Chapter VII.

CHAPTER VII.

OLD RED SANDSTONE.

Classification of Old Red Strata — Deposition of — Outliers of Old Red — Fossil Fishes of the Old Red—Leominster—Hereford, Historic Records of —The White Cross—Cornstones of Ewyas Harold—Rowlestone Beds— Fossils of—Abbey Dore—John of Kent—Abergavenny Castle—Scyrrid Fawr — Lord Cobham — Llanthony Abbey—Foundation of — Gadir — Brownstones of the—Onchus Major, from Cornstones of Cusop—Hay— Isle of Skomer, Birds of the—Brecon—Church of St. Almedha—Brecknockshire Beacons — Llynsavaddon — Old Red Conglomerates — Daren Sandstones — Farlow Sandstones — Pterichthys — Ross — Sections near Tenby—Manorbeer Castle—Organic Remains of Old Red Sandstone.

Upper Old Red Sandstone.	The Upper beds are Red Beds interstratified with yellowish grey sandstones, and below are Old Red conglomerates and red marls.	*Fish.*	Pterichthys. Holoptychius.
		Mollusca.	Conularia at the Clee Hills.
			Land plants.
Brownstone Series.	Red marls overlying chocolate-coloured sandstones, passing downwards into reddish and grey sandstones and marls, with thin cornstones.	No fossils known in these strata, but fragments of Pteraspis and Cephalaspis.	
Cornstone Series and Lower Old Red, with interbedded Sandstones.	The Upper beds, where not denuded, are grey and greenish sandstones, with remains of plants, as at Rowlstone, near Abergavenny, and Cusop, near Hay. Below are impure limestone concretions, named cornstones, interstratified with reddish and grey sandstones, red marls, &c.	*Crustacea.*	Stylonurus. Pterygotus. Præarcturus.
		Plants.	Probably Fucoids.
		Fish.	Cephalaspis. Didymaspis. Zenaspis. Scaphaspis. Pteraspis. Cyathaspis. Onchus.

It will be understood from what has been already stated, that there is no visible break between the Upper Silurian rocks and the overlying Passage beds. As observed in the Ledbury tunnel and other localities, there is no unconformability; but the rocks of the Silurians pass into those of the

SILURIAN ROCKS OF MARLOES BAY, DIPPING UNDER THE OLD RED SANDSTONE OF HOOK POINT, PEMBROKESHIRE.

Ledbury shales by an easy transition, only marked by a decided change in colour. The red marls that commence with the Passage beds and overlie all the Ludlow rocks cannot be mistaken by the most unpractised eye.

Sir Charles Lyell, in his last edition of the "Elements of Geology," has placed the Ledbury shales or Passage rocks at the base of the Old Red group. I have not followed this grouping, because, above the Ledbury shales, whether at Ledbury, Cradley, Ludlow, or Kington, there appears to be a decided break and unconformability in the strata, along which fault the river Leddon at Ledbury, the Teme at Ludlow, and the Arrow at Kington take their flow. Again, in the Ledbury shales (Passage beds), Silurian fossils undoubtedly occur, intermingled with forms of fishes closely allied to those found in the Lower Old Red. But no geologist has yet detected a single *species* which ascends from the Ledbury shales into the

Old Red rocks above the break alluded to. This appears to indicate a decided unconformability at the base of the Ledbury shales, and, if this be the case, it would be better to place the base of the Old Red proper above the break, than in the middle of a series of strata which are absolutely conformable, and where fossils intermingle.

The Old Red Sandstone received this name originally, because in Herefordshire and in Scotland these strata are covered up by the Carboniferous groups ; whereas the New Red Sandstone was deposited above the Carboniferous rocks. The term Devonian was afterwards applied by Murchison and Sedgwick to the whole series of Old Red strata, but this term nevertheless is more generally applied to the foreign representatives of the Old Red group, and the ancient nomenclature Old Red is not likely to be changed to Devonian as regards the rocks of Herefordshire and Monmouthshire, or the far-famed Scotch strata of Hugh Miller.

Objections have been raised against erecting an "Old Red System" or a "Devonian age," as a distinct geological formation, and certain geologists have proposed to link this series of rocks to the Silurian group ; while others propose that they should be considered as belonging to the Lower Carboniferous rocks. There can be little doubt however that these strata mark a new epoch in the progress and development of animal life, and thus stand apart as a system of geological history from the Silurian groups ; while in the total absence of many of the fossil remains typical of the Carboniferous rocks, it seems advisable to draw a line of division between this epoch on the one hand and the Silurian epoch on the other.

The change from the grey rocks of the Silurian strata to the red marls and grey and red sandstones of the overlying deposits, is hardly more striking than is the disappearance of the numerous fossils which are so characteristic of the Silurian epoch. The change is probably owing to oscillations of the land, changes of the sea-level, the flow of currents, and the deposition of strata, all of which would affect and often exterminate the inhabitants of the seas. The period of the Bone

bed and Upper Ludlow shales appears to have been one of shallow water and litoral conditions, judging from the number of crustaceans found imbedded therein with remains also of land plants. The Old Red rocks would seem to have been deposited on a sinking area and under conditions not favourable to the growth of corals and the life of marine mollusca.

It has been advocated by Mr. Godwin Austen, and since by Prof. Ramsay, that the Old Red of Scotland and Siluria may have been deposited in great freshwater lakes, but it is difficult to correlate this theory with the occurrence of Old Red fish, such as Coccosteus, in the rocks of Germany, and great numbers of Pteraspis in Devonshire, where they are associated with true Devonian marine shells ; or with the presence of crustaceans in the Cornstones of Herefordshire, as these crustaceans are probably marine, and species occur in Silurian strata associated with Lingula, and other marine

CRUSTACEAN FROM THE OLD RED OF HEREFORDSHIRE.

Stylonurus Symondsii (Eurypterus, Salter, Quart. Journ. Geol. Soc. vol. xv. pl. 10, fig. 1); from Rowlestone, south of the Hay, Brecknockshire. The cephalic shield of a Crustacean allied to Pterygotus. For figures of this and other species of Stylonurus, see Mr. H. Woodward's paper in the Quart. Journ. Geol. Soc. vol. xxi. p. 482.

shells. Should it be established that the Stylonurus is of marine, and not of fresh-water origin, we must regard the fresh-water theory of the Old Red of Herefordshire as untenable, for although we find fresh-water shells and fishes drifted into marine depositions by the agency of rivers, it would be difficult to account for any agency through which marine lobsters should be transported into a fresh-water lake.

LOWER OLD RED SANDSTONE.

In North Wales the Old Red Sandstone is but very slightly developed. When it occurs it appears to belong to the upper series of these strata, as the beds directly underlie the Carboniferous limestone. In Anglesea the Old Red appears between the mountain limestone of Lligwy and Moelfre, and the volcanic rock of Parys Mountain, and also in Dulas Bay, from whence it may be traced in a south-eastern direction to Llangefni, in the vale of Cefni. Near the small town of Abergele is a thick bed of Old Red Conglomerate, made up of fragments of Silurian and Igneous rocks; it rests unconformably upon Wenlock rocks, near Abergele, but it is conformable to the overlying mountain limestone. It strikes southwards, by Ruthin, with the limestone, and appears to the north by Llangollen. The fields lying between the Eglwsey rocks and the hills bounding the Valle Crucis, or Valley of the Cross, are red, with its detritus. At Llanymynech, south of Oswestry, the conglomerate rests upon fossiliferous Bala beds.

In studying the Old Red Sandstone of Siluria, the geologist should examine the grand exhibition of strata, commencing with the Lower series of beds as seen succeeding the Silurian rocks, then follow up the middle group of beds as developed in the hills of central Herefordshire and Monmouthshire; and finally pursue the investigation of the Upper rocks in the lofty hills of the Black Mountains, and in the Vans of Brecon and Carmarthen, which rise in the Brecon Mountains to the height of 2860 feet above the sea.

The most northern district of Siluria where we know of the existence of the Lower Old Red in situ, is in the Forest of Hayes, in the Long Mountain, where a considerable outlier of Old Red deposits rests on Upper Ludlow strata with the typical fossils. This detached outlier, with its remains of Pteraspis and Scaphaspis, is especially interesting to the physical geologist, so completely does it exhibit how the masses that once connected it with the main formation have been removed by denudation; and it is here evident that the Lower Old Red of the Long

Mountain district is a remnant of a large area of the same strata which was formerly continuous with that of the Ludlow country and Clun Forest, before the Silurian rocks had been upheaved and dislocated.

Clun Forest, on the borders of Shropshire, between Montgomery and Knighton, is another great mass of detached Lower Old Red, which overlies the Upper Silurians, and occupies a district of nearly one hundred square miles. There are red beds near Felindre, which contain the characteristic fossils of the Passage beds, and these are again overlaid above Newcastle, and near Beltws, by Lower Old Red sandstones and marls, with plates of the characteristic fishes. This country also offers a study for the physical geologist who enters into the study of *outliers*, and the evidences of elevation and denudation, for around the town of Knighton are four outliers of Lower Old Red, separated by Silurian hill masses. Thus we have the Clun outlier, and that of Beltws-y-Cryn, with two smaller patches west of the Teme, and the outlier north of Knighton. Near Presteign we find a large mass of Lower Old Red running northwards, west of Brampton Bryan. These strata, like those of Clun Forest, are elevated with the Silurian hills. South of Presteign another small patch of great interest indicates the former continuity of the Lower Old Red over this country. It is called Lower Radnor Wood, and lies west of the upcast of Woolhope limestone by the Stanner trap, within a mile of Presteign. It is impossible to examine all these isolated patches of a great formation without feeling positive that the strata were once continuous with those of Clun Forest, and again of the Hayes Forest on the Long Mountain.

We have already alluded to the beautiful scenery and interesting geology of the neighbourhood of Old Radnor, and we would now direct attention to the singular remnants of Lower Old Red, which in this district lie caught up among Silurian and Trap rocks. One patch runs from Weighthall, south of Old Radnor, for three or four miles, and another occurs at Llanhowel, in the parish of Gladestry. Again, nowhere in this neighbourhood are the relations of the Upper Ludlow shales

with the Passage beds better shown than about Pain's Castle, beyond Glasbury; but the difficulty here, as elsewhere, is to shew a conformable passage upwards into the Old Red proper above the Passage rocks, which in this country are of considerable thickness.

