations, and announce to us the fact of our having reached the most ancient formations that it has been permitted to us to discover; those ancient foundations of the actual coating of the globe, the marble and primitive slates, the gneisses, and finally the granites.

Such is the exact arrangement of the successive masses with which nature has enveloped this earth. Geology has detected it by combining the lights of mineralogy with those furnished by the sciences of organic structure and existence; an order so new and pregnant with fact, that it has only been acquired since the actual proofs offered to observation have been preferred to fantastic systems, and contradictory conjectures, on the primary origin of the globe, and all those phenomena, which in nowise resembling those to which we are accustomed, could neither detect therein, to throw a light on the facts, materials to produce it, or a touchstone to try and prove. Some years since, the majority of geologists might be compared to historians who were only interested in the history of France with regard to what passed amongst the Gauls before Julius Cæsar;

but yet these historians, in composing their romances, availed themselves of their acquaintance with subsequent facts, while the geologists alluded to entirely neglected the posterior occurrences which alone could cast any light on the obscurity of former times.

In conclusion, it only remains for me to present the result of my individual researches, or in other words the summary of my great work. I shall enumerate the animals that I have discovered, in an order the reverse of that which I have followed in enumerating the formations. By going deeper and deeper into the series of layers, I got more and more remote as to the epochs of time. I shall now commence with the most ancient formations, and mention the animals found in them, and passing from epoch to epoch, point out those which successively present themselves, in proportion as they approach more nearly to the present age.

ENUMERATION OF THE FOSSIL ANIMALS DETECTED BY THE AUTHOR.

We have seen that zoophytes, mollusca, and certain crustacea begin to appear in the transition formations; there may be even at that period bones and skeletons of fishes; but they are at a very considerable distance from the epoch in which we discover the remains of animals which live on the earth and breathe the air of nature.

The vast beds of coal, and the trunks of palms and ferns of which they retain the impressions, although already evidencing dry lands, and a vegetation thereon, do not yet show any bones of quadrupeds, nor even of oviparous quadrupeds.

It is only a little above, in the coppery bituminous slates, that we discover the first traces of them; and, what is very remarkable, the first quadrupeds are reptiles of the lizard tribe, very much like the large monitors now existing in the torrid zone. Several individuals of this species are found in the mines of Thuringia,(1) in the midst of innumerable fishes of genera now unknown; but which, in their correspondence with the genera of the present times, appear to have lived in fresh water.

We know that the monitors are also fresh-water animals. A little higher is the limestone called Alpine, and above it the shelly limestone, so rich in entrochites and encrinites, which forms the basis of a great part of Germany and Lorraine.

It has produced skeletons of a large sea tortoise, whose shells might be from six to eight feet in length; and those of another oviparous quadruped of the lizard tribe, of great size, and with a sharp pointed nose.(2)

Ascending through the sandstones, which only offer vegetable imprints of large arundinaceæ, bamboos, palms, and other monocotyledonous plants, we reach the different layers of the limestone called limestone of Jura, because it forms the principal nucleus of this chain.

Herein the class of reptiles developes itself fully, and manifests itself in various forms, and of gigantic size.

The middle part, composed of oolites and lias, or of gray limestone with grypheæ, has had in deposite the remains of two genera the most extraordinary of all, which have united the characters of the

(1) See my 'Recherches sur les Ossemens Fossiles,' v. 5, 2nd part, p. 300.

(2) 'Recherches,' vol. 5, 2nd part, pp. 355 and 525.

class of oviparous quadrupeds with the organs of motion similar to those of the cetacea.

The *ichthyosaurus*, (1) discovered by Sir Everard Home, has the head of a lizard, but extended into a pointed muzzle, armed with conical and pointed teeth; enormous eyes, of which the sclerotica is strengthened with a bony case; a spine composed of flattened vertebræ, like the pieces used at the game of draughts, and concave on both sides like those of fishes; the ribs slender, the sternum and shoulder-bones like those of lizards and ornithorynchi; the pelvis small and weak; and four limbs, of which the humeri and femora are short and thick, and the other bones flatter, and set near each other like the stones of a pavement, so as to compose, when enveloped in skin, fins all in a piece and scarcely able to be bent; in a word, analogous, both in its use and construction, to those of cetacea. These reptiles lived in the sea; on land they could at best only crawl along like seals; and at the same time they breathed elastic air.

The remains of four species have been discovered.

That most extensively found (I. *communis*) has blunt conical teeth, and is sometimes twenty feet long.

The second (I. *platyodon*) at least as large, has compressed teeth, with round and swelling roots.

The third (I. *tenuirostris*) has slender and pointed teeth, and the muzzle slim and lengthened.

The fourth (I. *intermedius*) has teeth of a medium nature between the last species and the first. The two latter species do not attain half the size of the two former.(2)

(1) See Recherches, vol. 5, 2nd part, pp. 4 and 7.
(2) Ib. v. 5, 2nd part, p. 456.

The *plesiosaurus*, discovered by Mr. Conybeare, must have appeared even more monstrous than the ichthyosaurus. It had similar limbs, but rather more elongated and flexible; its shoulder and pelvis were stronger, its vertebræ were nearly assimilated to those of lizards, but what distinguished it from all oviparous and viviparous quadrupeds, was a slender neck as long as its body, composed of thirty vertebræ and upwards, a number greater than that of the neck of all other animals, rising from the trunk like the body of a serpent, and terminated by a very small head, in which are to be found all essential characteristics of those of lizards.

If any thing could justify those hydras and other monsters which are so often drawn on the monuments of the middle ages, it would assuredly be this plesiosaurus.(1)

Five species are already known, the most generally distributed (P. *dolichodeirus*) is more than twenty feet long.

A second (P. *recentior*) found in recent strata, has flatter vertebræ.

A third (P. *carinatus*) has a prominence on the lower surface of the vertebræ.

A fourth, and lastly a fifth (P. *pentagonus*) and (P. *trigonus*) have respectively five and three prominences.(2)

These two genera are every where distributed in the lias. They were discovered in England, where the lias is exposed in cliffs of great extent, and they have been also found in France and Germany.

With them there existed two species of crocodiles, whose bones are also deposited in the lias,

(1) See Recherches, v. 5, 2nd part, pp. 475, et seq.
(2) Ib. v. 5, 2nd part, pp. 485 and 486.

amongst ammonites, terebratulæ, and other shells of this ancient sea. We have skeletons of them in our cliffs at Honfleur, where are found the remains from which I have drawn their characters.(1)

One of the species, the *long-nosed gavial*, has a muzzle longer and the head sharper than the gavial, or long-nosed crocodile of the Ganges; the body of its vertebræ is convex in front, whilst in the crocodiles now existing they are so behind. It has been found in the lias of Franconia as well as in those of France.

A second species, the *short-nosed gavial*, with a muzzle of middling length, less pointing than that of the gavial of the Ganges, and more so than the crocodiles as now seen in San Domingo. The vertebræ were slightly hollowed at the two extremities.

But these crocodiles are not the only animals which have been found in these beds of secondary limestone.

The fine oolite quarries of Caen have produced a very remarkable one, of which the muzzle, as long and as pointed as the long-nosed gavial, has a head wider behind, with the fossæ of the temporal bones larger. It was by reason of its stony scales, with round cavities, the best armed of all the crocodiles.(2) The teeth of the lower jaw are alternately longer and shorter.

There is another species in the oolites of England, but it is only known by some parts of its cranium, which is not sufficient to afford a perfect idea of it.(3)

(1) See Recherches, v. 5, 2nd part, p. 143.
(2) Ib. vol. v. 2nd part, p. 127.
(3) We expect a full explanation of it from the researches of Mr. Conybeare.

Another very remarkable genus of reptiles, whose remains, although also found in the concretion of lias, abound particularly in the oolite and the higher sands, is the *megalosaurus*, properly so called; for, with the shape of lizards, and particularly of the monitors, of which it has also the cutting and indented teeth, it was of so enormous a size, that in assigning to it the properties of the monitors it would exceed seventy feet in length. It would be a lizard as large as a whale.(1) It was discovered in England by Mr. Buckland, but we have them also in France, and some of its bones have been found in Germany, if not of the same species, at least of a species which cannot be classed with any other genus. We are indebted to M. de Sœmmerring for the first description of it. He discovered the remains in the superior strata of the oolites, in the calcareous schists (slates) of Franconia, long celebrated for the numerous fossils with which they have supplied the cabinets of the curious, and which will be made still more useful by the services which their peculiar adaptation for the purposes of lithography will enable them to render to the arts and sciences.

Crocodiles also are found in these limestone schists, and always those with the long muzzle. M. de Sœmmerring has described one (the C. *priscus*) of which the entire skeleton of a small individual was preserved almost as well as it could have been in our cabinets.(2) It is one of those which resemble the real gavial of the Ganges; but the united portion of its lower jaw is not so long; the lower teeth are alternately and regularly longer

(1) See Recherches, vol. ii. 2nd part, p. 343.
(2) Ibid. vol. v. 2nd part, p. 120.

and shorter, and it has ten additional vertebræ at the tail.

But the most remarkable animals which are deposited in these limestone schists, are the flying lizards, which I have named *pterodactyli.*

They are reptiles with a very short tail, a very long back, a muzzle greatly extended and armed with sharp teeth, supported on high legs, the anterior extremity has an excessively elongated claw, which probably supported a membrane which sustained it in the air, together with four other toes of ordinary size terminated by hooked claws. One of these strange animals, whose appearance would be frightful, was about the size of a thrush,(1) and the other that of a common bat;(2) but from fragments we find that there existed a much larger species.(3)

A little above these calcareous schists is the limestone (nearly homogenous) of the ridge of Jura. It contains also bones, but always those of reptiles; crocodiles and fresh-water tortoises, of which it produces an abundance in the environs of Soleure. They have been there discovered and scrutinized with much care by M. Hugi; and from the fragments already collected we can easily recognise a considerable number of the species of the *fresh-water tortoise*, or *emydes*, which ulterior discoveries only can determine, but many of which have been already distinguished by their sizes and shapes from all kinds of known emydes.(4)

It is among these numerous oviparous quadrupeds of all sizes and forms; in the midst of these

(1) Ibid. pp. 358, et seq. (2) Ibid. p. 376.
(3) Ibid. p. 380.
(4) Ibid. vol. v. 2nd part, p. 225.

crocodiles, of these tortoises, of these flying reptiles, of these immense megalosauri, of these monstrous plesiosauri, that some small mammifera are said to be first detected. It is certain that jaw bones, and some bones discovered in England belong to this class, and particularly to the family of didelphides, or those of insectivorous animals.

It may, however, be suspected that the stones which incrust them have originated from some local recomposition subsequent to the epoch of the formation of these layers. However that may be, we find still that the reptile tribe predominated exclusively for a long time.

The ferruginous sands placed in England above the chalk, abound with crocodiles, tortoises, megalosauri, and particularly with a reptile which presents the singular character of using his teeth like our herbivorous mammifera.

