5. The relative chronological value of the divisions of the geological record is not to be measured by mere depth of strata. While it may be reasonably assumed that a great thickness of stratified rock must mark the passage of a long period of time, it cannot safely be affirmed that a much less thickness elsewhere represents a correspondingly diminished period. This may sometimes be made evident by an unconformability between two sets of rocks, as has already been explained. The total depth of both groups together may be, say 1000 feet. Elsewhere we may find a single unbroken formation reaching a depth of 10,000 feet; but it would be utterly erroneous to conclude that the latter represents ten times the length of time shown by the two former. So far from this being the case, it might not be difficult to show that the minor thickness of rock really denoted by far the longer geological interval. If, for instance, it could be proved that the upper part of both the sections lay on one and the same geological platform, but that the lower unconformable series in the one locality belonged to a far lower and older system of rocks than the base of the thick conformable series in the other, then it would be clear that the gap marked by the unconformability really indicated a longer period than the massive succession of deposits.

6. Fossil evidence furnishes the chief means of comparing the relative value of formations and groups of rock. A break in the succession of organic remains marks an interval of time often unrepresented by strata at the place where the break is found. The relative importance of these breaks, and therefore, probably, the comparative intervals of time which they mark, may be estimated by the difference of the facies of the fossils on each side. If, for example, in one case we find every species to be dissimilar above and below a certain horizon, while in another locality only half of the species on each side are peculiar, we naturally infer, if the total number of species seems large enough to warrant the inference, that the interval marked by the former break was very much longer than that marked by the second. But we may go further and compare by means of fossil evidence the relation between breaks in the succession of organic remains and the depth of strata between them.

Three formations of fossiliferous strata, A, C, and H, may occur conformably above each other. By a comparison of the fossil contents of all parts of A, it may be ascertained that, while some species are peculiar to its lower, others to its higher portions, yet the majority extend throughout the formation. If now it is found that of the total number of species in the upper portion of A only one-third passes up into C, it may be inferred with some probability that the time represented by the break between A and C was really longer than that required for the accumulation of the whole of the formation A. It might even be possible to discover elsewhere a thick intermediate formation B filling up the gap between A and C. In like manner were it to be discovered that, while the whole of the formation C is characterized by a common suite of fossils, not one of the species and only one half of the genera pass up into H, the inference could hardly be resisted that the gap between the two formations marks the passage of a far longer interval than was needed for the deposition of the whole of C. And thus we reach the remarkable conclusion that, thick though the stratified formations of a country may be, in some cases they may not represent so long a total period of time as do the gaps in their succession,—in other words, that non-deposition was more frequent and prolonged than deposition, or that the intervals of time which have been recorded by strata have not been so long as those which have not been so recorded.

In all speculations of this nature, however, it is necessary to reason from as wide a basis of observation as possible, seeing that so much of the evidence is negative. Especially needful is it to bear in mind that the cessation of one or more species at a certain line among the rocks of a particular district may mean nothing more than that, owing to some change in the conditions of life or of deposition, these species were compelled to migrate or became locally extinct at the time marked by that line. They may have continued to flourish abundantly in neighbouring districts for a long period afterward. Many examples of this obvious truth might be cited. Thus in a great succession of mingled marine, brackish-water, and terrestrial strata, like that of the Carboniferous Limestone series of Scotland, corals, crinoids, and brachiopods abound in the limestones and accompanying shales, but disappear as the sandstones, ironstones, clays, coals, and bituminous shales supervene. An observer meeting for the first time with an instance of the disappearance, and remembering what he had read about "breaks in succession," might be tempted to speculate about the extinction of these organisms, and their replacement by other and later forms of life, such as the ferns, lycopods, ganoid fishes, and other fossils so abundant in the overlying strata. But further research would show him that high above the plant-bearing sandstones and coals other limestones and shales might be observed, once more charged with the same marine fossils as before, and still farther overlying groups of sandstones, coals, and carbonaceous beds followed by yet higher marine limestones. He would thus learn that the same organisms, after being locally exterminated, returned again and again to the same area. After such a lesson he would probably pause before too confidently asserting that the highest bed in which we can detect certain fossils marked really their final appearance in the history of life. A break in the succession may thus be extremely local, one set of organisms having been driven to a different part of the same region, while another set occupied their place until the first was enabled to return.

