EXPLANATION OF PLATE VII.

- Fig. 1. *Didymograpsus flaccidus* (Hall. sp.), nat. size.
 1 a. Portion of the stipe of the same enlarged.
 2. Portion of *D. flaccidus*, showing the radicle, with three small spines on the opposite margin.
 3. Another specimen, with a longer radicle.
 4. *Diplograpsus Whitfieldi* (Hall. sp.), nat. size.
 4 a. The same, enlarged.
 5. *Diplograpsus mucronatus* (Hall. sp.), nat. size. Introduced for comparison with *D. Whitfieldi*.
 5 a. Portion of the same, enlarged.
 6. *Diplograpsus quadri-mucronatus* (Hall. sp.), nat. size.
 6 a. Portion of the same, enlarged.
 7. Enlargement of a portion of *D. quadri-mucronatus*, after Hall, showing the two spines arising from each cellule.
 8. Transverse section of the stipe of *D. quadri-mucronatus*, after Hall.
 9. *Corynoides calicularis* (gen. nov.), nat. size. 9 a. The same, enlarged.
 10. Ditto, with a single mucro. 11. Cup of *Corynoides*, enlarged.
 12. *Diplograpsus tubulariformis* (n. sp.), nat. size. 12 a. The same, magnified.
 13, and 13 a. Ditto, in which the lateral cellules are reduced in number. (Fig. 13) nat. size, and (Fig. 13 a) enlarged.
 14 and 14 a. Rounded variety of *D. tubulariformis*, in which the lateral cellules are still further reduced in number. (14) nat. size, and (14 a) enlarged.
 15 and 15 a. Another variety of the same, in which only the terminal cellules are left, nat. size, and enlarged.
 16 and 16 a. *Diplograpsus acuminatus*, (n. sp.), ordinary form, nat. size and enlarged. 16 b. Portion of stipe of the same, enlarged. 16 c. Radicle of the same, enlarged.
 17 and 17 a. Variety of *D. acuminatus*, in which the cellules are rounded, and very variable in shape, (*D. angustifolius* Hall.?) 17 b. Portion of the stipe of the same, enlarged.
 18. *Didymograpsus anceps* (n. sp.), with rudimentary radicle, nat. size. 18 a. Portion of the same, enlarged.
 19 and 20. Ditto, without any apparent radicle, nat. size. 20 a. Portion of stipe, enlarged.
 21 and 21 a and b. Germs of *Diplograpsus pristis*, enlarged.
 22 and 23. Germs of a di-prionidian Graptolite, enlarged.
 24. Germ of a mono-prionidian Graptolite, enlarged.

V.—ON THE ARENIG AND LLANDEILO GROUPS.¹

By the late H. WYATT-EDGEELL, Esq., 13th Light Infantry.

THE lower strata of the Silurian system are, as yet, but little known. The labours of Welsh and other geologists have brought to light the large fauna of the Lingula flags; but while the Upper Cambrian has thus been established and elucidated, the beds which lie immediately above it, namely the "Arenig group," and the Llandeilo flags, remain to be searched, and a great part of the respective fauna of each to be described.

The Arenig, or Skiddaw, group of Sedgwick forms the base of the true Silurian rocks; it immediately underlies the Llandeilo flags;

¹ This paper (originally read before the "Geologists Association," and published in their Proceedings in July, 1866,) was handed to the Editor of the GEOLOGICAL MAGAZINE, in the autumn of last year, by the Rev. E. Wyatt-Edgell, with a request from his son (at that time in Ireland) that it should appear in this Journal. In addition to the author's own MS. corrections, the copy was obligingly corrected by Mr. J. W. Salter, F.G.S.—Edit.