Mr. Mantell, of Lewes, in Sussex, discovered this peculiar animal, as well as other large reptiles, in the sands beneath the chalk. He named it the *iquanodon.* (1)

In the chalk itself there are only reptilia, we find remains of tortoises and crocodiles. The famous soft sandstone quarries (*carrières de tuffau*) of the mountain of St. Peter, near Maestricht, which belong to the formation of chalk, have given beside the very large sea tortoises and a vast quantity of shells and marine zoophytes, a genus of lizards, not less gigantic than the megalosauri, which has become famous from the researches of Camper, and by the figures which Faujus has given of its bones in his history of this mountain.

It was upwards of twenty-five feet long; its great jaws were armed with very strong teeth, conical,

(1) See Recherches, pp. 161, 132 and 350.

rather arched and ridged, and it had also some of these teeth in the palate. There were more than a hundred and thirty vertebræ in its spine, convex in front and concave behind. Its tail was high and broad, and formed a large vertical oar.(1) Mr. Conybeare has recently proposed to call it the *mosasaurus.*

The clays and lignites, which are above the chalk, have only produced crocodiles;(2) and I have every reason to conclude that the lignites in Switzerland, in which have been found the bones of the beaver and mastodon, belong to a more recent period. It is only in the coarse limestone which rests on these clays that I have first found the bones of mammifera; and even these belong to marine mammifera, to unknown dolphins, to lamantins and morses.

Amongst the dolphins, there is one whose muzzle, more lengthened than in any known species, had the lower jaw united to an extent nearly equal to that of a gavial. It was found near Dax, by the late President of Borda.(3)

Another of the rocks in the department of Orne, has also a long muzzle, but rather differently shaped.(4)

The whole genus of lamantins is now marine, and inhabit the seas of the torrid zone; and that of the morses, of whom we have but one living species, is confined to the icy sea. However, we find the skeleton of these two species together in the layers of the coarse limestone of the middle of France; and this union of species, of which the most similar are now in opposite zones, will again occur in our researches more than once.

(1) See Recherches, vol. v. 2nd part, pp. 310, et seq.
(2) Ibid. p. 163.
(3) Ibid. 1st part, p. 316. (4) Ibid. p. 317.

Our fossil lamantins differ from the known lamantins, by having a head more elongated, and otherwise constructed.(1) Their ribs easily recognised by their rounded thickness and by the density of their texture, are not rare in our different provinces.

As to the fossil morse we have as yet only fragments insufficient to characterise the species.(2)

It is only in the layers which have succeeded the coarse limestone, or at most in those which might have been formed at the same time with it, but deposited in the fresh water lakes, that the class of land mammifera begins to show itself in any abundance.

I regard as belonging to the same age, and as having lived at the same time, but perhaps in different situations, those animals whose remains are buried in the molasse, and the ancient beds of gravel in the south of France; in the gypsum layers mingled with limestone, similar to those in the environs of Paris and Aïx, and in the marly deposites of fresh water, covered by the marine beds of Alsace, the province of Orleans, and of Berri.

This animal population has a very remarkable character in the abundance and variety of certain genera of pachydermata, which are unknown amongst the quadrupeds now existing, and the characteristics of which are more or less nearly related to tapirs, rhinoceroses, and camels.

The genera whose discovery is entirely due to me are: the *palæotheria*, the *lophiodonta*, the *anoplotheria*, the *anthracotheria*, the *cheropotami*, and the *adapis*.

(1) See Recherches, p, 266.
(2) Ibid. p. 521.

The palæotheria resemble the tapirs in the general form, in that of the head, and particularly in the shortness of the bones of the nose, which proves that they had, like the tapirs, a small proboscis; and also in having six incisores and two canine teeth in each jaw; but they resembled the rhinoceros in their grinders, of which the upper ones were square, with prominent ridges differently shaped, and the lower ones shaped like double crescents, and their feet in like manner were divided into three toes, while the fore feet of the tapir have four divisions.

It is one of the genera the most distributed and numerous in species, that are found in the layers of its particular period. Our gypsum quarries in the environs of Paris are crowded with them. The first, (P. *magnum*) as large as a horse. Three resemble swine, but one (P. *medium*) has narrow and long feet; one (P. *crassum*) with larger feet; one (P. *latum*) with feet still larger and much more short; the fifth species (P. *curtum*) of the size of a sheep, is much lower, and has feet still larger and shorter in proportion than the last; a sixth, (P. *minus*) is of the size of a small sheep, and has slim feet, the lateral toes of which are shorter than the others; and finally, there is one (P. *minimum*) not larger than a hare, which has also long and slender feet.(1)

They have also been found in other provinces of France; at Puy in Velay, in the beds of gypseous marl, one species (P. *velaunum*,) (2) very similar to the (P. *medium*,) but differing from it in the formation of the lower jaw; in the vicinity of Orleans, in the layer of marly stone, a species (P. *aurelia-*

(1) See Recherches, v. iii. and particularly p. 250, and v. 5, 2nd part, p. 505.
(2) Ibid.

nense,) (1) distinguished from the others by having the returning angle of the lower grinders with the crescent cleft into a double point, and by some difference in the prominences of the upper grinders: near Issel, in a layer of gravel, or molasse, along the declivities of the Black mountain, a species (P. *isselanum,*) (2) characterised like those of Orleans, but smaller; but principally in the molasse of the department of the Dordogne, the palæotherium occurs not less abundantly than in the gypsum quarries of Paris.

The Duke de Caze has discovered in the quarries of one field, bones of three species which appear different from all those of our environs.(3)

The *lophiodons* resemble the tapirs still more closely than the palæotheria do, as their lower grinders have transverse prominences like the tapirs. They differ from them however because they have the front teeth more simple, and the back one of all has three prominences, and the upper ones are rhomboidal and ridged similarly to those of the rhinoceros.

We are ignorant of the form of their muzzle and the number of their toes. I have discovered exactly twelve species, all in France, embedded in the marly stones, formed by the fresh-water deposites, and filled with lymneæ and planorbes, shells which are peculiar to pools and marshes.

The largest was found near Orleans, in the same quarry as the palæotheria. It closely resembles the rhinoceros.

There is another smaller species, in the same

(1) See Recherches, vol. iii. p. 254, and v. iv. pp. 498 and 499.
(2) Ibid. vol. iii. p. 258.
(3) Ibid. p. 505.

place; a third is to be found at Montpelier; a fourth near Laon; two near Buchsweiler, in Alsace; five near Argenton, in Berri; and one of the three is again found near Issel, where there are two others. There is also a very large species near Gannat.(1)

These species differ in size, which in the smallest is scarcely equal to that of a lamb three months old; and in details in the formation of their teeth, which it would be tedious to enter upon here.

The *anoplotheria* are at present only found in the gypsum quarries in the environs of Paris. They have two characteristics not observed in any other animals; feet, with two toes, of which the metacarpus and metatarsus are distinct, and not joined in one solid piece, as in ruminating animals; and teeth in a continuous series, without any space intervening; man alone has teeth so closely placed without any gap between. Those of the anoplotheria consist of six incisores in each jaw; one canine and seven grinders on each side, as well above as below; their canine are short, and resemble the exterior incisores. The first three grinders are compressed; the other four are in the upper jaw, square, with transverse ridges, and a small cone between them; and in the lower jaw, shaped like a double crescent, but without any prominence at the base. The last has three crescents. Their head is oblong, and does not announce that the muzzle has terminated either with a proboscis or a snout.

This extraordinary species, comparable to no species now existing, is subdivided into three sub-genera. The *anoplotheria*, properly so called, the anterior grinders of which are still tolerably thick,

(1) Recherches, vol. ii. first part, pp. 177 and 218; vol. iii. p. 394; and vol. iv. p. 498.

Fig. 2.

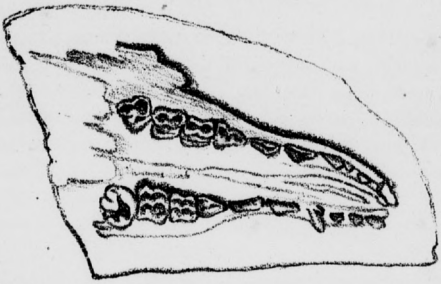


Fig. 3.

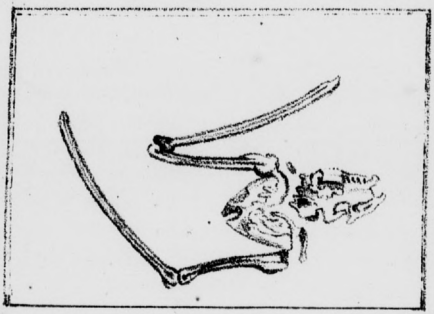
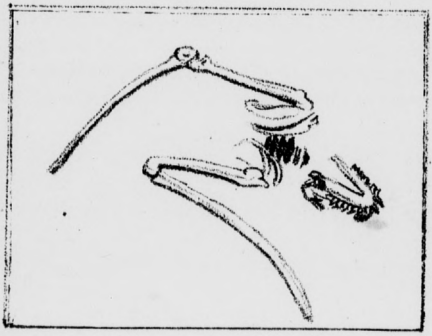


Fig. 4.



and the posterior of the lower jaw have a plain ridge in the crescent. The *xiphodons*, whose anterior grinders are thin and cutting, and whose posterior in the lower jaw have, immediately opposite to the concavity of each of their crescents, a point which by use assumes the form of the crescent, so that there the crescents are double, as in ruminating animals. The *dichobunes*, whose exterior crescents are also pointed at the beginning, and which thus have points arranged in pairs on the back grinders of the lower jaw.

The *anoplotheria*, the most common in our gypsum quarries, (A. *commune*,) is an animal as tall as a wild boar, but much larger, and with a very long and very thick tail, so that as a whole it has nearly the properties of the otter, but much larger.

It is probable that it swam well, and frequented lakes, at the bottom of which the bones have become incrusted by gypseous deposites. We have one smaller species, but otherwise quite similar (An. *secundarium.*)

We have as yet found only one *xiphodon*, a very remarkable animal, which I have named *An. gracile.* It is slender and slightly formed, like the most beautiful gazelle.

There is one *dichobune*, nearly the size of a hare, which I call *An. leporinum.* In addition to its subgeneric characteristics, it differs from the anoplotheria and xiphodons by having two small and slender toes on each foot on the sides of the two large toes.

We are not aware whether these lateral toes existed in the two other dichobunes, which are small, and scarcely exceed the Guinea pig in size.(1)

(1) Recherches, vol. iii. pp. 250 and 396.

The genus of *anthracotheria* is nearly the medium between the palæotheria, the anoplotheria, and hogs. I have thus named it, because two of its species have been found in the lignites of Cadibona, near Savone. The first was nearly as large as the rhinoceros; the second was smaller. They are also found in Alsace and Velay. Their grinders are similar to those of the anoplotheria, but they have projecting canine teeth.(1)

The genus *cheropotamus* is found in our gypsum quarries, together with the palæotheria and anoplotheria, but it is much more rare. The back grinders are square at top, rectangular at bottom, and have four large conical projections surrounded by some smaller. The front grinders are short cones, slightly compressed with double roots; its canine teeth are small. We are not yet acquainted with its incisores nor its feet. I have only one species, of the size of a Siam hog.(2)

The genus *adapis* has in the same way but one species at most, not larger than a rabbit. This is also found in our gypsum-quarries, and must have had a close alliance with anoplotheria.(3)

Thus we have mentioned nearly forty species of *pachydermata*, belonging to genera now quite extinct, to the sizes and shapes of which we have no closer existing resemblance than in the tapirs and a daman.