If a geologist in search of rock sections and fossils, and who disdains not antiquarian and legendary lore, arrives perchance at the little village of Glascwm, in this border land, let him turn into the church, where in the days of Giraldus there was "a portable bell, endowed with great virtues, called Banyn, and said to belong to St. David. A certain woman secretly conveyed this bell to her husband (who was confined in the Castle of Raidergwy, near Warthrenion, which Rhys, son of Gruffydh, had lately built) for the purpose of his deliverance. The keepers of the castle not only refused to liberate him for this consideration, but seized and detained the bell, and in the same night, by divine vengeance, the whole town, except the wall in which the bell hung, was consumed by fire."

In the Wenlock country the Lower Old Red beds fringe the Upper Ludlow rocks, and run southwards by Holgate, down Corvedale to Ludlow. It was at Whitbach, about three miles north-east of Ludlow, that Dr. Lloyd first discovered the shield of a ganoid fish, which is still in the Ludlow Museum, and bears the name of Scaphaspis Lloydii. The strata are flagstones, and are overlaid by a band of thin Cornstones with scales of the Pteraspis, similar to those obtained by Mr. Ray Lankester at Cradley. I have frequently examined the Whitbach quarries, and I believe that they lie at the base of the Old Red proper in the Ludlow country. They yielded a specimen of a nearly perfect Cephalaspis Lyellii, to the hammer of Mr. Marston of Ludlow; and here, and at Bouldon, the searcher for fossils may also obtain the Cephalaspidean fish, Zenaspis Salweyi, with Scaphaspis Lloydii, and the long-snouted Pteraspis Cronchii, as well as fish tracks, and egg packets of Pterygotus. The Zenaspis Salweyi is allowed to be a well defined species by Messrs. Ray Lankester and Powrie. It was first discovered in the Old Red Cornstones at Hinston, and Acton Beauchamp,

near Bromyard, by my friend Mr. Humphrey Salwey of Ludlow, who has also detected it in Corvedale.

In his great work, "Recherches sur les Poissons Fossiles," (1835) Prof. Agassiz established the genus Cephalaspis to include four divisions of Devonian fishes, namely—C. Lyellii, C. rostratus, C. Lloydii, C. Lewisii.

Sir P. Egerton * described several new species related to C. Lyellii, viz.—C. Murchisonii, C. Salweyi, C. ornatus, and a new genus, Auchenaspis, which had a distinct neck-plate. Pteraspis, supposed by Dr. Kner to be the internal shell of a Cephalopod allied to Sepia, was shown by Prof. Huxley to be a fish.† He says "No one can, I think, hesitate in placing Pteraspis among fishes. So far from its structure having no parallel among fishes, it has absolutely no parallel in any other division of the animal kingdom. I have never seen any Molluscan or Crustacean structure with which it could for one moment be confounded." Pteraspis is closely allied to Cephalaspis in its structure, and Prof. Huxley believes that all the Cephalaspidean fishes are related to the existing Callichthys and Loricaria (Siluroid fishes) on one hand, and Scapirhynchus and Spatularia (Chrondrostean Ganoids) on the other.

Mr. Ray Lankester, in his monograph ‡ "On the Fishes of the Old Red Sandstone of Great Britain," divides the Cephalaspidæ into two sections, Heterostraci and Osteostraci. The reasons upon which the division is based, are derived from the structure of the Cephalic shields; the terms meaning that the Heterostraci possess a shell or dermal plate of a structure differing (ἕτερος = of another kind, and ὄστρακον = a shell, or dermal bone) from that of the Osteostraci (ὀστεον = a bone) which possess true bony structure in their plates or shields, as Cephalaspis Lyellii; the division may be as follows:—

Heterostracon Cephalaspidæ.....	Scaphaspis, Cyathaspis, Pteraspis.	Osteostracon Cephalaspidæ ...	Cephalaspis, Auchenaspis, Didymaspis.

* Quart. Journ. Geol. Soc., 1857.
† Memoirs of the Geol. Survey of Great Britain, Dec. 10, p. 38.
‡ Palæontogr. Soc. vol. xxi.

In the same monograph Mr. Ray Lankester considers it necessary to divide the Pteraspidean fishes into the genera Scaphaspis, Cyathaspis, and Pteraspis; and the genus Scaphaspis includes the species Lloydii and truncatus, &c., with a simple ovate shield. Mr. Lankester mentions an interesting fact with regard to the original type specimen of the genus Pteraspis of Dr. Kner, which he saw at Vienna in 1870. "A form like Pteraspis rostratus (C. rostratus of Sil. System) is present in one of the blocks; and in the block with Kner's figured specimen there are marine shells. An Orthoceras is lying almost against the fish shield, which is very perfect, and there are two Lamellibranchs in close proximity. We must not therefore conclude from the Cornstones and Scotch beds that the Cephalaspidæ were exclusively lacustrine or fluviatile.' * Kner's original specimen is exceedingly like Scaphaspis Lloydii.

Pteraspis, Cyathaspis and Scaphaspis are distinguished by the following characteristics :—

		Species.
Pteraspis	Shield composed of seven anchylosed but *distinct* pieces or plates, with a posterior spine.	Pteraspis rostratus, Pt. Crouchii, Salter MS.
Cyathaspis	Shield composed of four distinct pieces, spine reduced to a mere point.	Cy. Banksii, Huxley, and Salter. Cy. Symondsii, Lankester.
Scaphaspis	No distinct species recognisable in the large oval head-plate; spine represented by the acute termination of the disc.	Scaphaspis Lewisii, Ag. (Cephalaspis Lewisii, Sil. Syst.) Sc. Lloydii, Ag. Sc. Ludensis, Salter.

The genus Cephalaspis is divided by Mr. Lankester into three subgenera, Eucephalaspis, Hemicyclaspis, and Zenaspis.

Cephalaspidean fishes occur in Lower Ludlow beds—in Upper Ludlow Bone bed and shales—Downton rocks—Passage Red rocks at Ledbury and Ludlow—Lower Old Red and Middle Old Red of Breconshire. They have been found in

* Geol. Mag., vol. vii. p. 399. 1870.

Scotland, in Siluria, and Devonshire, in America, in Russia, in Galicia, and in the Eifel, in rocks intermediate between the Upper Silurians (inclusive) and the Lower Carboniferous.

In traversing the section from Whitbach to Hayton Sutton and Bouldon, we pass over successive beds of rocks; the Devil's Mouth, at the top of Hayton, yielding the plates of Scaphaspis and Pteraspis in considerable abundance. At Hopton Gate, two miles east of Hayton, that large form of Cephalaspis, Zenaspis Salweyi, was found by Mr. Harley. Mr. Harley thus describes the beautiful structure of the inner plate of the head of this fish. "It presents lacunæ and long branching caniculi precisely resembling those of human bone. Many of these are completely injected with a transparent blood-red material; and so beautifully are they thus displayed, that one ignorant of the structure of bone would be able to apprehend it by a glance at a minute part of this ancient fragment. So wonderfully indeed has Nature treasured up her secrets in this disentombed relic of a time so distant as to be incalculable, that she distinctly reveals in their minutest details the structure of canals not more than the one fifty thousandth of an inch in diameter, and such as to defy the skill of the anatomist to inject."

I do not consider the Clee Hill district near Ludlow at all a good neighbourhood for studying the physical relations of the Upper beds of the Lower Old Red, or those of the overlying Brownstones. In this country there is a great deal of faulting caused by the elevation of the Trap rocks through the Old Red and the Coal Measures, and this faulting throws down and dislocates the strata and obscures their physical positions. The Upper beds of the *Lower Old Red* are quarried above Bitterly Court, on the western side of the Titterstone Clee, and at Abdon and Ditton below the Brown Clee. I have never seen any fossils from these localities.

Near Tenbury, bold hills of the Middle beds of the Lower Old Red rise around the picturesque country of Stamford and Shelsley Wallsall. In Sir Thomas Winnington's grounds a large rock of travertine, called the "South stone rock,"

owes its origin to the percolation of water through Old Red Cornstone. The chancel of the church at Quatford, near Bridgenorth, appears to have been built of this travertine.

Leominster, in Herefordshire, is a place well adapted for pursuing investigations of the Lower Old Red. Leland describes the site of the town as "sumwhat lowe, and all the ground very neere about it is farre lower." These low lands are situated on those Lower marls and cornstones which are characterized by abundance of the remains of Cephalaspis Lyellii, and Scaphaspis Lloydii; the hills which rise from the plain consist of higher beds of sandstone and cornstone. The quarries at Leysters Pole, about four miles north-east of Leominster, and around Puddlestone contain many of the enamelled plates of Scaphaspis Lloydii, and P. rostratus, which, when first struck out from the rock glisten with purple and blue, the effect of phosphate of iron.

Ivington Camp, like all the hills in the immediate neighbourhood of Leominster, consists of cornstones, marls, and sandstones which overlie the Pteraspis-bearing beds of Puddlestone and Leysters Pole. Such are also the hills of Weobly, Dinedor, Moccas, and Tibberton, which stand out as rounded wooded hills on escarpments, and dip under the Upper Old Red strata of the Black Mountains. The fish remains in the Cornstones are very fragmentary.

Dinmore Hill between Hereford and Leominster is a good example of the succession of beds of the Lower Red epoch, capped by strata that pass into those which, for the sake of definition, we call the Middle Old Red. Fish plates were found in the tunnel when it was being excavated, but I saw nothing new or worthy of remark. The geologist will not fail to observe the great expanse of the Lugg meadows, the rich pastures whereof are the effect of the silting of the existing river during a comparatively late geological period. A circumstance of considerable interest happened in this district not many months ago. My friend Mr. Curley, who was engaged in draining the Dinmore country, obtained from the silts of the Lugg very fine specimens of the horns of the Red

Deer and of the head of Bos primigenius. They were both disinterred at some distance from the bed of the present stream. He also obtained from the workmen a worn tooth of Rhinoceros tichorhinus, which he imagined came from the same site as the remains of the Deer and the Bos; but on our thoroughly investigating the localities together we were convinced that the Rhinoceros tooth came from the low level drifts and gravels on the Marden side of the Lugg, and not from the silts and alluvium of the existing river. Leland speaks of the view from Dinmore Hill "as a specula to see all the country about."

The neighbourhood of Leominster abounds with subjects of interest to the antiquarian. The church is remarkable on account of its relics of Norman architecture. Leland says that, as he saw it, "Yt is a grate likelihood that yt is the church that was afore the Conquest." It was much injured in the fire of 1700.