from which it is totally distinct, although classed with them in Murchison's "Siluria." The name is derived from Arenig-fawr, Merionethshire, where the group is well shown and full of igneous rocks: from this locality Prof. Sedgwick and Mr. Salter obtained two of the characteristic fossils, *Calymene parvifrons* and *Ogygia Selwynii*. He recognized the beds as different from those above, and called them Arenig slates, considering them the top of his Festiniog group. (See "Introduction to Synopsis of Woodwardian Museum," London and Cambridge, 1855.) But the group was not well known as a distinct one, until the appearance of the last edition of Lyell's "Manual of Geology;" since then it has been established more completely by the lists of fossils given in vol. iii. of the "Memoirs of the Geological Survey." In England it is seen in the lead-mining district of the Stiperstones, Shropshire, underlying the Llandeilo flags of Shelve and Cornden Hill; here it is that Murchison more especially describes it under the name of Lower Llandeilo. It occurs again near St. David's Head, overlying the Cambrian, and passing upwards into the Llandeilo flags; here it was first recognized by Mr. Salter, who frequently cites this locality in his "Monograph of British Trilobites," now coming out. (See Palæontogr. Monogr.)

The distinctness of our group from the latter is evident when the fossils of each are compared. The character of the fauna varies as much as it does between the Llandeilo and the Caradoc—more so than between the Caradoc and the Lower Llandovery. This will at once be seen from the lists here given.

ARENIG.—*Ogygia peltata*; *O. Selwynii*; *Calymene parvifrons*; *Æglina binodosa*; *Æ. grandis*; *Æ. caliginosa*; *Trinucleus Murchisoni*; *T. Gibbsii*; *Orthoceras Avelinei*; *Obolella plumbea*; *Orthis* sp. (Whitesand Bay); *Cucullella Anglica*; *Encrinites* (two).

LLANDEILO.—LOWER.—*Asaphus tyrannus*; *A. peltastes*; *Ogygia Buchii* var. *convexa*; *Calymene Cambrensis*; *Trinucleus favus*; *Lichas patriarchus*; *Bellerophon bilobatus*; *Helicotoma* sp.; *Lingula granulata*; *L. attenuata*; *Orthis striatula*; *Ctenodonta* sp.

LLANDEILO.—UPPER.—*Asaphus Corndensis*; *O. Buchi*, ordinary var.; *Barrandia (Ogygia) radians*; *B. Cordai*; *Calymene duplicata*; *Trinucleus fimbriatus*; *Cheirurus Sedgwickii*; *Ampyx nudus*; *Agnostus Maccoyi*; *Lingula Ramsayi*; *B. perturbatus*; *Murchisonia simplex*; *Modiolopsis inflata*; *Didymograpsus Murchisoni*.

The first fossil cited from the Arenig is from Whitesand Bay, near St. David's Head. It has recently been described by Mr. Salter under the name of *Ogygia peltata*; this description will be published, I believe, in the next volume of the Palæontographical Society.¹

Ogygia Selwynii, the next on the list, is the most characteristic fossil of the Arenig, or Skiddaw, rocks. It is found both in the Stiperstones district and in North Wales, and serves to mark these beds, just as *Ogygia Buchi* does the Llandeilo flags. Associated with

¹ This paper was written in March, 1866. The volume referred to, has since been published.

it is the remarkable *Calymene parvifrons*, first described from Taihirion, near Arenig-fawr, but found since then in Shropshire. *Trinucleus Murchisoni* is from Cefn-y-Gwynlle, one of the Stiperstone range of hills. *Trinucleus Gibbsii* is from Whitesand Bay. But the most notable genus of this group is the singular trilobite *Æglina*, of which there are other species besides the three here given. Having but seven body-rings, no rostral shield, and a large lobeless tail, it is classed with the *Asaphus* family; but at the same time the circular glabella and elongated eyes seem to connect it with *Remopleurides*, one of the *Olenida*. It is eminently characteristic of the Arenig period, where it attains its highest development; and this genus may be looked upon as one of the patriarchs of Silurian trilobites, for it seems to indicate a passage from the numerous *Olenida* of the Upper Cambrian to the *Asaphida* of the succeeding era. Represented by one or two species during the formation of the Llandeilo flags, this genus fades away in the Caradoc. Of shells there are but few species as yet described. The best known are the *Orthoceras Avelinei* and *Lingula* or *Obolella plumbea*, which are not uncommon in the black shales of the Stiperstones. The latter species is the only one I know which is common to the Arenig and Llandeilo; even this is doubtful, for the *Obolella* found at Builth, and referred to this species, is not in every respect the same. There is an undescribed species of *Orthis* found at Whitesand Bay; *Cucullella Anglica* from the Stiperstones, the Bryozoa *Didymograpsus geminus* and *Graptopora (Dictyonema)* sp. (? *socialis*) Whitesand Bay represent the inferior mollusca. Two species of Encrinites, the one from Shropshire, and the other from the St. David's district, complete the lists of the more common fossils.