7. The geological record is at the best but an imperfect chronicle of the geological history of the earth. It abounds in gaps, some of which have been caused by the destruction of strata owing to metamorphism, denudation, or otherwise, some by original non-deposition, as above explained. Nevertheless from this record alone can the progress of the earth be traced. It contains the registers of the births and deaths of tribes of plants and animals which have from time to time lived on the earth. But a small proportion of the total number of species which have appeared in past time have been thus chronicled, yet by collecting the broken fragments of the record an outline at least of the history of life upon the earth can be deciphered.

The nomenclature adopted for the subdivisions of the geological record bears witness to the rapid growth of geology. It is a patch-work in which no system nor language has been adhered to, but where the influences by which the progress of the science has been moulded may be distinctly traced. Some of the earliest names are lithological, and remind us of the fact that mineralogy and petrography preceded geology in the order of birth—Chalk, Oolite, Greensand, Millstone Grit. Others are topographical, and often recall the labours of the early geologists of England—London Clay, Oxford Clay, Purbeck, Portland, Kimeridge beds. Others are taken from local English provincial names, and remind us of the debt we owe to William Smith, by whom so many of them were first used—Lias, Gault, Crag, Cornbrash. Others of later date recognize an order of superposition as already established among formations—Old Red Sandstone, New Red Sandstone. By common consent it is admitted that names taken from the region where a formation or group of rocks is typically developed, are best adapted for general use. Cambrian, Silurian, Devonian, Permian, Jurassic, are of this class, and have been adopted all over the globe.

But whatever be the name chosen to designate a particular group of strata, it soon comes to be used as a chronological or homotaxial term, apart altogether from the stratigraphical character of the strata to which it is applied. Thus we speak of the Chalk or Cretaceous system, and embrace under that term formations which may contain no chalk; and we may describe as Silurian a series of strata utterly unlike in lithological characters to the formations in the typical Silurian country. In using these terms we unconsciously allow the idea of relative date to arise prominently before us. Hence such a word as chalk or cretaceous does not suggest so much to us the group of strata so called, as the interval of geological history which these strata represent. We speak of the Cretaceous, Jurassic, and Cambrian periods, and of the Cretaceous fauna, the Jurassic flora, the Cambrian trilobites, as if these adjectives denoted simply epochs of geological time.

The geological record is classified into five main divisions:—(1) the Archæan, Azoic (lifeless), or Eozoic (dawn of life) Periods; (2) the Primary or Palæozoic (ancient life) Periods; (3) the Secondary or Mesozoic (middle life) Periods; (4) the Tertiary or Cainozoic (recent life); and (5) the Quaternary or Post-Tertiary Periods. These divisions are further ranged into systems, each system into formations, each formation into groups, and each group or series into single zones or horizons. The subjoined generalized table exhibits the order in which the chief subdivisions appear.

Order of Succession of the Stratified Formation of the Earth's Crust.

	Britain.	Continental Europe.	North America.
Post-Tertiary or Quaternary	Recent—Alluvium, peat, &c.	Alluvium.	Recent or Terrace.
	Pleistocene—*Cave deposits, Glacial drift.*	Diluvium.	Champlain. Glacial.
Tertiary or Cainozoic.	Pliocene—*Crag deposits of Norfolk and Suffolk.*	Pliocene—*Tegel, Dinotherium-Sand.*	Sumter.
	Miocene—*Lignite of Bovey Tracey, Mull, &c.*	Miocene—*Leithakalk, Upper Molasse.*	Yorktown.
		Oligocene—*Lower Molasse, Grès de Fontainebleau, &c.*	
	Eocene—*Tertiaries of Hampshire Basin, and Isle of Wight.*	Eocene—*Nummulite-limestone, Flysch.*	Alabama. Lignitic.
Secondary or Mesozoic.	Cretaceous. Upper	Senonian—*Craie blanche et tuffeau, Upper Quadersandstein.*	Fox-Hills group. (Upper Missouri Region.)
	Cretaceous.	Turonian—*Plänerkalk.* Cenomanian—*Grès vert.* Gault.	Pierre group. Niobrara group. Benton group. (Upper Missouri Region.)
	Cretaceous. Lower.	Neocomian.	Dakotah group. (Upper Missouri Region.)
	Jurassic. Oolitic. Upper.	Upper or White Jura (Malm).	Jurassic rocks appear to be but poorly developed in N. America.
	Jurassic. Oolitic. Lower.	Middle or Brown Jura (Dogger).	
	Jurassic. Liassic.	Lower or Black Jura (Lias).	
	Triassic. Upper.	Rhætic beds, Keuper. Muschelkalk.	Triassic.
	Triassic. Lower.	Bunter.	
Primary or Palæozoic.	Permian.	Dyas or Permian *Zechstein, Rothliegendes.*	Permian.
	Carboniferous. Coal-measures.	Terrain houiller, Steinkohlen.	Carboniferous.
	Carboniferous. Millstone Grit.	Flötzleerer Sandstein	Sub-Carboniferous.
	Carboniferous. Carboniferous Limestone.	Calcaire Carbonifère, Kohlenkalk, Kulm.	
	Devonian and Old Red Sandstone.	Devonian	Devonian.
	Silurian.	Silurian (Transition or Grauwacke system).	Silurian.
	Cambrian.	Primordial Silurian, older grauwacke and slate. Primitive schists.	Primordial Silurian and Cambrian. Huronian.
Archæan or Azoic (Eozoic).	Fundamental gneiss.	Ur-gneiss.	Laurentian.