From the particulars recorded in the Doomesday book Leominster had become a place of considerable importance at the period of the Doomesday Survey. The town is spelt Leofminstre in Doomesday book. According to Leland "The antiquity of the towne is most famous by a Monastery of Nunnes that Merwaldus, Kinge of the Marches, built there." "Some say that the Nunnery was after in the Danes wars destroyed, and the certainty is known that the Abbey of Shaftesbury had rule at Lemster, and possessed much landes there, and sent part of the reliques of St. Edward the Martyr to be adored there."

Henry I. "annexed the laws of Lemster to his Abbey of Reading," and in the time of Henry II. we find Giraldus Cambrensis and the preachers of the Crusades passing through Leominster on their road to Hereford. Giraldus mentions this town under its ancient name of "Leonis Monasterium." But Camden says the British name was "Llan Lieni," signifying a church of nuns.

In the reign of King John, William de Breose, Lord of Brecknock, seized Weobly Castle, and marching on Leominster

burnt and plundered the town, together with the Priory and Church.

In the reign of Henry IV., Owen Glyndwr defeated the "Revolted Mortimer," on the banks of the river Arrow, (the "sweet Severn" of Shakespeare, being a mistake of the Poet) and confined him in a dungeon at Leominster. Ivington Camp is supposed to be the camp occupied by the Welsh chieftain after the battle of Shrewsbury, and from whence his army finally dispersed and fled. Many coins of the dates 1340 and 1390 were formerly found on the site of his camp.*

Hereford is *par excellence* the city of the Old Red, and few are the localities in Great Britain where the geologist, naturalist, and antiquarian can meet with more of interest than lies around this old city. Our notes upon the antiquities of Hereford are far too long to quote *in extenso* here; it must suffice to say that the precise era of its foundation is not known, and that wise men disagree as to the origin of its name. The most probable derivation is that given by Mr. Gough, in his "Additions to Camden's Britannia," viz., that the Britons called it Hên-fordd, or the Old Way, and from these words he believes the Saxons to have formed its present name, which in their language signifies the Ford of the Army.† It is probable that Hereford was founded soon after the decay of Magna Castra, or Kenchester, the Roman station a few miles to the westward. In Saxon times it became the capital of the Mercian kingdom, and possessed a church, which, according to Polydore Virgil, was very fine. "Templum quod Herefordiæ id temporis magnificum erat." This early church is supposed to have been constructed of wood, as Polydore Virgil records that the edifice, which was erected on the site of the present cathedral by King Offa, in expiation of the murder of Ethelbert, King of the East Angles, was built of stone, "lapidea structura:" apparently, observes Mr. Duncumb, "as a marked distinction from that which preceded it."

* See Price's Leominster, p. 25, and note.

† Additions to Camden's Britannia, vol. ii., p. 451.

Athelstan was at Hereford in the year 939, and made a treaty with the Cambrian chief and extorted an annual tribute.

During the reign of Edward the Confessor, about 1055, an army, under Gryffyth, King of Wales, and Algar, Earl of Chester, who married his daughter, ransacked Hereford, pillaged the cathedral, and killed Bishop Leofgar. According to Powell's "Chronicles of Wales," "the Britons returned home with manie worthie prisoners, great triumph, and rich spoiles, leaving nothing in the town but blood and ashes, and the walls razed to the ground." Edward the Confessor, who much preferred fasting to fighting, sent Harold (afterwards King Harold) to avenge the slaughter of his subjects at Hereford. Harold rebuilt, and probably laid the foundation of, the Castle, which was afterwards completed by the Normans, and he reduced the Welsh to such a state of submission that they put their King Gryffyth to death, and sent his head as a peace-offering to Harold.

After the Conquest King William held Hereford in his own demesne; and in 1141 it is recorded that Stephen attended divine service in the Cathedral on Whitsunday.

Henry III. and his gallant son Prince Edward were taken as prisoners to Hereford by Simon de Montfort, Earl of Leicester, and it was from Wide Marsh Common that the Prince, mounted on a swift horse, escaped to Dinmore Hill, and from thence to Wigmore Castle. During the Parliamentary wars Hereford held out so well for the King, under the gallant Barnabas Scudamore, that after the Restoration the city received a new charter, with the motto "Invictæ Fidelitatis Premium."

The antiquary should remember that Sutton Walls, east of Hereford, is the site of the Palace of Offa, King of the Mercians, and here Ethelbert was murdered by Quendreda, Offa's wife, while courting her daughter. According to all accounts the body of Ethelbert was first buried where the little church of Marden now stands, but was afterwards removed to Hereford. In his "Life of St. Ethelbert," Giraldus Cambrensis

mentions Sutton Walls under the name of "King's Sutton," and he also notices the ruins of a castle there. Leland speaks of the "notable ruines of some ancyent and great building sumtyme the mansion of King Offa, at such time as Kentchester stood, or els Hereford was a begynning." Camden says that Hereford owes "its greatest increase and growth to religion and the martyrdom of Ethelbert."

The walk from Hereford to Sutton Walls is interesting to the geologist who has learnt that the surrounding hills of Old Red Sandstone consist of the Cornstone series to their summit, the Brownstones being denuded. The railway excavations on the line towards Shrewsbury, are in Lower Old Red Sandstones, and are interstratified with Cornstones containing Pteraspis. Cephalaspis Lyelli has been found in these strata, and I have seen the plates of Pteraspis in stones lying around Sutton Walls and Marden.

Dynedor Hill, S.W. of Hereford, consists of the Cornstone strata, but the sections are not satisfactory. The camp on the summit of the hill is said to have been occupied by the Romans under Ostorius Scapula, although the principal reason for investing it with such dignity appears to have arisen from the fact that it was once called "Oyster Hill." *

There is good field work for the geologist to the westward of Hereford, while some old history is attached to every village tower, or hill summit. The White Cross, that old relic of generations long since dead, on the steps of which many a pilgrim has rested in the days of yore, stands at the cross-roads leading to Weobley and Hay, only a mile from the old city itself. Tradition ascribes its erection to Bishop Cantilupe (1282) who, in commemoration of a miraculous ringing of bells at the cathedral, which he heard when journeying thither from his palace at Sugwas, built the cross on the spot where he first heard the bells. Dr. Duncombe, however, affirms that it was erected in 1348 by Dr. Charlton, afterwards Bishop of Hereford, on the site where the weekly markets were held, during the visitation of a plague, known as "the black dethe."

* Gibson's Camden, p. 579.

A pleasant walk from the White Cross will soon place the rambler on Credenhill, a fine bold eminence of Cornstone. Of late years much stone has been raised there for railway and other purposes, but the only fossils are remnants of fish plates, and a few fragments of plants. On the summit of this hill are the remnants of a large Camp, supposed to have been the summer station of a Roman army, when the city of Magna (Kenchester) flourished within two miles of its base. "Kenchester," says Leland, "is far more ancient than Hereford, and was celebrated in the Roman's time as apperith by many things, and especially by antique money of the Cæsars. By likelihood men of old time went from Kenchester to Hay, and so to Breknock and Carrmardin. The place where the towne was is all overgrown with brambles, hazels, and like shrubs." Here, in 1669, a tesselated pavement was discovered, and we learn from Aubrey's Manuscripts that in 1670 buildings of Roman brick were found, on which grew oak trees. A hypocaust was also discovered about the same time. The then Dean of Hereford, the Very Rev. John Mereweather, opened up many vestiges of this ancient Roman city.

Weobly is a quaint old town with curious timbered houses, and possessing one of the most remarkable church towers in the county of Herefordshire. From the days of Edward I. up to the time of the Reform Bill, it returned two members to Parliament. It is a good locality for examining the phenomena which is presented by the hard Cornstone and sandstone hills resisting the effects of denudation by former seas. The lowest beds at Weobly are Cornstones, with Cephalaspis, succeeded by thick sandstones, which are again followed by Cornstones and sandstones.

Robin Hood's Butts, Lady Lift, near Foxley, and Wormsley Hill are all worth a visit. The strata, of which these adjacent hills consist, were certainly once continuous; and, without doubt, they were also once continuous with strata which now underlie the Upper beds of the Blorenge, the Scyrrid, and the Black Mountains, distant as these hills now appear, when seen from the summit of Lady Lift or Credenhill. The Upper beds, with

vegetable remains, above Mr. Peploe's park, are probably the equivalents of those on the top of Rowlestone near Pontrilas, and also of those above Cusop, near Hay, which contain Stylonurus and remains of plants.

Large quarries have been worked in the Lower Old Red at Lugwardine, south of Hereford, where fragments of fish may be found, but the sandstones rarely yield any but broken and triturated remains. The section is worth examining, as Drift occurs on the hill at Hagley; and a mile and a half further S.W. the Upper Silurians and Passage beds are elevated in a dome. Near Lugwardine is the Trap dyke which alters the Old Red at the little hamlet of Bartestree. Sir R. Murchison describes this trap as "a highly crystalline greenstone, made up of hornblende and felspar." The rocks into which the ancient lava is infiltrated by a fissure, belong to the lowest division of the system.

In the neighbourhood of Malvern the best Old Red section occurs at the northern extremity of the parish of Cradley. Here, as at Ledbury, there is a fault intervening along the line of the Cradley brook, between the Bone bed and the Passage beds of Hales-end, and the Old Red of the hill on the north. On ascending the hill from Stifford's Bridge to the great quarry on the summit, we see Cornstones and Marls cropping out on the flanks, and the western flank when quarried for road stone, yielded relics of Pteraspis rostratus, Scaphaspis Lloydii, and C. Lyellii. These sandstone strata represent, in my opinion, the summit of the Lower Cornstones of the Abergavenny districts. The Cradley sandstones have been largely employed at Malvern for building purposes, and that fine edifice, the College, is principally erected of these Old Red strata. The only fossils I ever saw in these Upper beds at Cradley, were a few remains of plants, but they were too triturated to make anything of the structure. And this is the case generally throughout the Old Red district. The fossil fish, plants, and crustacea are found only in limited zones, the sandstones as a rule, being destitute of anything but an occasional cast of a spine. Mr. Gill of Cradley, paid a good deal

of attention to the fossils in his district, and most of the specimens in the museums at Worcester and at Malvern, both at Dr. Grindrod's and the College, were of his collecting. These specimens were principally found in some small quarries opened for road metal near an old timbered house about a mile from the great quarry on the hill. They were unusually fossiliferous, and from them, Mr. Ray Lankester obtained the tail of a Pteraspis with the scales attached. In the Acton Beauchamp district, a little to the west, there are quarries, which afford Zenaspis Salweyii. Old Red Cornstones are exposed at Heitington, near Bewdley, and contain the plates of the same species of fish.