The Llandeilo series consists of two distinct strata, which I have before proposed to call Upper and Lower Llandeilo flags, the latter having nothing to do with the "Lower Llandeilo" of Murchison, more properly distinguished by Sedgwick, as Arenig.

It is strange that the existence of two beds making up the Llandeilo flags should never have been remarked before; for there is as much difference between the subdivisions, both in fossils and mineral character, as there is between the Upper and Lower Llandovery, which it has been proposed to call even distinct groups—not that, as a rule, the mineral character of beds is much of a criterion for their classification.

I have long thought that the true Llandeilo ought properly to be subdivided into two strata, but it was not until lately that I saw these occurring together, and so was enabled to determine which was the higher, and which the lower member of the series. Near Builth, in Radnorshire, there appear the Upper Llandeilo flags in the shape of black shales and fine white sandstone, lying conformably on the Upper Llandeilo, with the associated volcanic grit and bedded trap. This is seen in the section (Sheet No. 5) published by the Geological Survey, which crosses the shales and bedded trap of the Lower Llandeilo at the Carneddau hill, and the grit, black shales, etc., representing the Upper Llandeilo near Wellfield.

The Upper subdivision is also seen at Abereiddy Bay, Pembrokeshire, in the form of dark slate, and black shale with graptolites. (The two most common species found in this shale, viz. *Didymograpsus Murchisoni* and *Diplograpsus pristis*, occur also at Builth, where they mark the bottom beds of the Upper Llandeilo, just as they do at Abereiddy. This fact may be of importance.)

The Lower subdivision, on the other hand, occurs as sandy flagstones with large beds of limestone at Llandeilo, also at Narberth, Pembrokeshire; often it contains trap and volcanic deposits (mentioned before). In a section near Llandeilo, published in "Siluria" (p. 57), the Lower Llandeilo is made to overlie what I suppose is the Bala limetone of Bird's Hill. Perhaps it is faulted against it.

Besides the one near Builth made by the Geological Survey, there is a section of the whole Llandeilo group near Llangadock published in "Siluria" (p. 58). Here the *Upper* Llandeilo, full of Graptolites, is represented by shales thrown up into an anticlinal over the *Lower*, seen as bedded trap, flags, and limestone.

The characteristic fossil of the whole Llandeilo series is undoubtedly *Ogygia Buchii*. It is, however, of a greater size and commoner in the upper subdivision; in the lower it is represented by a smaller and more convex variety, with but eleven side-ribs to the tail. This variety was recognized by Mr. Salter some time since, and the name *conveza* was proposed for it.

Asaphus tyrannus and the nearly allied *Asaphus peltastes* are found everywhere in the Lower Llandeilo, associated with the variety of *O. Buchii* just mentioned. These, with *Calymene Cambrensis* and *Trinucleus favus*, are fossils quite peculiar to this zone, not found in the upper subdivision. *Lichas patriarchus* is a new species, of which my description was published in the GEOLOGICAL MAGAZINE for April, 1866, Vol. III. p. 160. The *Ophileta* or *Helicotoma*, mentioned in the list, is from Fairfach, near Llandeilo. *Lingula granulata* is a characteristic fossil of this stratum. *Orthis calligramma* is found in the volcanic grit near Builth, and *Orthis striatula* at Llandeilo and Narberth. Associated with *Asaphus peltastes*, is a small *Ctenodonta*, not uncommon in the limestone of Dynevor Park, Llandeilo; this completes the list of the common fossils from the Lower beds.