I. ARCHÆAN.

Underneath the oldest unaltered stratified and fossiliferous formations in Europe there occur masses of gneiss and other crystalline schistose rocks belonging perhaps to widely different geological periods, but, from want of satisfactory means of discrimination, necessarily united provisionally in one common series. That they are separated by a vast interval of time from the rocks which lie upon them is shown by the strong unconformability with which they are related to every formation of younger date than themselves. Everywhere thoroughly crystalline, they are disposed in rude, crumpled, often vertical beds, out of the ruins of which the overlying formations have been partly built.

Britain.—In no part of the European area are these ancient rocks better seen than in the north-west of Scotland. Their position there, previously indicated by MacCulloch and Hay Cunningham, was first definitely established by Murchison, who showed that they possess a dominant strike to N.N.W., and are unconformably overlaid by all the other rocks of the Scottish Highlands. They consist of a tough massive gneiss usually hornblendic, with bands of hornblende-rock, hornblende-schist, quartz-felsite, granite, and other crystalline rocks. In two or three places they enclose bands of limestone, but neither in these nor in any other parts of their mass has the least trace of any organic structure been detected. It is impossible at present to offer any conjecture as to their probable thickness. It must be many thousand feet; but its approximate amount, if ever ascertainable, will only be made out after the region where they occur has been mapped in detail. These gneisses and schists possess a massiveness and rudeness of bedding which strongly distinguishes them from all the other and younger metamorphic rocks of Britain. They form nearly the whole of the Outer Hebrides, and occupy a variable belt of the western parts of the counties of Sutherland and Ross. Murchison proposed to term them the Fundamental or Lewisian Gneiss from the isle of Lewis—the chief of the Hebrides. Afterwards he called them Laurentian, regarding them as the equivalent of some part of the great Laurentian system of Canada.

In recent years Mr Hicks and others have endeavoured to show that in Wales there exist here and there protrusions of an old crystalline group of rocks from beneath the Cambrian system, and they have described these "pre-Cambrian" masses as overlaid unconformably by younger formations, as in the north-west of Scotland. Professor Ramsay, however, who with his colleagues in the Geological Survey mapped the Welsh areas in detail, contends that the supposed older gneiss is merely a metamorphosed portion of the Cambrian rocks.

Continental Europe.—On the continent of Europe numerous areas of ancient gneiss rise from under the oldest fossiliferous formations. In Scandinavia the structure of part of the country resembles that of the north-west of Scotland: the fundamental-gneiss (*Urgneiss*), covering a large area, is overlaid unconformably by red sandstones which underlie the most ancient strata containing organic remains. The gneiss and its accompanying rocks range through Finland into the north-west of Russia, reappearing in the north-east of that vast empire in Petchora Land down to the White Sea, and rising in the nucleus of the chain of the Ural Mountains, and still further south in Podolia. In Central Europe they appear as islands in the midst of more recent formations. In the midst of the Carpathian Mountains they protrude at a number of points, but westwards in the Alpine chain they rise in a more continuous belt in the central portion of these crests, and show numerous mineralogical varieties, including protogine, mica-schist, and many other schists, as well as limestone and serpentine. But perhaps their most intelligible sections are those which they present in Bavaria and Bohemia between the valley of the Danube and the head-waters of the Elbe. They are there divided into two well-marked groups—(*a*) red gneiss, covered by (*b*) grey gneiss. According to Gümbel the former (called by him the Bojan gneiss) may be traced as a distinct formation associated with granite, but with very few other kinds of crystalline or schistose rocks, while the latter (termed the Hercynian gneiss) consists of gneiss with abundant interstratification of many other schistose rocks, graphitic limestone, and serpentine. The Hercynian gneiss is overlaid by mica-schist, above which comes a vast mass of argillaceous schists and shales. Gümbel some years ago found in the marbles associated with the younger gneiss what he considered to be an organism of the same genus as the *Eozoon* of Canada, to which reference will immediately be made. He named it *Eozoon Bavaricum*. More recently a similar substance was obtained in the Archæan series of Bohemia, and named by Fritsch *Eozoon Bohemicum*.