Near Ledbury the Lower Old Red is best seen between the Bush Pitch, where there is a railway cutting, and the summit of the Wall Hills. At the Bush Pitch, at the base of the hill, some fish spines and scales of Pteraspis were found by Henry Brooks of Ledbury. On the south side of the hill, is a large unworked quarry in thick bedded Cornstone, capped by reddish Sandstone, which yields here and there fragments of a fish which I believe to be Zenaspis Salweyii. The adjacent hills around Canon Frome and Bosbury consist of Sandstones and Cornstones, containing plates of Pteraspis and Cephalaspis.

I would now transport the reader to the picturesque districts of Pontrilas, Kentchurch, and Rowlestone, on the borders of Herefordshire and Monmouthshire, for the study of some of the Upper beds of the Lower Old Red. Close to the railway station at Pontrilas is a quarry of sandstone which affords a fair section; and some years ago the plate of a Cephalaspis was still adhering to a stone in the tunnel. From these railway beds I and my friend, the Rev. William Thackwell, obtained Parka decipiens, and remains of plants, with here and there portions of the plates of Scaphaspis or Pteraspis. Above these strata are the Cornstones of the High Common of Ewyas Harold; and it is this hard Cornstone which arrested the denudation which has been so rife in this district, and which occupies the plateaux of many hills in this part of Herefordshire and Monmouthshire These Ewyas Cornstones are not on the same zone as those

on the *upper flanks* of the Black Mountains, though both yield fish remains, which however are far more sparse in the upper zone. I saw portions of the plates of Pteraspis and a fish spine last year, in the Upper Cornstones when descending from the Black Mountain to Hay. Besides occurring in the railway beds at Pontrilas, Parka decipiens, (or the egg packets of Pterygotus) has been found on the common of Ewyas Harold; in the beds which cap the hill at Rowlestone; and also at Cusop, near Hay. This fossil marks no particular zone in the Old Red, as it is found in the very basement strata that abut on the Passage rocks. The castle of Ewyas Harold stood on Cornstones which form a concretionary limestone, such as, in former days, was burnt for lime in many parts of Herefordshire. In these beds fish remains occur, usually of a fragmentary character. A fine specimen of C. Lyellii was found some years ago on the Common; and in the quarry at the summit of the Common, Dr. M'Cullough obtained a new Pterygotus; Pterygotus taurinus (Salter).

Proceeding from Ewyas Harold up the opposite hill to Rowlestone, thick marly and sandy beds cap the summit of the hill, and were formerly quarried near the church. These Rowlestone strata are, in my opinion, the equivalents of the building stones of Cradley which overlie the fish-bearing strata on the Bromyard road, and also the equivalents of a similar series of deposits which, at Cusop, near the town of Hay, in Breconshire, overlie the Lower Cornstones, and underlie an Upper Cornstone series which are associated with the Brownstones of the Black Mountains. The Rowlestone beds have yielded the fossil crustacean, the "Stylonurus Symondsii" of "Siluria," which has not hitherto been found elsewhere; a Cephalaspis; and the remains of a giant Isopod, Prærcturus Gigas (Woodward), discovered by Dr. M'Cullough of Abergavenny, and figured in the "Transtacions of the Woolhope Club," by Dr. Bull. The geologist who has traced the Lower Old Red from Kilpeck, Whitfield, and Pontrilas upwards through the hills of Rowlestone, Kentchurch, Grosmont, and the Graig, will comprehend the geology of the district and the

succession of a series of strata, which are nowhere better developed than in this picturesque border-land; but walking up to a quarry, and finding a plate or two of a fish, should not satisfy the physical geologist with respect to the horizon of the strata he is examining.

In exploring this district many interesting historic remains claim the attention of the antiquary. Near Pontrilas is Kilpeck church, with its Norman apse, standing close by the ancient castle of the family of Kilpeck, who lived there in the days of Edward I.; but the castle was in ruins when Leland wrote. To the west, on the banks of the river from which it takes its name, stands Abbey Dore, founded in the reign of Henry I. by Robert, Lord of Ewyas, for Cistercian monks. The church was completed during the reign of Henry III., after a hortatory letter by Peter de Aqua Blanca, Bishop of Hereford. The tomb of this Bishop is one of the most remarkable in the Cathedral of Hereford. Several of the abbots were eminent men. One, named Cadugan, was Bishop of Bangor in the time of King John; and in 1236 he gave up his bishopric to become a monk of Dore Abbey. Another was Richard Stradel, celebrated for his religious treatises; while a third was one of the special ministers appointed by Edward III. to treat with the King of France. The remains of the church, with its remarkable chancel, stone altar, and massive tower, tell of its former magnificence.

A mile to the east of Pontrilas is Kentchurch Court, called by Leland "Penchirche, the seat of the eldest House of the Escuedamours." The renowned chieftain Owen Glyndwr is said to have died here in obscurity, and is believed to have been buried at Monnington-on-the-Wye. At Kentchurch lived also John of Kent, a mathematician and poet. The tradition is that he sold his soul to the devil, and constructed the bridge over the Munnow in a single night. A mile beyond Kentchurch are the ancient church and ruined castle of Grosmont. The church is of Transition Norman architecture, with a remarkable octagonal tower. The castle was formerly the residence of the dukes of Lancaster, and was

the scene of many a conflict. Lambardi quaintly says of one of the sieges which it stood in the reign of Henry III., "The King coming with a great army to raise the siege, whereof as sone as the Welshmen had understanding they saved their lives by their legges." Here, also, Henry of Monmouth defeated the Welsh in a great battle in 1405, and took prisoner Griffith, the son of Owen Glyndwr.

Three miles lower down the river are the ancient ruins of Skenfrith Castle. Its area forms a trapezium, and it is believed to be the most ancient fortress in Monmouthshire. Leland speaks of it as being nearly perfect in his time; but a survey, made during the reign of James I., describes it as "ruinous and decayed—time out the memory of man." At the period of the Norman invasion, Skenfrith was the residence of a Welsh prince—Bach, son of Gwaithvoed, Prince of Cardigan; but shortly afterwards it became a Norman stronghold, like Grosmont and Longtown. At Rowlestone the little church should not be neglected, for there is a wonderful chancel arch, and beneath the carved canopy is a strange old effigy of a lady holding her heart in her hand.

The derivation of the name of Ewyas Harold is a mooted point among archæologists and antiquaries. The Rev. W. Fowle believes that it is derived from "Ea," Saxon for water; but only a very small stream runs near. Mr. Flavell Edmunds of Hereford, a learned student on the origin and derivation of names, considers that Ewyas comes from the British "Yw, ys," the place of yews; and these trees flourish here still in abundance. The lord of the castle bore, without doubt, the name of Harold; but who he was is a subject of dispute. Mr. Freeman, author of the "History of the Norman Conquest," believes that he was the natural son of one "Drogo Fitz Pontz." Leland says, "The fame is that the castle of Map Hærald was builded of Harold afore he was Kynge, and when he overcame the Walsche men." He describes the extent of the domain as "a myle in breadth where it is narrowest, and most in length two myles. It hath good corn and grasse and woode."* After

* Itin., vol. vii., p. 83.

the death of Harold, the Conqueror appears to have given it to Alured de Marleborough, who possessed it at the time of the Doomsday survey. Leland, when speaking of the inhabitants of Talgarth and Ewyas, says, "The natives of these parts, actuated by continual enmities and implacable hatred, are perpetually engaged in bloody contests."

Having made acquaintance with the upper rocks of the Lower Old Red in the Pontrilas district, the geologist should proceed to Abergavenny. Abergavenny was the site of the Roman station Gobannium of Antoninus, and lies embosomed among the hills of the Scyrrid Fawr on the east, the Sugar Loaf on the north-west, and the Blorenge on the south.

The Castle is a mere ruin and appears to have been very dilapidated even in the time of Queen Elizabeth, for Churchyard wrote of the towers as "bare and naked left," and prayed,

> "Would God, therefore, the owner of the same,
> Did stay them up for to increase his fame."

It occupies a good position towering above the Usk, but had a grievous reputation through the abominable atrocities committed by the Normans against the Welsh; atrocities worthy of a Front de Bœuf. It was here that William de Braose invited several Welsh chieftains to his hospitality and then butchered them in cold blood; and it is of Abergavenny Castle that Giraldus remarks that "it was dishonoured by treason oftner than any fortress in Wales." Giraldus relates that when he and the Archbishop were at Abergavenny, and many persons were converted to the Cross, a certain nobleman of those parts named Artheum, came to the Archbishop, who was proceeding towards the Castle of Usk, and humbly begged his pardon for having neglected to meet him sooner. Being questioned whether he would take the cross, he replied "That could not be done without the advice of his friends;" the Archbishop then asked him "are you not going to consult your wife?" He modestly answered with a down-cast look, "When the work of a man is to be undertaken the counsel

of a woman ought not to be asked," and instantly received the cross from the archbishop!

With respect to the geology around Abergavenny the explorer will have no difficulty in recognizing a portion of the Cornstone strata of the Old Red in the railway cuttings between Abergavenny and Llangvihangel. These are the lowest beds exposed in the district, and the Upper Cornstone group rises into the hills named the Deri and the Rolben below the Sugar Loaf, and again into the wooded escarpments that lie below the Blorenge. Above the Upper Cornstones and Sandstones of the Deri and the Rolben, the Brownstones set in, and those unfossiliferous deposits constitute the higher strata of the Sugar Loaf, and the Scyrrid Fawr; while in the Blorenge the Brownstones are themselves overlaid by the uppermost rocks of the Old Red, viz., the Old Red Conglomerate and the yellow and grey sandstones, these again being capped by the Carboniferous Limestone and millstone grit. The Lower Flagstones and Cornstones around the town are fossiliferous, and there are some fine specimens of fish scales, heads, tails and spines in the collections of Dr. Elmes Steele and Dr. M'Cullough. Some of these were obtained from beds upon which the Asylum stands, with some fine plates of Cephalaspis, and one or two remarkable Ichthyodorulites or fish spines. Again some good scales have been found in higher Flagstones and Cornstones at the base of the Scyrrid; and among them a magnificent shield of the head of Zenaspis Salweyii was found by Mr. Steele. I am not aware that any fish remains have been found in the upper beds on the Deri and Rolben.