This great number of pachydermata is the more remarkable, as the ruminantia, now so numerous, in the genera of stags and gazelles, and which attain so vast a size in those of oxen, giraffes, and ca-

(1) Recherches, vol. iii. pp. 398 and 404; vol. iv. p. 501; vol. v. second part, p. 506.
(2) Ibid. vol. iii. p. 260.
(3) Ibid. p. 265.

mels, are rarely to be found in the strata to which we have been alluding.

I have never detected the smallest relic in our gypsum-quarries, and all that has come to me consists of some fragments of a stag, of the size of the roebuck, but of another species, collected from the palæotheria of Orleans,(1) and in one or two other small fragments from Switzerland, both perhaps of equivocal origin.

But our pachydermata were not consequently the only inhabitants of the countries where they lived. In our gypsum-quarries, at least, we find with them carnivora, glires, many sorts of birds, crocodiles and tortoises, and these two latter also accompany them in the molasse and marly rock of the middle and south of France.

At the head of the carnivora I place a bat very recently discovered at Montmartre, and of the proper genus vespertilio.(2) The existence of this genus at so remote an epoch is the more surprising, as neither in this formation, nor in those which follow it, have I been able to discover any trace either of *cheiroptera* nor of *quadrumana*. No bones, no tooth or monkey nor maki, however, presented themselves to me in my long researches.

Montmartre has also produced for me the bones of a fox different from ours, and equally different from the jackals, isatises, and the various species of foxes which are known in America;(3) also the bones of a carnivorous animal, akin to the racoon and coa-

(1) Recherches, vol. iv. p. 103.

(2) I am indebted to the Count de Bournon for my knowledge of this, and as it is not described in my great work, I give the preceding drawings of it.

(3) Recherches, vol. iii. p. 267.

ties, but larger than any of the known species,(1) those of a peculiar species of civet cat;(2) and of two or three other carnivora which could not be determined for want of parts sufficiently perfect.

What is yet more singular is, that there are skeletons of a small sarigue, a-kin to the marmoset, but different, and consequently of an animal whose genus is now confined to the new world.(3) We have also collected skeletons of two small glires, or the genus of the dormouse;(4) and a head of the squirrel genus.(5)

Our gypsum-quarries are more prolific in bones of birds than any of the other layers, either anterior or subsequent to its deposite. We find whole skeletons, perfect skeletons, and parts of at least ten species of all the orders.(6)

The crocodiles of that age resembled our common crocodiles, in the form of the head, whilst in the layers of the epoch of the Jura formation, we only discover the species a-kin to the gavial.

There has been found at Argenton a species remarkable for its compressed teeth, with sharp edges, cutting like the dentated teeth of certain monitors.(7) We also see some remains in our gypsum-quarries.(8)

The tortoises of this age are all of fresh-water production; some belong to the sub-genus of emydes; and there are some as well at Montmartre,(9) as in

(1) Recherches, p. 269.
(2) Ibid. vol. iii. p. 272.
(3) Ibid. vol. iii. p. 284.
(4) Ibid. pp. 297 and 300.
(5) Ibid. vol. v. second part, p. 506.
(6) Ibid. vol. v. iii. pp. 304, *et seq.*
(7) Ibid. vol. v. second part, p. 166.
(8) Ibid. vol. iii. p. 335; vol. v. second part, p. 166.
(9) Ibid. vol. iii. p. 333.

the molasse of the Dordogne,(1) of a greater magnitude than any now existing; the others are trionyces, or soft tortoises.(2)

This genus, which is easily distinguished by the vermiculated surface of the bones of its shell, and which now only exists in the rivers of hot countries, such as the Nile, the Ganges, and the Oronooco, was very plentiful in the same formation as the palæotheria. There are a vast quantity of these remains at Montmartre,(3) and in the molasse sandstone of the Dordogne, and other gravelly deposites of the south of France.

The fresh water lakes about which these animals lived, and which received their bones, nourished, besides tortoises and crocodiles, some fishes and some shelly animals. All that have been collected are as foreign to our climate, and even as unknown in our present waters, as the palæotheria and other contemporary quadrupeds.(4)

The fish even belong partly to unknown species.

Thus we cannot doubt but that this population, which may be termed that of the middle age,—this first great production of mammifera, has been entirely destroyed; and in fact, wherever we discover their remains, there are above them vast marine deposites, so that the sea must have overwhelmed the countries which these races inhabited, and has covered them for a very considerable period.

Were the countries thus inundated vast in extent? The investigation of the ancient beds formed in their lakes has not yet enabled us to decide this question.

(1) Recherches, vol. v. second part, p. 232.
(2) Ibid. vol. iii. p. 329, and vol. v. second part, p. 222.
(3) Ibid. vol. v. second part, pp. 223—227.
(4) Ibid. vol. iii. p. 338.

To the same epoch I attribute our gypsum beds and those of Aix, many of the quarries of marly stones and the molassic sand-stones, at least those of the south of France. I am also disposed to assign to the same period portions of the molasses of Switzerland, and the lignites of Liguria and Alsace, in which are found quadrupeds of the families above described; but I do not learn that any of these animals are found in other countries. The fossil bones of Germany, England, and Italy, are all either older or more recent than those we have enumerated, and belong either to that ancient race of reptiles of the Juraic and copper-slate formations, or to the deposites of the last general deluge,—the diluvial layers.

We may then believe, as there is no proof of the contrary, that at the epoch when these numerous pachydermata existed, the globe only afforded them, as habitations, a small number of tolerably fertile plains, wherein they could multiply; and perhaps these plains were insulated regions, separated by considerable spaces of lofty chains, where we do not find that our animals have left any vestiges of their existence.

We have, through the researches of M. Adolphe Brongniart, become acquainted with the nature of the vegetables which covered these few countries. In the same layers with our palæotheria are collected trunks of palm trees, and many other beautiful plants whose genus is now only to be found in hot climates; palm trees, crocodiles, and trionyces are always found in greater or lesser numbers wherever the ancient pachydermata are discovered. (1)

But the sea, which had covered these countries

(1) Recherches, vol. iii. pp. 351, et seq.

and destroyed their animals, left great deposites, which still form, at a trifling depth, the basis of our great plains: then it retired again, and yielded vast surfaces to a new population, of which the relics are to be found in the sandy and muddy layers of all known countries.

It is to this tranquil deposite of the sea that we should ascribe some cetacea very much like those of the present time; a dolphin similar to our epaulard,(1) and a whale(2) very similar to our rorquals, both exhumed in Lombardy by M. Cortesi; a large whale's head found in the very centre of Paris,(3) and described by Lamanon and by Daubenton; and a genus entirely new, which I discovered and named *ziphius*, and which at least consists of three species. It is allied to the cachalots and hyperoodons.(4)

In the population which fills our post-diluvial and superficial strata, and which has existed in the deposite we have just mentioned, there are no longer palæotheria, anoplotheria, nor any of this peculiar genus. The pachydermata, however, still were found there; the gigantic pachydermata, elephants, rhinoceroses, hippopotami, accompanied by innumerable horses, and many large ruminantia. Carnivora of the size of lions, tigers, and hyænas, desolated the new animal kingdom. Its general character, even in the extreme north, and on the banks of our Icy Sea, was similar to that now only presented by the torrid zone; and yet there was no species exactly similar to those of the present day.

Amongst these animals, in particular, was the elephant, called by the Russians the mammoth (*ele-*

(1) Recherches, vol. v. part first, p. 309.
(2) Ibid. p. 390.
(3) Ibid. p. 393.
(4) Ibid. pp. 352—357.

phas primigenius of Blumenbach) from fifteen to eighteen feet in height, covered with a coarse red wool, and long black bristly hairs, which formed a mane along its back; its enormous tusks were implanted in alveolæ longer than those of the elephants of our times; otherwise it was very similar to the elephant of India.(1) It has left thousands of its carcases from Spain to the borders of Siberia, and has been discovered throughout North America; so that it was spread over the two coasts of the Atlantic ocean, if indeed the ocean was at that time in the place where it now flows. It is well known that its tusks are still so well preserved in cold countries, that they are used for the same purpose as new ivory, and, as we before remarked, individuals have been found with the flesh, skin, and hair, which had been frozen since the final catastrophe of the globe. The Tartars and Chinese have imagined it to be an animal which lives under ground, and perishes whenever it appears in daylight.

After it, and nearly equal to it, came also in the countries forming the two present continents, *the narrow-toothed mastodon*, which resembled the elephant, being armed, like it, with enormous tusks, but these tusks covered with enamel; lower in the legs, and with grinders mamillated and cased with a thick and shining enamel, which have long supplied what is called the occidental turquoise.(2)

Its remains, so common in the temperate parts of Europe, are not found so generally in the north; but we discover them in the mountains of South America, with two kindred species.

(1) Recherches, vol. i. p. 75 to 195 and 335; vol. iii. pp. 371—405; vol. iv. p. 491.

(2) Ibid. pp. 250 to 265 and 335; and vol. iv. p. 493.

Fig. 5.

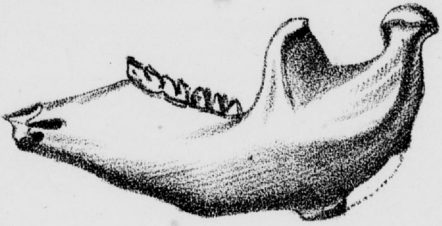
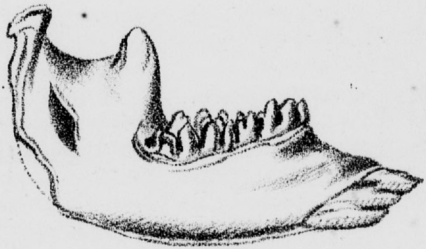


Fig. 6.



North America has an immense quantity of the remains of the *great mastodon*, a species still larger than the preceding, as tall in proportion as the elephant, with tusks not less enormous, and whose grinders, full of sharp points, have caused it to be taken for the carnivorous animal. (1)

Its bones were very thick, and had much solidity; even its hoofs and stomach are said to have been found in good preservation, and easily recognisable. It is asserted that the stomach was filled with the crushed branches of a tree. The savages believe that this race was exterminated by the gods, lest they should destroy the human race.

With these enormous pachydermata existed two genera rather less than the rhinoceros and hippopotami.

The hippopotamus of the period was common enough in the countries which now form France, Germany, and England, and particularly in Italy. Its resemblance to the present African species was such that it requires an attentive scrutiny to ascertain the distinguishing characteristics. (2)

There was also, at this period, a small species of hippopotamus, of the size of a wild boar, to which we have at present nothing similar.