AMERICA.—In North America Archæan rocks cover a large part of the continent from the Arctic Circle southwards to the great lakes. They appear likewise, as in Europe, along the central parts of prominent mountain chains, as in the Rocky Mountain range and that of the Appalachians. They have been carefully studied in Canada, where the late Sir W. E. Logan, Director of the Geological Survey of the Dominion, estimated their depth at about 30,000 feet, but neither their top nor their base can there be found. He named them the Laurentian system from their abundant development along the shores of the St Lawrence. They have been divided into two series—(1) a lower formation more than 20,000 feet thick, consisting chiefly of granitic, orthoclase gneiss, with bands of quartz-rock, schists, iron-ore, and limestone; and (2) an upper formation fully 10,000 feet thick, composed also, for the most part, of gneiss, but marked by the occurrence of bands of Labrador felspar, as well as schist, iron-ore, and limestone. The upper division has been stated to lie unconformably on the lower. Mr Selwyn, however, has recently pointed out that this is almost certainly not the case, but that the limestone-bearing series rests conformably upon a massive granitoid gneiss, to which he would restrict the term Laurentian, classing the limestones in the next or Huronian system (*Nat. Hist. Soc. Montreal*, Feb. 1879).

In one of the Laurentian limestones of Canada, specimens have been found of a remarkable mixture of calcite and serpentine. These minerals are arranged in alternate layers, the calcite forming the main framework of the substance with the serpentine (sometimes loganite, pyroxene, &c.) disposed in thin, wavy, inconstant layers, as if filling up flattened cavities in the calcareous mass. So different from any ordinary mineral segregation with which he was acquainted did this arrangement appear to Logan, that he was led to regard the substance as probably of organic origin. This opinion was adopted, and the structure of the supposed fossil was worked out in elaborate detail by Dr Dawson of Montreal, who pronounced the organism to be the remains of a massive foraminifer which he called *Eozoon*, and which he believed must have grown in large thick sheets over the sea-bottom. This opinion was confirmed by Dr W. B. Carpenter, who from a large suite of additional and better preserved specimens, described a system of internal canals having the characters of those in true foraminiferal structures. (See FORAMINIFERA.) Other observers, notably Professors King and Rowney of Galway and Möbius of Kiel, have opposed the organic nature of *Eozoon*, and have endeavoured to show that the supposed canals and passages are merely infiltration veinings of serpentine in the calcite. In some cases, however, the "canal-system" is not filled with serpentine but with dolomite, which seems to show that the cavities must have existed before either dolomite or serpentine were introduced into the substance. Dr Carpenter contends that the disposition of these passages in his decalcified specimens is very regular, and quite unlike any mineral infiltration with which he is acquainted.

The opinion of the organic nature of *Eozoon* has been supposed to receive support from the large quantity of graphite found throughout the Archæan rocks of Canada and the northern parts of the United States. This mineral occurs partly in veins, but chiefly disseminated in scales and laminæ in the limestones and as independent layers. Dr Dawson estimates the aggregate amount of it in one band of limestone in the Ottawa district as not less than from 20 to 30 feet, and he thinks it is hardly an exaggeration to say that there is as much carbon in the Laurentian as in equivalent areas of the Carboniferous system. He compares some of the pure bands of graphite to beds of coal, and maintains that no other source for their origin can be imagined than the deoxidation of carbonic acid by living plants. In the largest of three beds of graphite at St John he has found what he considers may be fibrous structure indicative of the existence of land-plants.

Still further evidence in favour of organized existence during Archæan time in the North American area has been adduced from the remarkably thick and abundant masses of iron ore associated with the Laurentian rocks of Canada and the United States. Dr Sterry Hunt has called attention to these ores as proving the precipitation of iron by decomposing vegetation during the Laurentian period on a more gigantic scale than at any subsequent geological epoch.[1] Some of the beds of magnetic iron ranged up to 200 feet in thickness. Large masses also of hæmatite and titaniferous iron, as well as of iron sulphides, occur in the Canadian Archæan series. These great bands of iron ore run southward, and form an important feature in the economic geology of the Northern States of the Union.