Every geologist should ascend the Scyrrid Fawr, as its summit commands a splendid view of the surrounding country. There is a downthrow on the Scyrrid, from the Sugar Loaf series which is not altogether satisfactory to those who have little time to spare for fault investigations. Every one, however, should see the Scyrrid and the escarpment of Brownstones laid open by the great slips which have descended from the northern slope. At the summit of the Cornstone group there is probably a break in the stratigraphical succession,

for the Brownstones overlap the Rowlestone beds both on the Scyrrid, and the Sugar Loaf. It is on this line of break that denudation appears to have been arrested throughout a large area of the Cornstone hills of Herefordshire and Monmouthshire. There are numerous hills where the Brownstones are denuded and only just denuded. We hope that local geologists will one day clear up this important question. This, however, can hardly be done without much trouble and research, nor by any but those who can give time and attention to the study of the phenomena of the district.

Llantillio Crosseney should be visited from Abergavenny for the sake of the White Castle (Castell Gwyn) which was standing at the time of the Norman invasion, and was the habitation of Sir Gywn ap Gwaithfoed, Prince of Cardigan.

Near Col. Clifford's park are the relics of an old house said to have been occasionally the residence of Sir David Gam, the faithful squire of Henry V., who, when sent to reconnoitre the French army before the battle of Agincourt, said that "there were enough to fight, enough to be killed, and enough to run away." It was of such men as Gam, who was knighted by his master, as he was dying at his feet, that Fluellen is said by Shakespeare to have reminded the king that "the Welshmen did goot service in a garden where leeks did grow, wearing leeks in their Monmouth caps."

The neighbourhood of Abergavenny was rich in heroes in olden days, for again about four miles to the north east and near Pandy station, is Old Castle, which every lover of religious freedom should visit in homage to the memory of Sir John Oldcastle, Lord Cobham, who suffered an ignominious death as a traitor and a heretic. He was the early friend of Henry V., the defender of religious liberty and of the persecuted Lollards, the follower of Wickliffe, and as Horace Walpole says, "the first author as well as the first martyr among our nobility!" The last time I visited Old Castle I saw, at the farm-house close by, an ancient portrait which "old people said was a true likeness" of one who helped to plant the standard of the Reformation in the English church. Alas! he, like too many

who lived before his day, and others who have lived since, found that any attempt to develop religious truth is followed of necessity by persecution on the part of the ecclesiastical powers that be.

There are few more beautiful ruins than those of Llanthony Abbey, distant about six miles from the Llanvihangel station on the Hereford and Abergavenny Railway, and situated in a wild and secluded valley among the hills of the Black Mountains; hills where

> "Moorcock springs
> On whirring wings
> Amid the blooming heather,"

and where ages ago the hermit chose this secluded spot for retirement from the world.

Giraldus Cambrensis gives a long account of the foundation and history of this Abbey and speaks of its "situation as truly calculated for religion and more adapted to canonical discipline than all the monasteries of the British isle." "It was founded by two hermits in honour of the retired life, far removed from the bustle of mankind in a solitary vale watered by the river Hodeni." From Hodeni it was called Lanhodeni, for Lan signifies an ecclesiastical place. "Owing to its mountainous situation the rains are frequent, the winds boisterous, and the clouds in winter almost continual." "Here the monks sitting in their cloisters, enjoying the fresh air, when they happen to look up towards the horizon behold the top of the mountains as it were touching the heavens, and herds of wild deer feeding on their summits." According to the notes of antiquaries a small rustic chapel dedicated to St. David was first built on or near to the site of this abbey, whither in 1103 William de Laci, a Norman knight, retired, and was afterwards joined by Ernicius, chaplain to the Queen Maud, consort of King Henry I. These hermits erected the first "mean church." At the request of Ernicius, Hugh de Laci, Earl of Hereford, founded a priory for Black Canons of the order of St. Augustine. Henry I. and his queen were benefactors, and Giraldus Cambrensis, who evidently visited Llanthony, describes the

LLANTHONY ABBEY, AND HILLS OF OLD RED SANDSTONE.

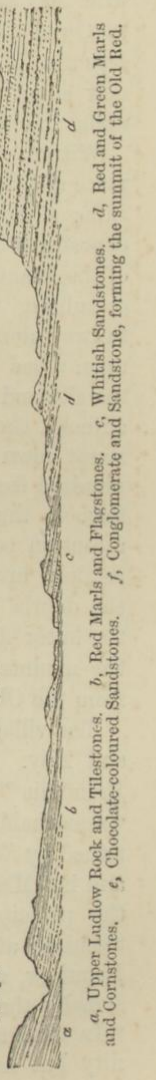
W. V. Guise.

conventual church as a good building having "an arched roof of stone and covered with lead." Evil days arose and the monks of Llanthony were ill-treated and pillaged by the Welsh, so their former prior, Robert de Betune, Bishop of Hereford, enabled them to erect a new monastery near Gloucester in the year 1136, and the church among the mountains was gradually despoiled of its valuables to enrich the monasteries at Gloucester. Giraldus also says concerning the stones of the Black Mountains near Llanthony, "Parian stones are frequently found there and are called free stones ("qui et liberi vulgo dicuntur") from the facility with which they admit of being cut and polished ; and with them the church is beautifully built. It is also wonderful that, when after a diligent search all the stones have been removed from the mountains and no more could be found, upon another search a few days afterwards they appear in greater quantities to those who seek them."

In this district, there is good work for the physical geologist in tracing up the Old Red strata along the hill sides, in the gullies and brooks. An interesting route passes by Capel-le-fin, a little Welsh chapel among the hills, and in following the stream to the base of the Black Mountains the explorer arrives at a small waterfall. On the left of the waterfall, under the hill, is a considerable mass of travertine, a station for the somewhat rare fern Asplenium viride, and covered, in summer time, with a small Saxifrage. This travertine owes its origin to the percolation of water through a thick band of cornstone which may be seen *in situ* in the rocks above. These are, as far as I know, the highest Cornstones of this district, and they are succeeded by the great mass of Brownstones which, in the high hill to the west, called the Gadir, rise to a height of 2000 feet, and from the summit of which the geologist will not fail to remark that the Carboniferous deposits are only just denuded. The geologist should now cross the hills to the Hay in Breconshire, and examine the Upper Silurian section on the banks of the Wye near Trewerne, and follow up the rocks, in ascending order, by Cusop, to the Brownstones on the summit

of the Black Mountains. Sir R. Murchison records an attempt made to find coal some years ago; the undertaking was suggested by the quantity of carbonaceous matter contained in some of the Old Red Flagstones. Vestiges of this attempt at mining may still be seen on the eastern side of a ravine above the village of Cusop. I believe that these strata are the equivalents of the Stylonurus Flagstones of Rowlestone near Pontrilas, and overlie the Lower Cornstones. From the Cornstones, below the (Rowlestone) flags and building stones of Cusop, I obtained, last summer (1871) through the kindness of Mr. Thomas, C.E., of Hay, a very fine fish spine, which has been named "Onchus major" by Mr. Etheridge, and is the largest yet found in the Lower Old Red Sandstone. It was exhibited at the meeting of the British Association at Edinburgh, and is now in the museum of the Earl of Enniskillen.

The early history of the town of Hay is involved in obscurity. Leland and Camden both state that Roman coins have been dug up here, and the latter says that it is "a place which seems to have been well known to the Romans." In the time of William Rufus the manor of Hay fell into the hands of Bernard Newmarch, who probably erected the Castle; at all events, it was built before the days of Giraldus Cambrensis, for he records "preaching a sermon at Hay," and alludes to "the



SECTION FROM THE TOP OF THE SILURIAN ROCKS, ON THE N.W., IN RADNORSHIRE, ACROSS THE OLD RED SANDSTONE, ON THE S.E.

a, Upper Ludlow Rock and Tilestones. *b*, Red Marls and Flagstones. *c*, Whitish Sandstones. *d*, Red and Green Marls and Cornstones. *e*, Chocolate-coloured Sandstones. *f*, Conglomerate and Sandstone, forming the summit of the Old Red.

Castle." It was taken in 1265 by Prince Edward, together with the Castle of Brecon, and its final destruction is attributed to Owen Glyndwr in 1403. Leland describes its ruins and says that it "hath been some time right stately." On its site now stand the Parsonage, covered with ivy, a portion of the walls, and a gothic gateway.

Within a short walk of the Hay is Clifford Castle, the birthplace of Rosamond Clifford, the mistress of Henry II. The ruins of this Norman castle stand upon a hill of drift, the deposits of an ancient Wye, which, long ages before the days of the Plantagenet, swept over the site where the ruins are now crumbling to decay. During the excavations made for the railway along the base of the castle hill, the workmen came upon a bed of bones partly stratified in the gravel. I examined the site and the bones, which were all appertaining to existing animals, the ox, boar, and deer. The animals must have been swept down in a flood and entombed at a remote period, as one nundred feet of stratified silt and gravel lie above them. I have to thank Mr. Curley, C.E., of Hereford, for calling my attention to these drifted bones. Unfortunately, the hill-side sections are much masked by drifts of another character, viz., the débris brought down by the land ice and snow, which in the latter days of the Glacial Period swept down the sides of the mountains and bore along large masses of local débris from the Old Red Hills above.

The village of Brynllys lies on the road between Brecknock and Hay. Giraldus Cambrensis speaks of "the castle of Brendlais" and notes that while Mahel, a son of Earl Milo, "remarkable for inhumanity," was "being hospitably entertained by Walter Clifford, the house was by accident burned, and he (Mahel) received a mortal blow by a stone falling from the principal tower on his head." The round tower still remains, and the church preserves its Norman windows. Llanthew, a village two miles from Brecknock, was occasionally the residence of Giraldus. He says concerning it, "In these temperate regions I have obtained a place of dignity but no great omen of future pomp and dignity, and

possessing a small residence near the Castle of Brecheinoc, well adapted to literary pursuits and to the contemplation of eternity."

An agreeable day's ramble from Hay may be had by taking the rail to Letton station and walking by Brobury Scar, a good Lower Old Red section on the Wye, through the village of Bredwardine to the very fine cromlech on Merbridge Hill. It is known by the name of "Arthur's stone," and rests in the middle of an old road with a small mound near at hand. It is in a good state of preservation. The large incumbent stone was no doubt hewn from the rock close by. The rock was exposed *in situ* some summers ago, which enabled me to arrive at this conclusion. The other stones, some of which have fallen from their originally upright position, belong for the most part to the hard limestone of the Cornstones and are not *in situ* on the horizon of the cromlech, but lie scattered about as boulders upon the land. All the stones belong to the Old Red Sandstone of the country.*

In Caermarthenshire, a section on the River Sowdde near Llangadock has already been alluded to, where the Lower Old Red may be traced from the Upper Ludlow and Passage Rocks at Pont-ar-llechc, through a series of marls and thin bedded limestones in the vale of Gwinfe, up to the Brownstones and Conglomerate of the Caermarthen Vans. This is an important section, the beds being highly inclined. It appears, the upper Cornstones of this section are unconformable with the Brownstones of the mountains above, and there seems also to be an overlap which requires attention. Again, towards Caermarthen, the question arises as to whether the Conglomeratic series of the Upper Old Red does not overlap the Lower Old Red. In this district I suspect there is a break in the succession of the strata between the Upper Cornstone series, and the Brownstones, and again between the Brownstones and the Conglomerate farther south.