The rhinoceroses of large size were at least three in number; all double horned. The species most distributed over Germany (viz. Rh. *tichorhinus*,) and which, like the elephant, is found to the very shores of the Icy Sea, where entire individuals are to be discovered, had a long head, the bones of the nose very strong, supported by an osseous junction of

(1) Recherches, vol. i. pp. 206 to 249; vol. iii. p. 376.

(2) Ibid. vol. i. pp. 304 to 322; vol. iii. p. 380; vol. iv. p. 493.

the nostrils, not simply cartilaginous, and wanted incisores.(1)

Another species, rarer and belonging to a more temperate climate (Rh. *incisivus*,)(2) had incisores like the present rhinoceros of the East Indies, and particularly resembled that of Samatra.(3) Its distinctive characteristics were to be found in a different formation of the head.

The third (Rh. *leptorhinus*) wanted incisores like the first, and the Cape rhinoceros of the present day; but it was distinguished by a muzzle more pointed and limbs more slender.(4) In Italy, particularly, its remains are found, in the same strata as those of the elephants, mastodonta, and hippopotami.

Lastly, there is a fourth species (Rh. *minutus*) furnished, as the second, with incisores, but of lesser size, and scarcely larger than a hog.(5) It was undoubtedly rare, for its relics have only been collected in some places in France.

To these four genera of large pachydermata may be added a tapir; equal to them in size, and consequently twice or thrice as large in the linear dimensions as the American tapir.(6)

We find its teeth in many parts of France and Germany, and generally accompanied with those of the rhinoceros, mastodon, and elephant.

There is still another to be added to these, which occurs however in very few places,—a large pachy-

(1) Recherches, vol. ii. part first, p. 64; and vol. iv. p. 496.

(2) Ibid. vol. ii. part first, p. 89; vol. iii. p. 390; vol. v. part second, p. 501.

(3) Ibid. vol. iii. p. 385.

(4) Ibid. vol. ii. part first, p. 71.

(5) Ibid. vol. ii. part first, p. 89.

(6) Ibid. vol. ii. part second, p. 165.

derma, of which only the lower jaw has been found, and whose teeth were doubly crescented and modulated. M. Fischer, who discovered it amongst the bones from Siberia, has named it the *elasmotherium.*(1)

The genus of the horse also existed at this period.(2) Thousands of its teeth, are found with those which we have just described in nearly all their deposites: but it is impossible to say whether it was or was not of the same species as that now existing, because the skeletons of this species so much resemble each other, that they cannot be determined from isolated fragments.

Ruminating animals were infinitely more numerous than at the epoch of the palæotheria; their numerical proportion even must differ but little from what it now is; but we are convinced that there were many different species.

This we may confidently assert with respect to the stag of superior size even to the elk, which is common in the marl deposites and turf bogs of Ireland and England, and of which remains have been disinterred in France, Germany, and Italy, in the same beds which contain the bones of the elephant. Its large and branching antlers extend twelve or fourteen feet from one point to the other, in allowing for the curved portions.(3)

This distinction is not so clear with respect to the bones of deer and oxen which have been collected in certain rocks; they are (and particularly in England) sometimes accompanied with the bones of the elephant, rhinoceros, and hippopotamus, and those

(1) Recherches, vol. ii. part second, p. 95.

(2) Ibid. p. 109.

(3) Ibid. vol. iv. p. 70.

of the hyena, which are also met with in many layers of alluvial deposites, together with the pachydermata: consequently they are of the same age; but there is yet much difficulty in deciding how they differ from the present breeds of similar animals.

The clefts of the rocks of Gibraltar, Cette, Nice, Uliveta, near Pisa, and others on the banks of the Mediterranean, are filled with a red and firm cement, which envelopes fragments of rock and fresh-water shells, with many bones of quadrupeds, for the most part fractured, and which have been called osseous brecciæ. The bones which fill them sometimes present characteristics sufficient to prove that they have belonged to animals unknown at least in Europe. We find there, for instance, four species of deer, three of which have characteristics in their teeth observable only in the deer of the Indian Archipelago.

There is a fifth race known, near Verona, whose antlers exceed in spread those of the deer of Canada. (1)

We also find in particular places, with the bones of the rhinoceros and other quadrupeds of this epoch, those of a deer so closely resembling the rein-deer, that it is difficult to assign distinguishing characters to it; and what is still more extraordinary, rein-deer are confined to the coldest climates of the north, whilst the whole genus of the rhinoceros belongs to the torrid zone. (2)

There are in the layers of which we were speaking, remains of a species very similar to the fallow-deer, but a third larger, (3) and quantities of horns very

(1) Recherches, vol. iv. pp. 168 to 225.

(2) Ibid. vol. iv. p. 89.

(3) Ibid. vol. iv. p. 94.

much resembling those of our deer,(1) as well as bones very closely assimilating to those of the aurochs(2) and those of the domestic ox,(3) two very distinct species, which former naturalists had improperly confounded. However, the entire heads, like those of other animals, as well as the musk ox of Canada,(4) which have often been dug up, do not come from positions sufficiently assured to enable us to determine that these species were cotemporary with the great pachydermata that we have above mentioned.

The osseous brecciæ, of the banks of the Mediterranean, have also afforded two species of *lagomys*,(5) an animal now only existing in Siberia; two species of rabbits,(6) lemmings, and rats of the size of the water-rat, and that of a mouse,(7) They are also found in the caverns of England.(8)

The osseous brecciæ, contain even the bones of shrew mice and lizards.(9)

There are in certain sandy strata of Tuscany, the teeth of a porcupine;(10) and in those of Russia, the head of a species of beaver larger than ours, which Mr. Fischer calls *trogontherium*.(11) But it is principally in the class Edentata, that these races of

(1) Recherches, p. 98.
(2) Ibid. p. 140; and vol. v. part second, p. 509.
(3) Ibid. p. 150; and vol. v. part second, p. 510.
(4) Ibid. vol. iv. part second; p. 155.
(5) Ibid. vol. iv. pp. 199 to 204.
(6) Ibid. pp. 174, 177, and 196; vol. v. part first, p. 55.
(7) Ibid. pp. 178, 202 and 206; ibid. p. 54.
(8) Ibid. vol. v. part first, p. 55.
(9) Ibid. v. iv. p. 206.
(10) Ibid. vol. v. part second, p. 517.
(11) Ibid. vol. v. part first, p. 59.

animals, prior to the last period, assume a size much greater than that of the present congenerate species and attain even a gigantic size.

The *megatherium* unites one portion of the generic character of the armadilloes with a portion of that of the sloth, and in size it equals the largest rhinoceros. Its nails must have been of monstrous length and power; all its frame has vast solidity. It has yet only been found in the sandy strata of North America.(1)

The *megalonyx* resembled it much in its characteristics, but was somewhat less; its nails were longer and sharper. Some of its bones and entire toes have been found in certain caverns in Virginia, and in an island on the coast of Georgia.(2)

These two enormous edentata have only deposited their remains in America; but Europe possessed one which did not yield to them in bulk. It is not known by a single terminating toe-joint; but this is sufficient to convince us that it very much resembled a pangolin, but a pangolin is nearly twenty feet long. It lived in the same districts as the elephant, the rhinoceros, and the immense tapir; for we find its bones with theirs in a sandy layer near Darmstadt, not far from the Rhine.(3)

The osseous brecciæ also contain, but very rarely, bones of carnivora,(4) much more numerous in caverns, that is to say, in cavities larger and more complicated than the clefts or veins containing osseous brecciæ.

The Jura formation particularly is celebrated for

(1) Recherches, p. 174; and part second, p. 519.
(2) Ibid. p. 160.
(3) Ibid. part first, p. 193.
(4) Ibid. v. iv. p. 193.

them, in that part which extends into Germany, where for ages incredible quantities have been carried off and destroyed, because peculiar medical properties have been assigned to them, and there is sufficient remaining to astound the imagination. They are principally bones of a species of very large bear (*ursus spelæus*) characterised by a rounder forehead than that of any of our living bears;(1) with these bones are mingled those of two other species of bears (U. *arctoideus et* U. *priscus*,) (2) those of a hyena, (H. *fossilis*) allied to the spotted Cape hyena, but differing in certain details of its teeth, and the form of its head;(3) those of two tigers or panthers,(4) those of a wolf,(5) those of a fox,(6) those of a glutton,(7) those of weasels, civets, and other small carnivora.(8)

We may remark here, that singular association of animals of which those similar live now in climates as distant as the Cape, the country of the spotted hyenas, and Lapland, the country of our gluttons. And we have thus seen in a cavern in France, a rhinoceros and rein-deer beside each other.

Bears rarely occur in alluvial strata, though they are said to have been found in Austria and Hainault, of the large species discovered in caves, and there is one in Tuscany of a peculiar species, remarkable

(1) Recherches, p. 351.
(2) Ibid. pp. 356 and 357.
(3) Ibid. pp. 392 and 507.
(4) Ibid, p. 452.
(5) Ibid. p. 458.
(6) Ibid. p. 461.
(7) Ibid. p. 475.
(8) Ibid. p. 467.

for its compressed canine teeth (U. *cultridens*,) (1) hyenas are found there more frequently. We have discovered them in France with the bones of elephants and rhinoceroses. A short time since a cavern was discovered in England which contained prodigious quantities of them, of all ages, and in the soil even the excrements were plainly to be recognised. They must have lived there for a long period, and they had dragged into their cave the bones of the elephants, rhinoceroses, hippopotami, horses, oxen, deer and of various glires which are there mingled with their own remains, and bear evident marks of the tooth of the hyenas. But what must have been the soil of England when these enormous animals served as prey to these ferocious beasts? These caverns also contain the bones of tigers, wolves and foxes; but those of the bear are of extremely rare occurrence. (2)

However this may be, we see that at the period of the animal population, now under our consideration, the class of carnivora was numerous and powerful. It had three bears with rounded canine teeth; one bear with compressed canine teeth, a large tiger or lion, another of the felis tribe of the size of a panther, a hyena, a wolf, a fox, a glutton, a martin or polecat, and a weasel.

The class of glires, composed generally of a weak and small species, has had but little notice from fossil collectors; and yet its remains, in the layers and deposites of which we are treating, have also presented unknown species. Such in particular is a

(1) Recherches, v. iv. pp. 378 and 507; and vol. v. part 2nd, 516.

(2) See Mr. Buckland's admirable work, 'Reliquiæ Diluvianæ.'

species of lagomys of the osseous brecciæ of Corsica and Sardinia, somewhat similar to the Alpine lagomys of the high mountains of Siberia; so true is it, that it is not in the torrid zone that we must always seek for animals resembling those of the epoch preceding the last general catastrophe.

These are the principal animals whose remains have been discovered in that mass of earth, of sand and of mud, in that *diluvium*, which every where covers our vast plains, fills our caverns, and chokes up the fissures of many of our large rocks. They formed most indubitably the population of the continents at the epoch of the great catastrophe which has destroyed their race, and which prepared the soil on which the animals of the present day subsist. Whatever resemblance certain of the species of the present day offer to them, it cannot be disputed that the total of this population had a totally distinct character, and that the majority of the races which composed it have been annihilated.