Above the Laurentian rocks in the region of Lake Huron lies a vast mass of slates, conglomerates, limestones, and quartz-rocks, attaining a depth of from 10,000 to 20,000 feet. They are termed Huronian. No fossils have yet been found in them; but they must be much younger than the Laurentian rocks, on which they rest unconformably, and from which they have been in part at least derived.

II. PALÆOZOIC.

Under the general term of Primary or Palæozoic are now included all the older sedimentary formations containing organic remains, up to the top of what is termed the Permian system. These rocks consist mainly of sandy and muddy sediment with occasional intercalated zones of limestone. They everywhere bear witness to comparatively shallow water and the proximity of land. Their frequent alternations of sandstone, shale, conglomerate, and other detrital materials, their abundant, rippled, and sun-cracked surfaces marked often with burrows and trails of worms, as well as the prevalent character of their organic remains, show that they must have been deposited in areas of slow subsidence, bordering continental or insular masses of land. As regards the organisms of which they have preserved the casts, the Palæozoic rocks, as far as the present evidence goes, may be grouped into two divisions—an older and a newer:—the former distinguished more especially by the abundance of its graptolitic, trilobitic, and brachiopodous fauna, and by the absence of vertebrate remains; the latter by the number and variety of its fishes and amphibians, the disappearance and extinction of graptolites and trilobites, and the abundance of its cryptogamic terrestrial flora.

[1] *Geology of Canada*, 1863, p. 573.

CAMBRIAN.

This name was applied by Sedgwick to the rocks of North Wales (Cambria), where he first investigated them. Their base is there nowhere seen, so that, though they attain a great depth, some part of their total mass must be concealed from view. They pass up continuously into the base of the Silurian system. Considerable diversity of opinion has existed, and still continues, as to the line where the upper limit of the Cambrian system should be drawn. Murchison contended that this line should be placed below the strata where a trilobitic and brachiopodous fauna begins, and that these strata cannot be separated from the overlying Silurian system. He therefore included in the Cambrian only the barren grits and slates of the Longmynd, Harlech, and Llanberis. Sedgwick, on the other hand, insisted on carrying the line up to the base of the Upper Silurian rocks. He thus left these formations as alone constituting the Silurian system, and massed all the Lower Silurian in his Cambrian system. Murchison worked out the stratigraphical order of succession from above, and chiefly by help of organic remains. He advanced from where the superposition of the rocks is clear and undoubted, and for the first time in the history of geology ascertained that the "transition-rocks" of the older geologists could be arranged into zones by means of characteristic fossils as satisfactorily as the Secondary formations had been classified in a similar manner by William Smith. Year by year, as he found his Silurian types of life descend farther and farther into lower deposits, he pushed backward the limits of his Silurian system. In this he was supported by the general consent of geologists and palæontologists all over the world. Sedgwick, on the other hand, attacked the problem rather from the point of stratigraphy and geological structure. Though he had collected fossils from many of the rocks of which he had made out the true order of succession in North Wales, he allowed them to lie for years unexamined. Meanwhile Murchison had studied the prolongations of some of the same rocks into South Wales, and had obtained from them the abundant suite of organic remains which characterized his Lower Silurian formations. Similar fossils were found abundantly on the continent of Europe, and in America. Naturally the classification proposed by Murchison was adopted all over the world. As he included in his Silurian system the oldest rocks containing a distinctive fauna of trilobites and brachiopods, the earliest fossiliferous rocks were everywhere classed as Silurian, and the name Cambrian was discarded by geologists of other countries as indicative of a more ancient series of deposits not characterized by peculiar organic remains, and therefore not capable of being elsewhere satisfactorily recognized. Barrande, investigating the most ancient fossiliferous rocks of Bohemia, distinguished by the name of the "Primordial Zone" a group of strata underlying the Lower Silurian rocks, and containing a peculiar and characteristic suite of trilobites. He classed it, however, with the Silurian system, and Murchison adopted the term, grouping under it the lowest dark slates which in Wales and the border English counties contained some of the same early forms of life.