The old fortress of Llanstephan Castle stands upon a bed of

* The return walk may be made over the old British Camp on Merbridge Hill by the Clock Mills to Eardisley station.

crystalline Cornstone which probably represents the upper beds of the Lower Old Red. In South Pembrokeshire are two localities where the Old Red may be seen in contact with Upper Silurian rocks, viz., at Freshwater East and Freshwater West. I visited the eastern section, but it is an unsatisfactory place for determining the relation of the beds, as they are much obscured by blown sands. From Llamphey, which is situated on the Carboniferous Limestone, I crossed over the Old Red Sandstone by Parelew to Freshwater Bay, and found a small quarry of nearly vertical Silurian rocks, on the hill above the bay and on the right hand of the road leading to Stackpole. The Old Red basement rocks consist of a conglomerate of Silurian pebbles, consequently the Lower beds are probably wanting. The section at Marloes Bay is interesting. The Lower Old Red is seen at Hook Point on the east, at Gateholm Island and at the opposite promontory on the west of the bay, in contact with Upper Ludlow strata. The Upper Silurians are here faulted through the Old Red and interlaced with volcanic dykes.

Igneous rocks may be seen in contact with Old Red Sandstone in the grounds of Mr. Warren Davis of Trewarren, St. Ishmael's. They occur to the west of the Church. At Benton Castle, on the right bank of the river Haverford, volcanic rocks are erupted through Old Red strata. Towards the west the range of the Johnston traps traversed the Carboniferous deposits as well as the Old Red; and Sir H. de la Beche records that he saw a large fragment of Carboniferous Limestone twisted into a large mass of trap.

The Isle of Skomer off the south western coast consists entirely of trap rocks. During my last visit to Pembrokeshire I saw a number of the eggs of our rarer British birds, which had been collected by a lady and gentleman who had resided for many years on this lonely island; they were carefully preserved in a cabinet at Solva near St. Davids, and they included the eggs of the Woodcock, Snipe, Golden Plover, Whimbrel, also of the Cornish Chough, Peregrine Falcon and Stormy Petrel.

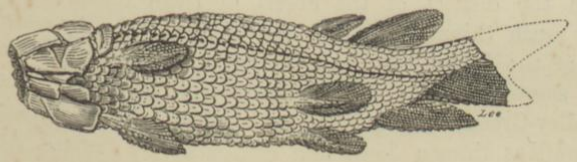
W. V. Guise.

MARLOES BAY, 1865—GATEHOLM AND PART OF SKOMER ISLAND. [*Page* 242.

BROWNSTONES AND UPPER OLD RED SANDSTONES.

In Scotland the researches of Prof. Harkness and Mr. Powrie have established the fact that the Lower Old Red is characterized by the presence of Cephalaspis, Pteraspis, and other peculiar fishes, as in the Silurian districts of Herefordshire and Monmouthshire. The Middle Old Red of Scotland furnishes the fossil remains of numerous well preserved fishes, the best known of which are the Pterichthys, Coccosteus, Cheiracanthus, Diplacanthus, Cheirolepis, Dipterus, Osteolepis, and Diplopterus, all described by the graphic pen of the late Hugh Miller in his famous work "The Old Red Sandstone."

GANOID FISH OF THE OLD RED SANDSTONE.



Dipterus macrolepidotus, Ag., of the Black Schists of Caithness. From a specimen in the cabinet of Sir Philip de M. Grey Egerton, Bart.

The Upper Old Red of Scotland is characterized by the presence of a peculiar Pterichthys, and the large scaled fish Holoptychius. A closely allied form of this Pterichthys is found in the Upper Old Red strata of Farlow, in Herefordshire near the northern base of the Titterstone Clee, while the remains of Holoptychius have also been detected in strata overlying the Old Red Conglomerate on the Daren near Crickhowell. Unfortunately no fossils have hitherto been discovered in the Brownstones, *i. e.*, those Old Red beds which in Siluria immediately underlie the Old Red Conglomerate, and overlie the Cornstone group. Some geologists have supposed that the central strata of Scotland, so rich in fishes, are wanting in Siluria. It is my belief that the Brownstones represent the Osteolepis bearing rocks of Scotland, and that

physically, they are largely developed in the mountains of Breconshire and Monmouthshire. A fair section of the lowest Brownstone beds may be examined at the Scyrrid near Abergavenny, where a landslip has laid bare the upper portion of the hill. They are capped by a marly conglomerate and dip away from the opposite hills of the Sugar Loaf and Black Mountains towards the Carboniferous rocks of Dean Forest. When examining this district some years ago I thought, from the dip and strike of the strata, that the Brownstones must have extended from the Scyrrid in the direction of the Sugar Loaf as a huge anticlinal in the direction of Pen-Cerrig-Calch. There are no sections on the Blorenge, or the Sugar Loaf, or on the Black Mountains, excepting where the rocks are partially bared by mountain rills.

In the district of the Forest of Dean these rocks have very much thinned out, but they may be seen by commencing at the Lower Old Red of Pyrton Passage and following the successive beds by Blakeney and Bryant's Green to Soudley Green. The Old Red in this district is much denuded, as well as thrown down and dislocated by faults. Anyone who has studied the physical geology of the Brownstones and flagstones in the mountain ranges of Brecon and Caermarthen will be led to the determination that these strata of the Old Red system must formerly have extended over a large extent of surface now occupied by the Lower Old Red and Silurian deposits, from above which they have been denuded. In certain directions they are evidently thinned out as compared with the thick masses occurring in Breconshire and Caermarthenshire, but there can be no doubt of their former persistence over a far larger area than they occupy at present.

The ancient British town of Aberhonddu, commonly known as Brecon, lies surrounded by old rocks and old ruins, while we agree with Hoare that it can hardly be surpassed for the picturesque beauty of its situation. "The different mills and bridges on the river Usk, and Honddu, the ivy mantled walls and tower of the Old Castle, the massive embattled turret and

gateway of the priory, with its luxuriant groves added to the magnificent range of mountain scenery on the southern side of the town, form in many points of view, the most beautiful, rich and varied outline imaginable."

The Castle was once the residence of Henry, Duke of Buckingham, who was executed at Salisbury by the orders of Richard III., although he was the "first that helped him to the crown" and "the last that felt his tyranny."—Leland says of the castle, "The castel stondith in the suburbe and is devided from the toune by the Hondency river over the wich is a hy bridge of 2 arches to go into the castel, the wich is very large, stronge, welle mainteynid; and the keep of the castel is very large and faire." During the reign of Charles I., the inhabitants nearly demolished the castle to avoid a siege. The unfortunate monarch was notwithstanding hospitably entertained at the Priory by Sir Hubert Price, and there he wrote the well known letter to the Prince of Wales advising him to fly to France.

The Church of St. Almedha is mentioned by Giraldus Cambrensis* ; the saint was one of the twenty-four daughters of Brachanus "in ancient times ruler of the province of Brecheinoc and from whom it derived its name." He relates that at the anniversary of the holy Saint Almedha, "you may see men and girls, now in the church, now in the churchyard, now in the dance, which is led round the churchyard with a song, on a sudden falling to the ground as in a trance, then jumping up as in a frenzy and representing with their hands and feet before the people whatever work they have unlawfully done on feast days."

Three miles above Brecon, near the confluence of the rivers Yscir and Usk is the Gaer-Bannau, the Bannium of the Romans, where according to Mr. Jones, the historian of Brecknockshire, Ostorius Scapula built a fortress, and where gold coins of Nero and Trajan have been found associated with bricks, one of which still bears the inscription LEG. II

* Hoare's Giraldus Cambrensis, vol. i. p. 35.

A.U.G. Until the days of William Rufus, Gaer-Bannium was the site of the principal town of Brecknockshire; it was then destroyed by the Norman knight Bernard Newmarch, who made the Welshmen carry away the stones of which it was built for the purpose of erecting his stronghold at Brecon. The Castle Hotel now stands on the site of this fortress, and hard by is the church of St. John, formerly the chapel of a priory founded by Newmarch for the good of his soul after a lifetime of savage violence, murder, and plunder. The geologist who visits the Gaer will observe a number of boulders of Old Red from the neighbouring hills lying all along the remains of the Roman road which leads by the "Maiden's Stone" to the Gaer. There is little doubt that boulders of large size were once scattered over the surrounding lowlands, but as cultivation increased they were broken up for roads and built into walls. The "Maiden Stone" (Maen-y-morwynion) is a large slab of Old Red with sculptured figures; it is probably a boulder set on end. Newton near Brecon was the birthplace of Sir David Gam.

The highest mountain peaks in South Wales are the Bannau Brecheinog or the Brecknockshire Beacons. They lie about five miles to the south-west of the town, and rising to a height of 2862 feet they command a noble view of very distant points in the surrounding country. The rocks on the summit consist of the Brownstone series of the Old Red which dip to the south under the Old Red Conglomerate and the Carboniferous Limestone of the South Wales coalfield. The summit of the Brecon Van is somewhat precipitous on the northern slope, where the rocks rise in a bold escarpment from a coomb which, we have no doubt, was once filled with the ice of a small glacier which stretched for a considerable distance down the vale. Indeed everywhere around these hills there are vast masses of angular local drift which have been swept down by land-ice and snow, those effective agents, which throughout a long period transported large boulders and lodged them at high levels and low levels along the flanks of the hills and against the sides of the valleys, so as in some instances to form

moraines. There is a marly conglomerate on the Brecknockshire Vans similar to that on the Scyrrid. These are the basement beds of the quartzose conglomerates which underlie the yellow sandstone and the lower limestone shale of the Carboniferous rocks. It is lower in the series than the *quartzose conglomerate* which has been denuded from above the Vans of Brecon. The strata now on their summit are the equivalents of those which cap the Caermarthenshire Beacons on the west, and the Gadir Vawr on the north-east across the valley of the Usk above Talgarth, and they underlie the isolated outlier of Carboniferous rocks at Pen-Cerrig-Calch. The lake of Llyn Cwm Llwch lies below the Vans, and the depression which the waters now fill is surrounded by moraine matter brought from the summit of the Vans.