It is wonderful, that among all these mammifera, of which at the present day the greater part have a congenerate species in the warm climates, there has not been one quadrumanous animal, not a single bone, or a single tooth of a monkey, not even a bone or a tooth of an extinct species of this animal.

Neither is there any remains of man. All the bones of the human race which have been collected along with those which we have spoken of, have been the result of accident,(1) and besides their number is extremely small, which it certainly would

(1) See, in Mr. Buckland's 'Reliquiæ Diluvianæ,' an account of the skeleton of a female found in a cave in Pavyland, and in

not be if men had then been established in the countries inhabited by these animals. Where then was the human race? Did the last and most perfect work of the Creator exist no where? Did the animals which now accompany him on earth, and of which are no fossil remains to be traced, surround him? Have the lands in which they lived together been swallowed up, when those which they now inhabit, and of which, a great inundation might have destroyed the anterior population, were again left dry? On this head the study of fossils gives us no information, and in this Discourse we must not seek an answer to our question from other sources.

It is certain, that we are at present at least in the midst of a fourth succession of terrestrial animals, and that after the age of reptiles, after that of palæotheria, after that of mammoths, mastodonta and megatheria, the age arrived in which the human species, together with some domestic animals, governs and fertilizes the earth peaceably; and it is only in formations subsequent to this period, in alluvial deposites, in turf-bogs, in the recent concretions, that those bones are found in a fossil state, which all belong to animals known and now existing.

Such are the human skeletons of Guadaloupe, incrusted in a species of travertine with land shells, slate, and fragments of the shells and madrepores of the neighbouring sea; the bones of oxen, deer,

my Recherches,' v. iv. p. 193, concerning a fragment of a jaw found in the osseous breccia, at Nice.

M. de Schlotheim collected human bones in the fissures of Kœstritz, where there are also rhinoceros bones; but he himself is doubtful as to the epoch of their deposition.

roebucks, and beavers of common occurrence in turf-bogs, and all bones of the human race, and of domestic animals found in the deposites of rivers, in burial grounds, and in fields of battle.

None of these remains belong either to the vast deposite of the great catastrophe, or to those of the ages preceding that wonderful event.

APPENDIX

TO THE

DISCOURSE ON THE REVOLUTIONS OF THE SURFACE OF THE GLOBE.

DESCRIPTION OF THE BIRD CALLED THE IBIS BY THE ANCIENT EGYPTIANS.

Every one has heard of the Ibis, the bird to which the ancient Egyptians paid religious worship; which they brought up in the interior of their temples, which they allowed to stray unharmed through their cities, and whose murderer, even though involuntary, was punished by death;(1) which they embalmed with as much care as their own parents. To this bird was attributed a virgin purity; an inviolable attachment to their country, of which they were made the emblem, an attachment of such force that they would die with hunger if removed elsewhere; a bird which possessed sufficient instinct to know the increase and wane of the moon, and regulated accordingly the quantity of its daily nourishment, and the development of its young; which checked, at the very frontiers of Egypt, the serpents

(1) Herod, 1, 2.

Fig. 7.

IBIS, from a Mummy brought from Thebes.
Two ninths of the real size.

which would have carried destruction into this sacred land,(1) and inspired them with so much terror, that they even feared their feathers;(2) this bird, whose form the gods themselves would have assumed if compelled to adopt a mortal shape, and into which Mercury was really transformed when he desired to travel over the earth, and teach men the arts and sciences.

Not any other animal could be as easily recognisable as this one; for there is no other of which the ancients have left us, as they have of the ibis, such admirable descriptions, figures so exact and even coloured, and the body itself carefully preserved with its feathers under the triple covering of a bituminous preservation of thick linen in many folds, and in vessels solid and highly varnished.

And yet, of all modern writers who have spoken of the ibis, Bruce alone—a traveller more celebrated for his courage than the accuracy of his notions on natural history—has not been in error regarding the true species of this bird; and his ideas in this respect, exact as they were, have not been adopted by other naturalists.(3)

After many changes of opinion concerning the ibis, it was apparently agreed, at the period when I published the first edition of this work, to give the name of ibis to a bird a native of Africa, nearly the size of the stork, with white plumage, and the plumes of the wings black, perched on long red legs, with a long beak, arched with cutting edges, rounded at the base, jagged at the point, of a pale yellow

(1) Ælian, lib. 2, c. xxxv. and xxxviii.

(2) Ibid. lib. i. c. xxxviii.

(3) Bruce's French translation, in 8vo. v. xiii. p. 264, and Atlas plate xxxv. under the name *Abouhannes*.

colour, and with its face covered with a red skin without plumage which does not go farther than its eyes.

Such is the ibis of Perrault,(1) the white ibis of Brisson,(2) the white ibis of Egypt of Buffon,(3) and the tantalus ibis of Linnæus, in his twelfth edition.

It was to this very bird, that M. Blumenbach, at the same time confessing its rarity at the present day, at least in Lower Egypt, asserted that the Egyptians paid divine honours;(4) and yet M. Blumenbach had an opportunity of examining the skeleton of a real mummy ibis, which he opened in London.(5) I was in the same error as these learned men whom I have just mentioned, until I had an opportunity of examining by myself some mummies of the ibis.

This pleasure was first procured for me by the late M. Fourcroy, to whom M. Grobert, colonel of artillery, returning from Egypt, had given two of these mummies, both taken from the pits of Saccara. On unfolding them carefully, we perceived that the bones of the embalmed bird were much

(1) Description of an ibis, and two storks. Acad. des Sciences of Paris, v. iii. pl. iii. p. 61, 4to. ed. 1754, pl. xiii. fig. 1. The beak is represented as truncated at the end, a fault of the engraver.

(2) Numenius sordide albo rufescens, capite anteriore nudo rubro; lateribus rubro purpureo et carneo colore maculatis, remigibus majoribus nigris, rectricibus sordide albo rufescentibus, rostro in exortu dilute luteo, in extremitate aurantio, pedibus griseis. Ibis candida Brisson Ornithologie, vol. v. p. 349.

(3) 'Planches Enluminées,' num. 389. Hist. des Oiseaux, vol. viii. in 4to. p. 14, pl. 1. The last figure is copied from Perrault, with the same fault.

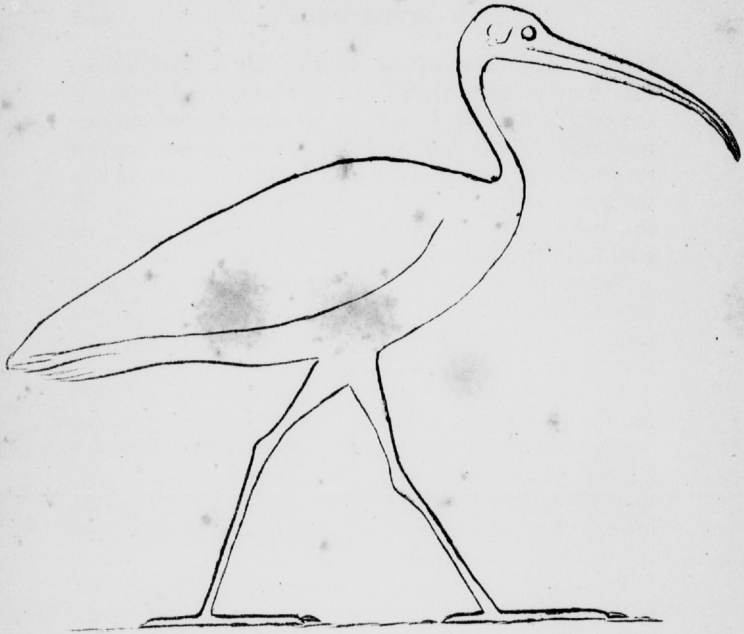
(4) Handbuch der Naturgeschichte, p. 203, of the edit. 1799, but in the edition of 1807, he has restored the name of ibis to the bird to which it belongs.

(5) Philosophical Transactions, for 1794.

Fig. 8.

NUMENIUS IBIS.
Two ninths of the real size.

Fig. 9.



IBIS, copied from one of the Temples of Upper Egypt.

Fig. 10.

Beak of an Ibis Mummy
Both these are drawn one third of the real size.

smaller than those of the tantalus ibis of naturalists; that they were but very little larger than those of the curlew; that the beak resembled that of the latter, only being somewhat shorter in proportion to its thickness, and not at all similar to that of the tantalus; in fact, that its plumage was white, with the plumes of the wing marked with black, as stated by the ancients.

We were then convinced that the bird embalmed by the ancient Egyptians was certainly not the tantalus ibis of naturalists; that it was smaller, and that it must be of the curlew genus.

We learnt, after some research, that the ibis mummies opened before by other naturalists were similar to our own. Buffon expressly says, that he had examined many; that the birds they contained had the beak and size of curlews, and yet he blindly follows Perrault, in taking the tantalus of Africa for the ibis.

One of these mummies opened by Buffon is still in the Musuem, and is similar to those which we have opened.

Dr. Shaw in the supplement to his travels (fol. edit. Oxford, 1746, plate 5, pp. 64 to 66,) describes and depicts with care the bones of a similar mummy, the beak, he says, was six English inches in length, like that of the curlew, &c. In a word, his account exactly tallies with our own examination.

Caylus (*Recueil d'Antiquitiés*, vol. vi. pl. 11, fig. 1,) represents the mummy ibis, as only one foot seven inches high, including its bandages, although he expressly says, that the bird was then placed on its feet, with the head erect, and that no part of it had been bent in the embalming.

Hasselquist, who took a small black and white

heron for the ibis, gives as his principal reason, that the size of this bird, which is that of a crow, corresponds very well with the size of the mummies of the ibis.(1) How then could Linnæus give the name of ibis to a bird as large as a stork? How indeed could he consider this bird as the same with the *ardea ibis* of Hasselquist, which besides its smallness, had a straight beak? And how could this latter error of synonomy have been perpetuated in the *Systema Naturæ*, down to the present time?

A short time after the examination made with M. Fourcroy, M. Olivier had the complaisance to show us some bones which he had brought from two mummies of the ibis, and to open two others with us. The bones there found resembled those of the mummies of colonel Grobert, only one of the four was smaller, but it was easy to judge by the epiphyses, that it had belonged to a young individual.

The only drawing of the beak of an embalmed ibis, which does not entirely agree with those which we examined, was that of Edwards (plate cv.;) it is a ninth larger, and yet we do not question its accuracy; for M. Olivier showed us also the length, an eighth or ninth longer than the others, in proportion of 180 to 165 equally taken from a mummy. *See Fig.* 10.

This beak only shows that there were among the ibis species, individuals larger than others, but proves nothing in favour of the tantalus, for it has not the same shaped beak as that; it precisely resembles the curlew; and, besides, the beak of the

(1) Hasselquist Iter Palestinum, p. 249, magnitudo gallinæ, seu cornicis, and p. 250, vasa quæ in sepulcris inveniuntur, cum avibus conditis, hujus sunt magnitudinis.

tantalus is a third larger than that of our large embalmed ibises, and two-fifths that of the smallest.