Investigations during the last twelve years, however, chiefly by the late Mr Salter and Mr Hicks, have brought to light a much more abundant fauna from the so-called primordial rocks of Wales than they were supposed to possess. These fossils were found to be in large measure distinct from those in the undoubted Lower Silurian rocks. Thus the question of the proper base of the Silurian system was re-opened, and the claims of the Cambrian system to a great upward extension were more forcibly urged than ever. But these claims could now be urged on palæontological evidence such as had never before been produced. Accordingly there has arisen a general desire among the geologists of Britain to revise the nomenclature of the older rocks. Though as yet a common accord of opinion has not been reached, there seems a strong probability that ultimately the boundary line between the Cambrian and Silurian systems will be drawn above the primordial zone along the base of the great Arenig group or Lower Llandeilo rocks of Murchison. All his Silurian strata of older date than these rocks will be classed as Cambrian.

According to this classification, the Cambrian system, as developed in North Wales and the border English counties, consists of purple, reddish-grey, and green slates, grits, sandstones, and conglomerates. Its true base is nowhere seen, yet even the visible mass of strata has been estimated to reach the enormous thickness of 25,000 feet. By far the larger part of this vast depth of rock is unfossiliferous. Indeed it is only in some bands of the upper 6000 feet, or thereabouts, that fossils occur plentifully. By fossil evidence the Cambrian system may be divided into Lower and Upper, and each of these sections may be further subdivided into two groups, as in the following table:—

Cambrian of Wales.	Upper.	4. Tremadoc slates.
		3. Lingula flags.
	Lower.	2. Menevian group.
		1. Harlech and Longmynd group.

1. *Harlech and Longmynd Group.*—This includes purple, red, and grey flags, sandstones, and slates, with conglomerates. These strata attain a great thickness, estimated at 4000 feet in South Wales, but more than 8000 in North Wales. They were formerly supposed to be nearly barren of organic remains; but in recent years, chiefly through the researches of Mr Hicks at St Davids, they have yielded a tolerably abundant fauna, consisting of 30 species. Among these are 16 species of trilobite (*Paradoxides, Plutonia, Microdiscus, Palæopyge, Agnostus, Conocoryphe*), four annelides (*Arenicolites*), a sponge (*Protospongia*), five brachiopods (*Discina, Lingulella*), two pteropods (*Theca*), &c. Many of the surfaces of the strata in some parts of this group are marked with ripples, sun-cracks, and rain-pittings as well as with trails of worms—indicative of shallow-water and shore-conditions of deposit. 14 of the 30 species, according to Mr Etheridge, F.R.S., pass up into the Menevian group, and 7 continue into the Lingula flags.

2. *Menevian Group.*—This subdivision has been proposed for a series of sandstones and shales, with dark-blue slates and flags, dark-grey flags and grey grits, which are seen near St David's (Menevia), where they attain a depth of about 600 feet. They pass down conformably into the Harlech group with which, as just stated, they are connected by 14 species in common. The Menevian beds have yielded upwards of 50 species of fossils, of which 24 are confined to the Menevian, while 18 pass up into the lower Lingula flags. Among these the trilobites are specially prominent, Some of them attained a great size, *Paradoxides Davidis* being nearly two feet long. But with these were mingled others of diminutive size. It is noteworthy also, as Mr Hicks has pointed out, that while the trilobites had attained their maximum size at this early period, they are represented among the older Cambrian rocks by genera indicative of almost every stage of development, "from the little *Agnostus* with two rings in the thorax, and *Microdiscus* with four, to *Erinnys* with twenty-four," while blind genera occur together with those having the largest eyes.[1] Upwards of 30 species of trilobites have been obtained from the Menevian beds, the genera *Agnostus* (7 species), *Conocoryphe* (7 species), and *Paradoxides* being specially characteristic. Four species of sponges (*Protospongia*) and some annelide-tracks likewise occur. The mollusca are represented by 6 species of brachiopoda of the genera *Discina*, *Lingulella*, and *Obolella*; 5 pteropods (*Theca*) have been met with. The earliest entomostraca (*Entomis*) and the first cystidean (*Protocystites*) yet discovered occur in the Menevian fauna.

3. *Lingula Flags.*—These strata, consisting of bluish and black slates and flags, with bands of grey flags and sandstones, attain in some parts of Wales a thickness of more than 5000 feet. They received their name from the discovery by Mr E. Davis (1846) of vast numbers of a *Lingula* (*Lingulella Davisii*) in some of their layers. They rest conformably upon, and pass down into, the Menevian beds below them, and likewise graduate into the Tremadoc group above. They are distinguished by a characteristic

[1] Hicks, *Quart. Journn. Geol. Soc.*, xxviii. 174.