Talgarth is a good locality from whence to visit the Brownstones of the Gadir Vawr, and those of Skethrog and Derwaddon. It is near also to a fine lake Llynsavaddon, or the lake of Llangorse, celebrated for its fine pike, perch, and waterfowl. This lake is mentioned by Camden as the probable site of the Loventinum of Ptolemy, which "was swallowed by an earthquake." Llynsavaddon affords some good marsh plants to the botanist. The rare Spearwort (Ranunculus lingua) grows here, together with the white Water Lily (Nymphæa alba) and the flowering Rush (Butomus umbellatus). It is, after Bala lake, the largest lake in Wales; and we find that in 1235 the monks of Brecon obtained leave from the Priory of Llanthony to fish in it three days a week, and daily in Lent provided they used only one boat. On the little island at the Llangorse end of the lake there have lately been discovered some remains of prehistoric human habitations, associated with bones of deer, horse, and ox.

The Bwlch, a pass on the road from Brecon to Crickhowell, should be visited, for the Old Red is quarried on the ridge of the hill; and here I once found the cast of a fish spine, and portions of fish plates. Near the road, too, are the ruins of Blaen-lyffin Castle, now only the haunts of rabbits. Under

the Alt is Buckland, the seat of the Gwynne Holfords, the representatives of the ancient family of Gwyns, who trace their descent from Gwrgan, Lord of Glamorgan, and a race who were British Chiefs before Bernard Newmarch had a beginning.

The Boulder drifts along the valley of the Usk are most interesting. There is a fine rolled erratic in the "Chain Pool" near the grotto at Buckland. Lower down the vale is the Maenhir of Llynfedwen, which is a great angular mass of Mountain limestone set upright; while the Maenhir in Sir Joseph Bailey's grounds between Gliffaes and Glanusk is of Old Red Sandstone. Both are erratic masses from the hills above.

It would be interesting to know what has become of a flint implement which was found in this neighbourhood. It is recorded in Jones's Brecknock, that in the parish of Llanelin, to the eastward of Brynllys, was discovered, "within a cairn in a field, a remnant of antiquity, in comparison with which even the Roman remains in this island may be said to be modern; it was a spear head of flint, nearly seven inches long and two broad at the widest place. It is rudely chipped into its present shape, and seems to be more ancient than the use of iron in this country. In the same cairn was also found a coarse earthen vessel."

UPPER OLD RED SANDSTONE.

In Siluria and South Wales, the uppermost strata of the Old Red Sandstone consist of Conglomerates which are overlaid by red marly beds; these are again succeeded by yellow and yellowish grey sandstones which pass upwards (as in Dean Forest) into the Lower Limestone Shale of the Carboniferous series. The Conglomerates of the Upper Old Red differ considerably from the conglomerates of the Millstone Grit, which, at first sight, are often difficult to distinguish, as they lie in large boulders on the flanks of the hills. The Old Red Conglomerates consist of quartz pebbles with red jasper in a red pasty matrix, whereas the Millstone Grit pebble beds are

made up of red and white quartz pebbles in a grey or yellowish silicious matrix. The geologist should note this difference in the matrix, which, when once observed, proves a well-marked distinction, as mistakes often occur, especially as regards transported masses of the two conglomerates. For example, the hill of Cefn Bryn in Gower is studded with Millstone Grit boulders resting on Old Red Conglomerate, the Millstone Grit and the Mountain Limestone being denuded from the upper part of the hill on which the boulders are stranded; and yet, the débris of Millstone Grit lie so thick on the Old Red as to be easily mistaken for the rock *in situ*. The upper deposits of the Old Red or substrata of the Carboniferous Limestone are very persistent in Siluria; we find them ranging from the Vans of Caermarthen, girdling the South Wales coal field, underlying Dean Forest and stretching far away on the slopes of the distant Clee hills of Shropshire.

The uppermost strata may be seen in an extraordinary position in Caermarthenshire, about three miles from Llandeilo. They are thrown down from their proper position on the summit of the Caermarthen Vans, with the Carboniferous Limestone of Castel-Cerrig-Cennen, into the vale of the Cennen. I detected their place *in situ* on the rising ground just north-west of Castel-Cerrig-Cennen, when there with my friend Prof. Harkness, several years ago.

The Daren Mountain, two miles north of Crickhowell, is capped by these uppermost sandstones. They were quarried as building stones for the house at Glanusk, the residence of Sir Joseph Bailey. There is some difficulty in detecting the position of the Old Red Conglomerate below the scar of the Daren, as it is masked by débris. Nevertheless, it may be found *in situ* in a small quarry hole to the east of the great quarry on the hill and considerably lower down. From the sandstones on the Daren, Sir R. Murchison records the scales of Holoptychius. There are impressions of stems of plants on the rocks below the Scar. These Daren sandstones occupy the same physical position as the yellow beds of Dean Forest, and as the yellow sandstones of Farlow,

near the Clee Hills, which have afforded the remains both of Holoptychius and Pterichthys.

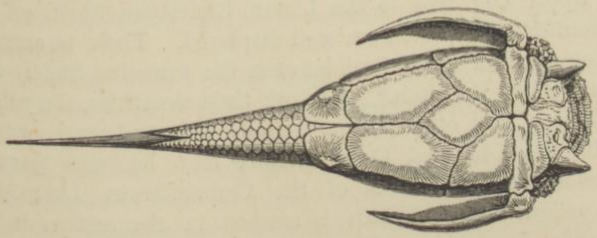
The Conglomerate is exposed on the hills, the other side of the Usk, as on the Blorenge above Abergavenny, but I know of no section of the Upper Yellow and Grey Sandstones. The inscribed stone in Sir Joseph Bailey's park is a mass of Conglomerate, and I was informed once formed a footbridge on the high grounds above Llanwyse.

The visitor to this district should see Crickhowell Castle, its Church and Monuments, and a Cistfaen, hard by the road side to Brecon. Tretower Castle also, and a remarkable Castellated Mansion of the Picards, lords of Ystradzw, are both within a short walk, and are well worth the notice of the antiquarian.

Throughout the district of Farlow, in the Clee Hill country, there has been great dislocation both of the Old Red rocks and of the Carboniferous series; consequently, the sections of strata are unsatisfactory and difficult, and their physical positions are not so well seen as in Dean Forest, and other localities. The Farlow Sandstones afford fossils found, as yet, in no other Silurian regions, and they are famous as having yielded the remains of fishes which characterize the celebrated beds of Dura Den in Scotland. Here Mr. Baxter, of Worcester, found a Pterichthys which Sir P. Egerton pronounced to be closely allied to the Pterichthys hydrophilus of Dura Den. There is also another species of this fish in the collection of Mr. Weaver Jones at Cleobury Mortimer.

The Pterichthys, or winged fish, was first discovered by Hugh Miller, who thus records, in his graphic work, "The Old Red Sandstone," the feeling with which he contemplated his first found specimen. "It opened with a single blow of the hammer, and there, on a ground of light coloured limestone, lay the effigy of a creature fashioned, apparently, out of jet, with a body covered with plates. Two powerful arms articulated at the shoulders, a head as entirely lost in the trunk as that of the ray or the sun-fish, and a long angular tail." The Pterichthys belongs to that group of fish known as Placoganoids or Ganoid fish, protected with plates of enamel.

The remains of Holoptychius (wrinkled scale), a large fish covered with scales of enamel instead of plates, have also been found there by Mr. George Roberts and Mr. Lightbody of Ludlow. Conularia also occur in these beds; and these fossils are the remains of marine Pteropods. Farlow is a wild, out-of-the-way place, with a new church built of the rotten Pterichthys sandstone.



UNDERSIDE OF PTERICHTHYS CORNUTUS, AGASSIZ.

The neighbourhood of Ross, in Herefordshire, may be explored with advantage by the geologist, while the antiquary may see the house where lived "ye man of Ross," and may gather much information respecting John Kyrle, the bishop's dungeons, and the church; how the little church of Bridstowe is built upon the very site where stood a church of wood in the days of King Harold; and how the Greys-de-Wilton lived and died in Wilton Castle, the ruins of which are now seen just across the Wye. There is, too, much to be learnt respecting Goodrich Castle,* a stronghold in the time of Edward the Confessor, when "entrenched in a stockade of wood, Goderic de Winchcomb held the Ford." And there are also accounts of the Ariconium of the Romans, and the Hellan (or Old Church, now Hentland) of Dubritius. At Pengethly, the seat of my cousin, Lt.-Col. Symonds, in the parish of Hentland, Pope is said to have written his celebrated poem of "The Man of Ross."† The "Old Church" was restored by my friend, the Rev. W. Poole.

* The reader is referred to "Castles of Herefordshire," by Rev. C. Robinson.
† See Powle's "Ross Guide Book."

Nearly opposite Goodrich, at Hill Court, the residence of Captain Power, are low level Wye drifts with large boulders stranded in the gravel.

There are two or three instructive sections in the Upper Old Red Sandstone, which may be visited from Ross. One is the Dry Brook section on the high road to Ross and Cinderford. Here the transition beds, from the conglomerate of the Upper Old Red to the Lower Limestone Shale of the Carboniferous deposits, are well displayed. There is another section south of Cinderford between the tunnel at Sudely and a place called Ruspitch.* At both these localities, the yellow sandstones, and other strata, yellow, red, and grey, which overlie the Old Red Conglomerate, may be seen passing upwards into the shales of the Carboniferous Limestone. The yellow series of beds is masked in the section below Symonds Yat, on the Wye, excepting when carefully examined. The Old Red Conglomerate occupies the base of the hill below Symonds Yat, on crossing the Whitchurch ferry, while it is elevated on the Great Doward on the right bank of the river.

The Buckstone, one of the most famous rocking-stones in Great Britain, is a detached mass of Old Red Conglomerate which underlies the margin of the Forest of Dean, and the Carboniferous rocks opposite the town of Monmouth. There are several other large masses which have been detached through the atmospheric degradation of the marls below the conglomerate, and have rolled far down the slope of the wooded hills which rise from the valley of the Wye along the escarpments of the forest. Near the Buckstone is Stauton-on-the-hill, a pretty village with a church containing Norman relics, and a curious stone pulpit, which for many years was built up and hidden in a buttress to save it from being destroyed by the Puritans.