We are, moreover, assured that there are similar variations in the size of our European curlews, according to age and sex; they are still larger in the green curlews of Italy, and in our pewits (*barges;*) and it appears that this is a property common to the greater part of the species of long-billed (*becasses*) birds.

Finally, our naturalists returned from the expedition to Egypt with a rich harvest of objects, ancient as well as modern. My learned friend, M. Geoffroy St. Hilaire, particularly occupied himself in collecting, with great care, mummies of every sort, and had brought a great number of those of the ibis, as well from Saccara as from Thebes.

The former were in the same state as those brought by M. Grobert; that is to say, that their bones had experienced a kind of half combustion, and were without consistency; they broke on the least touch, and it was very difficult to procure one entire, still more to detach them so as to form a skeleton.

The bones of those of Thebes were much better preserved, either from the greater heat of the climate, or from the greater care bestowed in their preparation; and M. Geoffroy having sacrificed several of them, my assistant, M. Rousseau, contrived, by the exercise of patience, skill, and ingenious and delicate methods, to form an entire skeleton, by stripping all the bones, and uniting them with a fine wire thread. This skeleton has been placed in the museum, of which it forms one of the most striking ornaments. We subjoin an engraving of it. *See Fig.* 7.

We remark that this mummy must have been

that of one kept in a state of domesticity in the temples; for the left shoulder has been broken and then united. It is probable that a wild bird, whose wing was broken, would die before it healed, for want of strength to pursue its prey, or power to escape from its enemies.

This skeleton enables us to determine unhesitatingly the character and proportions of the bird: we clearly see that it was in every respect a real curlew, rather larger than that of Europe, but with its beak thicker and shorter. We subjoin a comparative table of the dimensions of these two birds, taken for the ibis, from the skeleton of the mummy of Thebes, and for the curlew, from a skeleton which was formerly in our anatomical galleries. We have added those of the parts of the ibises of Saccara which we have been enabled to obtain entire.

PARTS.	Skeleton of the Ibis of Thebes.	Skeleton of the Curlew.	Ibis of Saccara.	
			Larger.	Smaller.
Head and beak together	0,210	0,215	.....	.....
Head only	0,247	0,040	.....	.....
The fourteen vertebræ of the neck together	0,192	0,150	.....	.....
The back	0,080	0,056	.....	.....
The sacrum	0,087	0,070	.....	.....
The coccyx	0,037	0,035	.....	.....
The femur	0,078	0,060	.....	.....
The tibia	0,150	0,112	.....	0,095
The tarsus	0,102	0,090	.....	.....
The middle toe	0,097	0,070	.....	.....
The sternum	0,092	0,099	.....	.....
The clavicle	0,055	0,041	.....	0,04
The humerus	0,133	0,106	0,124	.....
The fore-arm	0,153	0,117	0,144	0,144
The hand	0,125	0,103	.....	.....

We see by this table that the ibis of Thebes was larger than our curlew; that one of the ibises of Saccara was of the medium size between that of Thebes and our curlew; and that the other was smaller than this latter bird. We observe also, that the different parts of the body of the ibis have not the same proportions to each other as those of the curlew have. The beak of the former, for instance, is remarkably shorter, although all the other parts are larger, &c.

Yet these differences of proportion do not go beyond what may distinguish the species of the same genus; the form and character which are to be considered as generic, are precisely similar.

The true ibis, then, must be sought no longer amongst these tall tantali with a sharp beak, but amongst the curlews; and here we should note that by the word *curlew* (*courlis*) we do not mean the artificial genus formed by Latham and Gmelin, of all long-shanked (*echaissiers*) birds, with a beak curved downwards, and a head devoid of plumage, whether the beak be rounded or sharp,—but a natural genus, which we shall call *numenius*, and which will include all the long-shanked birds with beaks curved downwards, soft and rounded, whether their head be devoid of, or covered with, plumage. It is the *curlew* genus, such as Buffon has imagined it. (1)

A glance over the collection of birds in the king's cabinet enables us to recognise a species which has not been yet either named or described by authors of systems, except perhaps Mr. Latham, and

(1) We have definitely established this genus in our 'Regne Animal,' vol. i. p. 483, and it appears to have been adopted by naturalists.

which, examined with care, will satisfy us as being the same with those which the ancient monuments and mummies have given as the characteristics of the ibis.

We add an engraving of it. *See Fig.* 8.

It is a bird rather larger than the curlew; its beak is curved in a manner similar to that of the curlew, but rather shorter, and much thicker in proportion, a little flattened towards the base, and marked at each side with a furrow which proceeding from the nostril to the extremity, while in the curlew the corresponding furrow is effaced before it, reaches midway down the beak. The colon of this beak is more or less black. The head and two-thirds of the beak are entirely destitute of feathers, and the skin is black. The body feathers, those of the wings and tail, are white, with the exception of the ends of the large wing feathers, which are black; the four last secondary feathers have remarkably long beards, spread out, which fall upon the ends of the wings when closed; their colour is a brilliant black with a violet shade. The feet are black, the legs thicker, and the toes evidently longer in proportion than those of the curlew; the membranes between the bases of the toes are also more extended; the leg is wholly covered with small polygonal scales, or what are called reticulated; and the back of the toes even has only similar scales, whilst the curlew has two-thirds of the legs and the whole of the toes, scutulated, that is, furnished with transverse scales. There is a reddish hue under the wing, towards the commencement of the thigh, and on the covers of the large anterior wing; but this tint appears to be an individual characteristic, or the result of accident; for it does not ap-

pear in any other individuals otherwise precisely similar.

This first individual came from the collection of the stadtholder, and we do not know its native country. The late M. Desmoulins, assistant naturalist at the museum, who had seen two others, said that they came from Senegal. One of them must have been brought by M. Geoffroy de Villeneuve. But we shall presently find that Bruce(1) found this species in Ethiopia, where it is called *Abou Hannés* (Father John;) and that Savigny saw it in abundance in Lower Egypt, where it is called *Abou Mengel* (Father of the Sickle.) It is probable that the moderns will not take the assertion of the ancients literally, that the ibis never quitted its own country without perishing.(2)

This assertion would besides be as contrary to the tantalus ibis as to our curlew; for the individuals which we have in Europe came from Senegal. It was thence that M. Geoffroy de Villeneuve brought that now in the museum of natural history; it is even much more rare in Egypt than our curlew, since no one after Perrault mentions having seen it there, or received one from thence.

An individual without the reddish hue, but otherwise entirely similar to the first, was brought home by M. de Labillardière, after his voyage in Australasia with M. d'Entrecasteaux.

We have since learnt that this sort of numenius has, when young, the head and neck furnished with feathers on those parts which, as they advance in age, become denuded, and that the scapularies are less expanded, and of a paler and duller black. It is in

(1) Bruce, loc. cit.; and Savigny, Mem. sur l'Ibis, p. 12.
(2) Ælian, lib. 2, cap. xxxviii.

this state that the late M. Peron brought one from Australasia, which did not differ from our own and that of M. de Labillardière, except in some black lines on the early feathers, and the first coverings of the wings, and the head and top of the neck, were ornamented with blackish plumage. A young individual brought by M. Savigny from Egypt, and depicted in the first plate in his Memoir of the Ibis, and in the great work on Egypt "Birds," plate 7. The feathers of the head and back of the neck are rather gray than black, and those of the front of the neck are white. Finally, Bruce's drawing, in his Atlas, plate 35, was also made from a young individual seen in Abyssinia, and nearly similar to that of M. Savigny.

We have received from Pondicherry, by M. Leschenault, an individual resembling that of Peru, of which only the head, and a small part of the back of the neck, are covered with white feathers; but it is not less certain that all these birds have the head and neck bare when they reach their full growth.

The late M. Macé sent from Bengal to the museum many individuals of a species closely allied to this, of which the beak is rather longer and less curved; the first feather only has a little black on two sides of its extremity, and the secondary feathers are also rather extended and lightly tinged with black.

According to M. Savigny (page 25 of his work) it appears that M. le Vaillant has observed another, which has also the secondary feathers extended, but which always preserves its feathers, and whose face is of a red colour.

The same M. Macé also sent a tantalus closely resembling that which naturalists have regarded as the ibis, but the small wing covering of which, and a

large band below the breast, are black, speckled with white. The lower secondary feathers are lengthened, and of a white colour. We know that in the tantalus ibis of naturalists, the small wing coverings are speckled with lilac, and that the under part of the body is entirely white.

We add a table of the parts of some of these birds, which we have been able to measure accurately in stuffed individuals. If we compare them with those of the skeletons of the ibis mummies, we shall judge how impossible it was for an instant to believe that these were the mummies of the tantalus.

PARTS OF THE BODY.	Tantalus Ibis of Naturalists.	Tantalus of India of Mace.	Numenius Ibis; according to us the real Ibis of the ancients.	Numenius Ibis, measured by Savigny.	Numenius of Mace.	Numenius of Labillardiere.	Numenius of Peron.	Numenius of Leschenault.
Length of the beak from its commencement to the tip.	0,210	0,265	0,125	0,154	0,148	0,165	0,131	0,132
Length of the naked part of the leg.	0,130	0,150	0,041	0,056	0,055	0,040	0,034	0,044
Length of the tarsus.	0,190	0,250	0,085	0,097	0,095	0,084	0,080	0,093
Length of the middle toe.	0,105	0,115	0,080	0,092	0,088	0,086	0,078	0,086

If we examine the books of the ancients and their monuments, and compare what they have said concerning the ibis, or the figures they have left of it, with the bird we have just described, we shall find all our difficulties vanish, and all testimonies agree with the best of all, that is, the body of the bird itself preserved in its mummy state.

Herodotus says (in his Euterpe, No. 76,) "the most common ibises have the head and front of the neck denuded, the plumage white, except on the head, on the nape of the neck, the ends of the wings and the rump, which are black. (1) Their beak and feet resemble those of the other ibises," and he had said of these "they are of the size of a crow, of an entirely black colour, and have feet like those of the crane with a crooked beak."

How does it occur that the travellers of modern days do not give us descriptions of birds as accurate as that which Herodotus has made of the ibis?

How can this description be applied to a bird which has only the face denuded, and of a red colour, to a bird which has the rump white, and not covered as ours by the black feathers of its wings?

And yet the last characteristic was essential to the ibis. Plutarch says (de Iside et Osiride,) that the form of a lunar crescent was to be found in the manner in which the white was cut by the black in the plumage of this bird. It was, in fact, by the union of the black of these latter wing-feathers with that of the two extremities of the wings, that there is formed in the white a large semicircular indention which gives to the white the appearance of a crescent.

(1) ψιλη την κεφαλην, και την δειρην πασαν, λευκη πτεροισι, πλην κεφαλης, και αυχενος και ακρων των πτερυγων, και πυγαιου ακρου. The late Larcher, in his translation of Herodotus, v. ii. p. 327, has properly defined the difference of these words αυχην the nape, and δειρη or δερη the throat.

It is now difficult to explain what he meant, by saying that the feet of the ibis formed an equilateral triangle with its beak. But we can understand the assertion of Ælian, that when it draws back its head and neck into its feathers, it has something of the appearance of a heart. (1) It was thence, according to Horus Apollo (c. 35,) made the emblem of the human heart.