The genus *Asaphus* is represented in the Upper Llandeilo by the *A. Corndensis*¹ of Murchison, which is common at Gilwern, near Builth. This is the only species that I know of. The large many-ribbed variety of *O. Buchii* is eminently characteristic; curiously distorted specimens of it are found in the slates of Abereiddy Bay. The genus *Barrandia*, of which there will be four described species when the next volume of the Palæontographical Society appears, is peculiar to this zone. *Calymene duplicata* is a common fossil, and everywhere accompanies the ordinary variety of *O. Buchii*. *Cheiru-*

¹ *Asaphus Corndensis* belongs to the subgenus *Ptychopyge* of Angelin, which has certainly more the appearance of an *Asaphus* than of an *Ogygia*. The form of the labrum seems too variable in the *Asaphidae* to be considered a generic distinction.—H.W.E.—(See Mr. H. Wyatt-Edgell's paper "On the Genera *Asaphus* and *Ogygia*, &c." GEOLOGICAL MAGAZINE, January, 1867, Vol. IV. p. 14.—EDIT.)

rus Sedgwickii, *Barrandia Cordai*, *Agnostus Maccoyi*, *Ampyx nudus*, and *Trinucleus fimbriatus* are found both at Builth and Abereiddy; *Trinucleus Lloydii* at Builth and Llangadoc.

Of shells, *Bellerophon bilobatus* is found both in this subdivision and the lower one. Abundant in the Caradoc, this shell lived into the Lower Llandovery period. *B. perturbatus* occurs in the slates of Abereiddy. A gasteropod, *Murchisonia simplex?*, has lately been found at Percerrig, near Builth.

From the same locality I have seen specimens of a *Lingula* very like *Lingula plumbea*, *Lingula Ramsayi* is a common fossil at Abereiddy Bay; and a species of *Modiolopsis*, called *M. inflata* by M'Coy, represents the lamelli branchiate shells.

The notes on the Llandeilo flags that I have here brought before the notice of geologists were made during a tour in South Wales. I will add that I think it more than probable that if the group be carefully examined in Shropshire and North Wales, the same distinction will be found to exist between the Upper and Lower subdivisions of it.

NOTICES OF MEMOIRS.

I. PALÆONTOLOGY OF ASIA MINOR.

ASIE MINEURE. Description physique de cette contrée, par P. de Tchihatcheff.—*Paléontologie*, par A. D'Archiac, P. Fischer, et E. De Verneuil. 8vo. Paris, 1866. Ouvrage accompagné d'un Atlas grand in 4to. 18 plates.

THE geological portion of this work, to be completed in two volumes, by M. de Tchihatcheff, was intended to have been issued at the same time with the Palæontological portion, but the latter having been completed first, it was thought desirable to publish it at once, as a delay of even a few months might have been very prejudicial to it. The Geology is expected to be published in the course of the present winter.¹

An introductory chapter on the "General Palæontological Results" is given by M. D'Archiac, who prefaces it with a historical sketch of the labours of previous investigators into the geology of this region, from the times of Strabo, Aristotle, and Theophrastes, until when, towards 1835, it was first scientifically explored by Messrs. Hamilton and Strickland, Spratt, Edward Forbes, Ainsworth, and Ch. Texier.

Devonian, Cretaceous, and Lower and Upper Tertiary formations occupy the greatest geographical area; Jurassic and Carboniferous strata have only been observed in a few and very restricted localities, while rocks of Silurian, Permian, and Triassic age have not at present been determined. Quaternary deposits are spread over the country in many places.

DEVONIAN.—Beds characterized by fossils, mostly belonging to the Lower Devonian of Western Europe, are found in the North;

¹ Since writing the above the first volume of the "Geology" has been published; we shall notice it in a future number of the GEOLOGICAL MAGAZINE, after the issue of the second volume.