Monmouth itself is said to have been built on the Roman

* The former of these two sections may be best reached from the station at Mitchell Dean Road, and the latter from Newnham.

station Blestium. There is but little of interest in the town, save the Welsh Gate and the memories of Henry V.

The geology between Monmouth and Coleford is interesting as we pass from the lower Old Red beds of Wonastow and Monmouth, containing the remains of Cephalaspis, to the Coal measures with their fossil ferns and Calamites. Still further down the Wye to the north of Tintern, the upper Old Red is well marked by thick masses of "pudding stone" which, as at the Buckstone, rise to the summit of the high ground of Wentwood.

The author of the "Secret Memoirs of Monmouthshire" says that the forest of Wentwood was encompassed by six castles, "Dinham, Penhow, Pencoed, Llanvaches, Lanvaire, and Castrogy castles." Little remains of their ruins now, and Leland speaks of Pencoed as only "a fair manor place."

In the neighbourhood of Bristol there is a section at the banks of the Avon river where the upper Old Red Sandstone is developed and is overlaid by the limestone shales.

There are some good sections in the uppermost Old Red in Pembrokeshire, near Tenby, and at the mouth of Milford Haven. The Tenby sections are on the coast of Caldy Island, and at Skrinkle Bay. At Caldy Island the Old Red Sandstone is seen overlaid by yellow sandstones with conglomerates at the top, and these are again overlaid by shales containing Carboniferous fossils. On the eastern side of the island the Upper Old Red beds form the south end of Drinkim Bay, and on the west side Mr. Salter detected Serpulæ in masses of rock about 50 feet down in the Old Red series. The best view of the Skrinkle Bay section may be obtained by proceeding thither in a boat from Tenby, the path over the cliff being exceedingly precipitous. The bottom beds of the Old Red consist of some white sandstones (which occur also at Caldy Island) but there is a fault in the upper strata near their junction with the Carboniferous deposits. When visiting this country with Sir Wm. Guise, we were examining the coast for drift and cave phenomena, and taking no thought of the Upper Old Red and Carboniferous Passage beds, when we came upon this fine

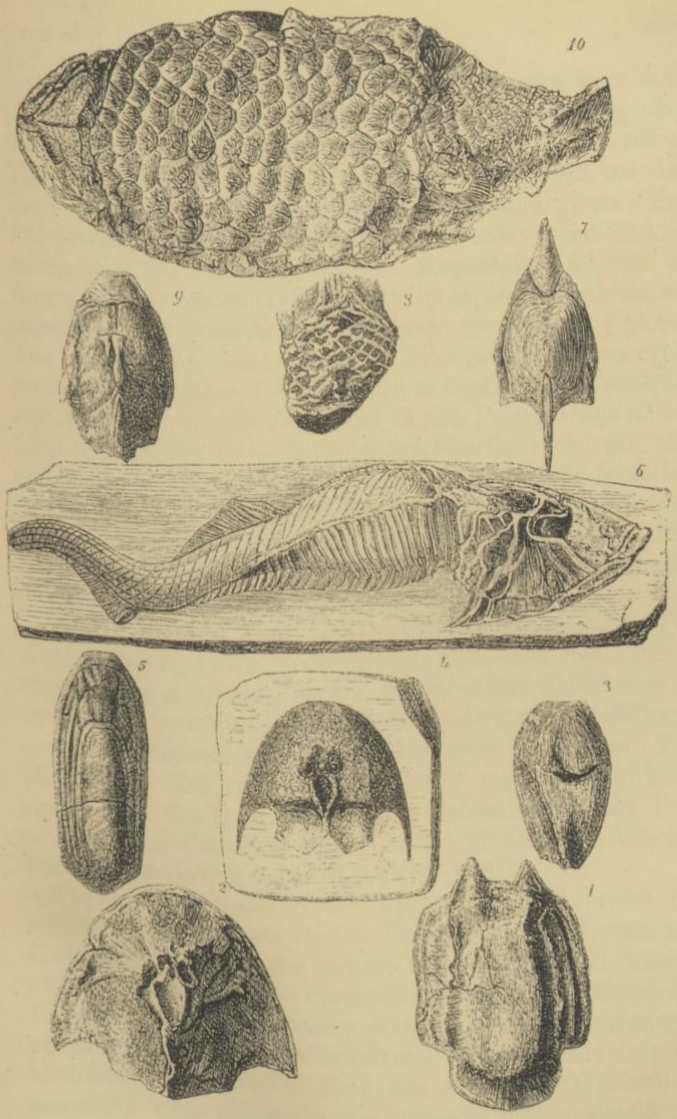
section at Skrinkle, and were struck with the colour and effect presented by the grouping of the strata as being very similar on a larger scale to the roadside section near Drybrook in Dean Forest, and thus we at once hailed old friends in a new locality. At West Angle Bay at the mouth of Milford Haven, the yellow Conglomerates of Caldy Island are wanting, and brown sandstones are intercalated in their place. There is a synclinal in the bay which shows the strata curved on either side. This section should be visited by every lover of physical geology.

Near the section at Skrinkle are the noble ruins of Manorbeer Castle, standing near the junction of the Old Red with the Lower Carboniferous slates. Manorbeer is noted as the birthplace of Giraldus Cambrensis, who describes the Castle in his time as being "excellently well defended by turrets and bulwarks, and situated on a hill extending on the western side towards the sea port, having on the northern and southern sides a fine fish pond under its walls, as conspicuous for its grand appearance as for the depth of its waters, and a beautiful orchard on the same side, enclosed on one part by a vineyard, and on the other by a wood remarkable for the projection of its rocks and the height of its hazel trees. On the right hand of the promontory, between the Castle and the Church, near the site of a very large lake and mill, a rivulet of never failing water flows through a valley, rendered sandy by the violence of the winds." We can readily recognize the site of the lake, mill and vineyard of the home of which the old scholar was so justly proud. The hazel grove on the promontory is there still. The sea washes the Old Red in the "hollow bay" with "inconstant waves and a raging sea," while hard by in the church is the sepulchral effigy of a De Barri cross-legged and sword in hand, in memory it may be of a brother of Giraldus himself.

ORGANIC REMAINS OF THE OLD RED SANDSTONE.

During the latter part of the Silurian epoch, the Ganoid fishes and Placoganoids make their appearance in the rocks. This group of fishes, of which 113 or 114 species have been

PLATE V.



1. Cyathaspis Symondsii. Lankester.
2. Zenaspis Salweyi.
3. Internal cast of Scaphaspis truncatus.
4. Auchenaspis Egertoni.
5. Convex cast of Scaphaspis rectus.
6. Cephalaspis Lyellii
7. Restoration of the Cephalic Shield of Pteraspis Crouchii. Salter.
8. Scales of Pteraspis, attached to a portion of the head-shield. Lankester.
9. Internal cast of Pteraspis Crouchii.
10. Holoptychius nobilissimus.

[*Page* 254.

determined from the Old Red and Devonian rocks, were once apparently cosmopolitan, but dwindled away during the Secondary epoch, when they were replaced by other orders. The only remnants now left of this ancient fish fauna, are the Bony Pike of the North American lakes and rivers; the Polypterus of South Africa; and the Ceratodus (mud fish) of Australia. The discovery of the Scaphaspis Ludensis in Lower Ludlow deposits is at present the earliest intimation we possess of the existence of vertebrate life upon the globe. The remains of other genera of Placoganoid fish, or fish protected with plates of enamel, such as Cephalaspis, Pteraspis, and Auchenaspis, have been found in the Passage beds which form a transition series between the Silurian rocks and the Old Red. The spines of some fish, which appear to be allied to the Onchi of the Upper Ludlow bone bed, occur in the Passage beds associated with the plates of Ganoids. The Onchi are generally believed to be the remains of a small shark-like fish allied to the Dog fish (Acanthias).

Sir R. Murchison found that the Cephalaspis-bearing beds of Scotland belong to the Lower division of the Old Red; this is also the case in Siluria, but the species of fish which occur in the Silurian rocks and Passage beds are altogether of different species as compared with those of the Lower Cornstones. The Middle Old Red of the district under review has hitherto supplied no fossils to enable us to determine whether they represent the Osteolepis-bearing strata of Scotland, but the Brownstones occupy the same physical position.

The highest strata of the Upper Old Red furnish the remains of land plants on the Daren near Crickhowell, and Earl Ducie possesses the remains of Calamites and Knorria from beds below the Carboniferous rocks of Tortworth. In Ireland, yellow sandstones occupying a similar stratigraphical position and of similar mineral character, yield in great abundance the beautiful fossil fern Sphenopteris Hibernica, associated with Stigmaria and Knorria, both Carboniferous forms of land plants, and also a shell supposed to be of fresh-water origin, the Anodon Jukesii.

The Upper Old Red of Farlow has furnished the characteristic remains of Pterichthys and Holoptychius, and occupies the same zone of uppermost or transition Old Red strata in Herefordshire, Monmouthshire, and Scotland as that occupied by the Holoptychius-bearing rocks of Scotland and the yellow sandstones of Ireland which yield the Anodon. Mr. Godwin Austen has suggested that the fish of the Old Red Sandstone are freshwater forms like the existing freshwater Ganoids of America; although numerous remains of Old Red fish have

Fossil Plant from the Yellow Sandstone of Ireland.

been found associated with marine fossils in Russia and America, and more sparsely in Devonshire and Cornwall. This might be the case, and the fish might nevertheless have been freshwater genera, for freshwater fish must often be swept out to sea by floods. There are two or three facts, however, which appear to me to militate against the idea that the Old Red of Herefordshire may have been a freshwater deposit. We find a number of Eurypteri, Stylonuri, and other forms of crustaceans, which Mr. Woodward believes were *marine*, associated with Lingulæ in the Passage beds, and these crustaceans evidently lived and died in the same waters as the marine Lingulæ. At Rowlestone, Stylonurus occurs high up in the Cornstone series, and Stylonuri occur high up also in the Scotch Old Red, far above at least the Passage beds and Lower Old Reds. Again at Caldy, near Tenby, we have Serpulæ which are marine fossils; and at Farlow, Conularia and other marine forms occur in the Upper Old Red in the same beds with Pterichthys and Holoptychius.

Lastly, I have seen a regular fish bed in the marine Devonian rocks of Cornwall made up almost entirely of the remains of Pteraspidean fishes.

WHYTHALL, NEAR ROSS, OCCUPIED BY OLIVER CROMWELL DURING THE SIEGE OF GOODRICH CASTLE.