According to what Herodotus says of the nudity of the throat, and of the feathers which covered the upper part of the neck, he seems to have had in his eye an individual of a middle age, but it is no less certain that the Egyptians knew also very well those individuals with the neck entirely denuded. We see such represented from sculptures of bronze in the collection of Egyptian antiquities of Caylus (vol. i. pl. 10, No. 4; and vol. v. pl. 11, No. 1.) This latter figure so much resembles the bird given in pl. 5, that we may think it was taken from it.

The paintings of Herculaneum leave no species in doubt. The paintings, No. 138 and 140, of David's edition, and vol. ii. p. 315, No. 59, and p. 321, No. 60, of the original edition, which represent Egyptian ceremonies, have many ibises walking in the courts of the temples. They are exactly similar to the bird that we have pointed out. We recognise particularly the characteristic blackness of the head and neck, and we easily see by the proportion of their figure with the persons of the picture, that it must have been a bird of half a metre at the most, and not a metre or nearly so, as the tantalus ibis.

The mosaic of Palæstrina also presents in its middle part many ibises perched on the buildings; and

(1) Ælian, lib. x. cap. xxix.

they differ in no respect from those of the paintings of Herculaneum.

A sardonyx in the collection of Dr. Mead, copied by Shaw, App. pl. 5, and representing an ibis, seems to be the miniature of the bird we have described.

A medal of Adrian in large bronze, represented in the Farnesian Museum, vol. vi. pl. 28, fig. 6, and another of the same emperor, in silver, represented in vol. iii. pl. 6, fig. 9, give us figures of the ibis, which, in spite of their smallness, are very similar to our birds.

As to the figures of the ibis engraved on the plinth of the statue of the Nile, at Belvedere, and on the copy of it in the garden of the Tuileries, they are not sufficiently finished to serve as proofs; but amongst the hieroglyphics, of which the Institute of Egypt has caused impressions to be taken on the spot, there are many which decidedly represent our bird. We give one of these impressions communicated by M. Geoffroy. (*Fig.* 9.)

We particularly insist on this latter figure, because it is the most fully authenticated of all; having been made at the time and on the spot where the ibis was worshipped, and being contemporaneous with its mummies; whilst those we have above cited, done in Italy, and by artists who did not profess the Egyptian worship may not be so accurate.

We owe Bruce the justice of saying, that he detected the bird which he has described under the name of *abouhannes*, as the real ibis. He expressly says, that this bird appeared to him to resemble that which the mummy pitchers contained; he also says, that this *abouhannes*, or *Father John*, is well known and common on the banks of the Nile, whilst he never saw there the bird represented by Buffon, under the name of the white ibis of Egypt.

M. Savigny, one of the naturalists of the expedition to Egypt, also assures us that he never discovered the tantalus in this country; but he found many of our *numenius* near the lake Menzale, in Lower Egypt, and he brought their relics away with him.

The *abouhannes* has been placed by M. Latham in his *Index Ornithologicus*, under the name of *tantalus Æthiopicus;* but he makes no mention of the conjecture of Bruce on its identity with the ibis.

Travellers before and after Bruce appear to have all been in error.

Belon thought that the white ibis was the stork, thereby evidently contradicting all testimonies; and none have been of his opinion except the apothecaries, who took the stork for an emblem, confounding it with the ibis to whom they attributed the invention of clysters. (1)

Prosper Alpinus, who relates that this invention was due to the ibis, gives no description of this bird in his medicine of the Egyptians. (2) In his Natural History of Egypt, he only speaks of it from Herodotus, to whose words he only adds, doubtless after a passage of Strabo, to which I shall recur presently, that this bird resembles the stork in size and figure. He says, that he was told that they were found in abundance, both white and black, on the banks of the Nile; but it is evident by his expressions, that he did not think they had been seen. (3)

Shaw says of the ibis, (4) that it is now excessively rare, and that he had never seen one. His *em-*

(1) Ælian, lib. ii., cap. xxxv. Phil. de Solest. An. Cic. de Nat. Deor. lib. ii. Phil. de Anim. Prop. 16, etc.

(2) De Med. Egypt. lib. i. fol. v. i. Ed. Paris, 1646.

(3) Recherches Egypt. lib. iv., cap. i. vol. i. p. 199, of the Leyden edit. 1735.

(4) See French translation, v. ii. p. 167.

seesy, or ox-bird, which Gmelin very improperly makes to correspond with the tantalus ibis, is the size of the curlew, white bodied and with red beak and feet. It is found in the fields near cattle; its flesh is not well flavoured; and soon decays.(1) It is easy to perceive that it is not the tantalus, and still less the ibis of the ancients.

Hasselquist neither knew the white ibis, nor the black ibis; his *ardea ibis* is a small heron with a straight beak. Linnæus (tenth edition,) has correctly placed it amongst the heron tribe; but he was in error, as I have already remarked, in afterwards removing it as synonymous with the *tantalus* genus.

De Maillet (Descrip. de l'Egypte, part 2, p. 23,) conjectures that the ibis may be a bird peculiar to Egypt, and which is there called Pharaoh's fowl (*Chapon de Pharaoh*,) and at Aleppo, *Saphan-bacha*. It devours serpents. There are a black and white species, and it follows for more than a hundred leagues, the caravans going from Cairo to Mecca, to feed on the carcases of the animals which are killed on the journey, whilst at any other season not one of them is to be seen on this route. But the author does not consider this as certain; he even says that we must give up the idea of understanding the ancients when they speak so as to seem unwilling to be understood. He concludes that the ancients have perhaps indiscriminately comprised under the name of ibis, all those birds which were serviceable to Egypt in clearing it of the dangerous reptiles which the climate abundantly produced; such as the vulture, falcon, stork, sparrow, hawk, &c.

He was right in not considering his Pharaoh's fowl as the ibis; for, though the description is very

(1) See Shaw's French translation, vol. i. p. 330.

imperfect, and Buffon believed that he detected the ibis in it, it is easily seen, as well as by what Pococke says of it, that this bird must have been carnivorous; and, in fact, we see by the figure given by Bruce (vol. v., p. 191, of the French edition,) that Pharaoh's fowl was only the *rachama*, or small white vulture, with black wings (*vultur percnopterus* of Linnæus) a bird very different from that which we have above proved to be the ibis.

Pocoke says, that it appears by the descriptions given of the ibis, and by the figures which he had seen of it in the temples of Upper Egypt, that it was a species of crane. I have seen, he adds, a quantity of these birds in the islands of the Nile: they were for the most part of a grayish colour (French translation, ed. 12mo. vol. ii., p. 153.) These few words are enough to prove that he did not know the ibis better than the others.

The learned have not been more fortunate in their conjectures than the travellers. Middleton compares with the ibis, a bronze figure of a bird with a short curved beak, the neck very long, and the head ornamented with a small crest, a figure which never had any similarity to the bird of the Egyptians (Antiq. Mon. pl. 10, p. 129.) This figure, besides, is not at all in the Egyptian style, and Middleton himself agrees that it must have been made at Rome. Saumaise, on Solinus, says nothing which relates to the real question.

As to the black ibis, which Aristotle places near Pelusium only,(1) it was long thought that Belon alone had seen it.(2) The bird described by him under this name is a species of curlew, to which he

(1) Hist. Anim. lib. ix. cap. xxvii. and lib. x. cap. xxx.
(2) Buffon's Hist. Natur. des Oiseaux, in 4to. vol. viii., p. 17.

attributes a head similar to that of the cormorant, that is to say, apparently bald, with red beak and feet;(1) but as he makes no mention of the ibis in his journey,(2) I suspect that it was only in France that he made this relation of the two, and by comparison with the ibis mummies. It is certain that the curlew with red beak and feet was unknown in Egypt,(3) but that the green curlew of Europe (*Scolopax falcinellus* of Linnæus is commonly seen there, and is even more plentiful than the white numenius;(4) and as it resembles it in form and size, and that at a distance its plumage may appear black, we can hardly doubt but that this was the real black ibis of the ancients. M. Savigny had a painting made of it in Egypt,(5) but only from a young individual. The figure of Buffon is from a full-grown bird, but the colours are too bright.

The mistake which at present prevails respecting the ibis, originated with Perrault, who was the first naturalist who made known the tantalus ibis of the present day. This error, adopted by Brisson and Buffon, has passed into the twelfth edition of Linnæus, where it is mixed with that of Hasselquist, which had been inserted in the tenth, forming together a most monstrous compound.

It was founded upon the idea that the ibis was essentially a bird inimical to serpents, and in this very natural conclusion, that a sharp beak was necessary to devour serpents, and more or less analogous to that of the stork or heron. This idea is

(1) Belon. Nat. des Oiseaux, pp. 199 and 200; and Portraits d'Oiseaux, fol. v. 44.

(2) Observations de plusieurs singularités, &c.

(3) Savigny, Mem. sur l'Ibis, p. 37.

(4) Idem ibid.

(5) See the great work on Egypt. Hist. Nat. des Oiseaux, pl. 7, fig. 2.

even the only good objection that can be adduced against the identity of our bird with the ibis. How, it is asked, could a curlew, a bird with a weak beak, devour these dangerous reptiles?

Our answer is, that positive proofs, such as descriptions, figures, and mummies, should always claim more belief than accounts of peculiar habits, too often devised without any other motive than to justify the various worships paid to animals. We might add, that the serpents from which the ibises freed Egypt are represented as very numerous, but not as very large. I believe, too, that I have ascertained decidedly that the bird mummies, which had a beak precisely similar to that of our bird, were real serpent-eaters; for I found in one of their mummies the undigested remains of the skin and scales of serpents, which I have preserved in our anatomical galleries.

But, at the present time, M. Savigny, who has observed whilst living, and even more than once dissected our white numenius, the bird which every thing proves to have been the ibis, asserts that it only eats worms, fresh water shell-fish, and other similar small animals. Supposing that there is no exception to this, all we can conclude is, that the Egyptians, as has before occurred to them and others, gave a false reason for an absurd worship. It is true, that Herodotus said, that he saw in a place on the borders of the desert,(1) near Buto, a narrow defile, in which an infinite quantity of bones and remains, which he was told were the relics of winged serpents, which sought to penetrate into Egypt at

(1) Euterpe, cap. lxxv. Herodotus says, *a place in Arabia;* but we cannot see how a place in Arabia could be *near the city of Buto,* which was in the western part of Delta.

the beginning of spring, and that the ibis stopped their progress; but he does not say that he witnessed their combats, nor that he had seen these winged serpents in a perfect state. The whole of his testimony consists then in having observed a mass of bones, which might have been those of this multitude of reptiles and other animals which the inundation destroyed every year, and whose carcases it would naturally convey to the points where it stopped, to the borders of the desert, and which would accumulate more abundantly in a narrow defile.

Yet it is in consequence of this idea of the combat of the ibis with the serpents, that Cicero gives a hard and horny beak to this bird.(1) Having never been in Egypt, he figured to himself that it must be so by analogy.

I am aware that Strabo says, that some part of the ibis resembles the stork in shape and height,(2) and that this author ought to have known this well, since he assures us that in his time the streets and crossways of Alexandria were so filled with them, that they were a serious inconvenience; but he spoke from memory. His testimony cannot be received when he contradicts all others, and particularly when the bird itself is there to disprove it.

In like manner I shall not concern myself about a passage of Ælian,(3) who states (like the Egyptian embalmers) that the intestines of the ibis were ninety-six cubits in length. The Egyptian priests of all classes have given such extravagant descrip-

(1) Avis excelsa, cruribus rigidis, corneo proceroque rostro. ic. de Nat. Deor. lib. i.
(2) Strab. lib. xvii.
(3) Ælian, Anim. lib. x. cap. 29.

tions of natural history, that we cannot make of much consequence whatever one of the lower order might assert.

Another objection may be made against me, drawn from the long extending and black feathers which cover the rump of our bird, and of which we detect some traces in the *abouhannes* of Bruce.

The ancients, it may be said, say nothing of it in their descriptions, and their figures of it do not represent them. But I have, to back my assertion, more than a written testimony or a traced image. I have found precisely similar feathers in one of the mummies of Saccara; I preserve them most carefully, as being at once a singular monument of antiquity, and a proof undeniable of the identity of the species. These feathers having an uncommon form, not being found, I believe, in any other curlew, leave, in fact, no doubt of the accuracy of my opinion.

I conclude this memoir by a recapitulation of its results.

1st. The tantalus ibis of Linnæus should form a genus distinct from the *tantalus loculator*. Their character will be *rostrum læve, validum, arcuatum, apice utrinque emarginatum.*

2nd. The other tantali of the latter editions should form a genus with the common curlews, and may be called the *numenius*. Their characters will be *rostrum teres, gracile, arcuatum, apice mutico,* for the special character of the sub-genus of the ibises we must add, *sulco laterali per totum longitudinem exarato.*

The white ibis of the ancients is not the ibis of Perrault and Buffon, which is a *tantalus;* nor the ibis of Hasselquist, which is an *ardea;* nor the ibis of Maillet, which is a *vulture;* but a bird of the

genus numenius, or curlew, of the sub-genus ibis, which has only hitherto been described by Bruce under the name of *abouhannes*. I name it NUMENIUS IBIS, *albus, capite et collo adulti nudis, remigium apicibus, rostro et pedibus nigris, remigibus secundariis elongatis nigro violaceis.*

4th. The black ibis of the ancients is probably the bird known in Europe under the name of *green curlew*, or the *scolopax falcinellus* of Linnæus; it also belongs to the genus of curlews and to the sub-genus of ibises.

5th. The tantalus ibis of Linnæus, in the real state of synonomy, includes four species of these different genera, viz.

1. A tantalus, the ibis of Perrault and Buffon.
2. An ardea, the ibis of Hasselquist.
3 and 4. Two numenii, the ibis of Belon and the ox-bird of Shaw.

We may judge by this example, and by many others, of the state in which this worst *Systema Naturæ* still remains, which it would be so important to cleanse gradually of the errors which throng it, and with which it appears continually to be loaded, by adding characters and synonyms and species, without just selection or competent judgment.

The general conclusion of my labour is, that the ibis still exists in Egypt as it did in the time of the Pharoahs, and that it is to the error of naturalists we are indebted for the belief so long prevalent, that the real species was lost or altered in its form.

GLOSSARY.

Acromium. The upper process of the scapula, or shoulder blade.
Alluvium. Beds of transported matter, constantly deposited by torrents and rivers, and which contain only bones of animals that still live in the country.
Aluminous. The technical name of pure clayey earth.
Alveolæ. The sockets in the jaws in which the teeth are set.
Ammonites, or snake stone, a fossil, univalved, many-chambered shell; of a flattened, spiral figure, containing many circumlocutions, which decrease in bulk gradually to the centre. From its resemblance to a ram's horn, or that with which the figure of Jupiter Ammon is drawn, it is called Cornua Ammonis.
Apophysis. The prominence or jutting out of a bone.
Arabesques, or Moresques; a style of painting or sculpture, so called from the Arabs and Moors, who were precluded by their laws and religion, from painting animals.
Arundinaceæ. Fossils composed of fragments of the bark of trees placed on each other.
Articulation (in anatomy.) The juncture or connexion of two bones.
Basalt. A mineral considered as produced by fire, and found in great quantities in volcanic districts. Its colour is a darkish gray, and it forms some of the most singular rocks in nature, as the Giants' Causeway, Fingal's Cave, &c.
Belemnites, or thunder stone, is a fossil, so called from a Greek word, signifying an arrow, because of its resemblance to an arrow-head. Its shape is intermediate between a long cylinder and an acute angled cone; the colour is usually a brownish yellow, with a transparency like alabaster.
Bituminous. Any thing partaking of the nature of pitch, or inflammable material.
Brecciæ, called also conglomerate, or masses of various pieces of stone, &c. of different kinds and species.
Calcareous, partaking of the nature of *calx,* or lime.
Caries. Rottenness or putridity.

Carnivorous. Flesh-devouring.

Cataclysm. A Greek word signifying *deluge.*

Cetacea. The seventh order of mammalia, according to Linnæus, including the four species, narvals, whales, cachalots and dolphins.

Clavicle. One of the bones of the shoulder.

Colures, are two great circles which intersect each other at right angles in the poles of the world, dividing the ecliptic into four equal parts, denoting the four seasons of the year; the one passing through *Aries* and *Libra,* is the *equinoctial colure;* and the other passing through *Cancer* and *Capricorn,* the *solstitial colure.*

Concretion, in geology, is the assemblage of small particles into a solid mass.

Crustacea. Aquatic shell-fish.

Diluvium. Deposites of mud and clayey sands, transported from distant countries and filled with fossil remains of land animals, for the most part unknown, or at least foreign to the country.

Didelphides, in zoology, a genus of mammalia, the opossums of our English writers.

Echidna. A species of serpent stone.

Encirites. A kind of columnar fossil, called also stone-lily: when found perfect, which is not common, the upper part resembles a closed lily with its stalk. In each of its ten arms are sixty bones, and in the fingers are eighteen hundred. In the small claws the number of bones is twenty-four thousand, and the whole number of bones in one of these wonderful animals is 26,680, though the animals themselves seem scarcely so large as a man's hand.

Entrochites. The fossilized remains of some marine animals of the echinæ, or stone-fish kind. They are cylindrically shaped, and about an inch long.

Epiphysis. A name given to certain parts of bones, at a particular period of their formation.

Felspar. A mineral of various colours, white, gray, reddish, and yellowish. It enters into the composition of granite, and has a foliated appearance.

Ferruginous. Any thing partaking of iron, or containing particles of that metal.

Fibula. The outer and smaller bone of the leg.

Gneiss. A species of rock, differing from granite chiefly in being of a slaty structure, in consequence of its containing a greater proportion of mica, and less quartz and felspar, which two last are usually in small grains, and not so distinct as in granite.

Granite. A species of rock, consisting of three substances, mica,

quartz, and felspar, and sometimes other minerals. The *mica* is in the form of soft, elastic scales, and in some sorts of granites is black, and in others yellowish. The *quartz* is white, red, brown, or yellowish, and even colourless and transparent, and may be known by the glass-like surface of the broken pieces; while the *felspar* is more splintery, and for the most part in pieces of a longish shape.

Gryphæa. A species of fossil bivalve shell.

Gypsum, or plaster of Paris, is the sulphate of lime, being composed of lime and sulphuric acid; and much used in the formation of cements, casts, &c.

Heliacal rising and setting of a star is, properly, when it rises or sets with the sun; or a star is said to rise heliacally, when it is first seen after a conjunction with the sun: and to set heliacally, when it is so near the sun as to be hidden by its beams.

Herbivorous. Herb-devouring.

Homogenous, is a term applied to various subjects, to denote that they consist of similar parts, or of parts of the same nature and kind.

Hornblende. A species of rock, usually of a dark bottle-green colour: it is more shining and glossy than felspar, and heavier, but not so hard.

Insectivorous. Insect-devouring.

Lava. The matter ejected by volcanos.

Lignites. The inflammable material called *brown coal.*

Limestone. The carbonate of lime, being composed of lime and carbonic acid. There are many species, including chalk and marble.

Lithophytes. The fourth order of vermes or worms. They produce the coral, and in this order are fifty-nine species, under the four genera of *tubipora*, *madrepora*, *millepora*, and *tullipora.*

Masseter. The powerful muscle of the under jaw.

Mica, vide *Granite.*

Mollusca. The second order of vermes, including animals that are naked, and furnished with tentacula, or arms.

Monads. A genus of insects of the order infusoria. The generic character is a worm invisible to the naked eye, simple, pellucid, and resembling a point. The genus includes five species.

Monitor. A large species of lizard.

Monocotyledonous. The term of one of the then great trees, into which the whole vegetable kingdom is divided, and signifying one stem or seminal leaf.

Myocus. The dormouse.

Œsophagus. The membranous and muscular tube that conveys the food from the throat to the stomach.

Oolite. The Bath stone or freestone, which may be cut with a saw.

Oviparous. Egg-producing.

Pantheism. A doctrine which confounds God with the universe, representing them as one and the same being, and admitting only one substance, whence all things proceed, and into which they all return. The tenets of Spinoza.

Petrifaction. An animal or vegetable, or their parts, changed into a fossil substance.

Planisphere. A projection of the sphere and the circles thereof on a plane, as on paper, &c.

Porphyry. A rock so called from its purple colour: but geologists term all rocks porphyry, where crystals are scattered through a mass of other compacted matter.

Pyrites. The name given to certain ores which contain a large quantity of sulphur, and have a metallic lustre.

Quartz. A substance very generally diffused throughout the mineral kingdom. *Vide* granite.

Scapula. The shoulder blade.

Schist. From a German word for slate.

Sclerotica. The external, dense and firm membrane of the globe of the eye.

Siliceous. Flinty.

Sphagna. Moss.

Stalactite. Carbonate of stalactic; limestone formed by the dripping of the water in a cavern, containing a superabundance of carbonic acid. The limestone is dissolved, but precipitately, when the acid is disengaged, it forms stalactite. The celebrated grotto of Antiparos is remarkable for the fantastic and beautiful form of its stalactites.

Synchronism. The occurrence of several events at the same time.

Terebratulæ. A species of arch shell, with a small hole in it, apparently bored by art.

Testacea. Fish covered with a strong shell, as oysters, &c.

Tibia. The leg bone.

Tufa. A stone formed by the depositions of springs and rivulets, containing much earthy matter; also, by the concretions of volcanic cinders, &c. cemented by water.

Travertine. A peculiar substance formed of petrified reeds, straws, &c. conglomerated.

Vermiculate. Resembling worms.

Viviparous. That produces its young alive, in opposition to *oviparous.*

Zoophytes. A kind of intermediate body, supposed to partake of the nature of animal and vegetable.

Zygoma. The bony arch of the head, under which the temporal muscle passes.

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THE END.

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