WEEKEND EXCURSION: NORTH CROP OF THE SOUTH WALES COALFIELD

Leader: J.D. Weaver

6th - 8th May 1977

General Geological Setting

At the close of Silurian times the Lower Palaeozoic rocks were uplifted and folded by the Caledonian earth movements, which uplifted the Welsh area to form "St. George's Land". The sea retreated southwards and in Southern Britain was confined to the Devon and Cornwall area. South Wales appears to have been a low lying coastal plain with the sea to the south and mountains rising to the north, throughout Devonian times.

The sequence is divided into two parts by an unconformity which cuts out the middle Old Red Sandstone deposits. The Lower Old Red Sandstone starts with 45 m of shales and siltstones passing upwards into a thick sequence of shales, mudstones and siltstones (Red Marls 1,070 m) which are followed by 600 - 900 m of sandstones and conglomerates (Senni Beds and Brownstones Table 1). These deposits appear to be floodplain and river channel deposits with the sediment almost entirely derived from the north. Lying unconformably on top of the Lower, is the Upper Old Red Sandstone which, along the North Crop of the South Wales coalfield, grades upwards into the Dinantian limestones. The Upper Old Red Sandstone Group is composed of sandstones and conglomerates, which reach a maximum thickness of about 100 m in the Black Mountains of Carmarthenshire and Breconshire (Plateau Beds and Grey Grits). These deposits are interpreted as those of southward flowing rivers on a coastal plain.

At the close of Devonian times the sea invaded this flat lying coastal plain and the marine sequence of limestones of the Dinantian were deposited. The junction between the Upper Old Red Sandstone and the basal limestone shales shows a gentle advance of the sea and in places the junction appears to be conformable. The Dinantian sequences in the Tawe and Neath Valleys are incomplete, (Tables 1 and 2), the mid-Dinantian unconformity being strongly developed. At Abercraf the basal K zone limestones and shales are followed by the S_2 zone dark grey limestones and the D zone oolites and siliceous limestones, while at Penderyn the Z and C_2S_1 zones are thinly developed below the S_2 and D zones. The limestones were mostly deposited in a clear shallow sea with little influx of terrigenous sediment.

At the close of Dinantian times earth movements led to a radical change in the environment of deposition and the Namurian rocks were laid down unconformably on those of the Dinantian. It has been suggested (Jones 1974) that the Namurian sediments in South Wales resulted from the southward and southwestward spread of coastal flat and deltaic conditions. The Namurian is about 245 m thick composed of a sequence of sandstones and conglomerates (Basal Grit) followed by a sequence of shales with some thin sandstones (Namurian Shales). Marine horizons yielding goniatites allow correlation. The top of the Namurian is marked by the base of the *Gastrioceras subcrenatum* Marine Band.

The Wesphalian starts with a new phase of fluvial sedimentation reflected by the sands of the Farewell Rock. The Coal Measures are composed almost entirely of terrigenous detritus derived from nearby sources and carried into a shallow, subsiding trough of sedimentation by rivers from a landmass lying mainly to the north. Secondary sources of sediment are found in the east early in Westphalian times and in the south in late-Westphalian times. The lower Wesphalian is dominated by shales and the upper Westphalian by sandstones.

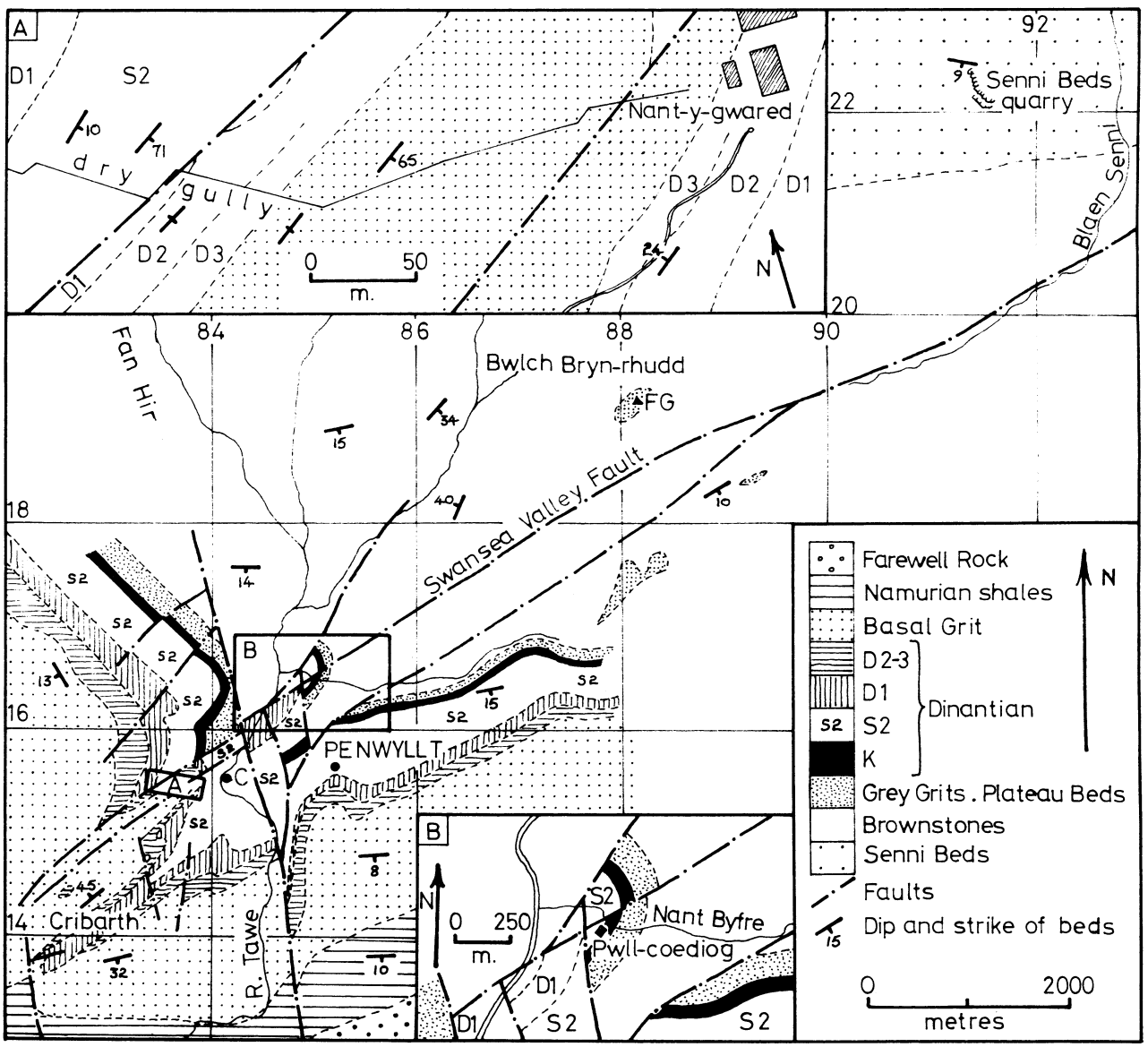
At the close of Westphalian times the whole of the South Wales area was affected by the Variscan orogeny which caused faulting, and folding of the Upper Palaeozoic rocks and no Stephanian, Permian or Lower Triassic rocks are thought to have been deposited. Sequences of Upper Triassic and Mesozoic rocks are now confined to the Vale of Glamorgan although they may once have covered much larger parts of the South Wales area.

Mercian Geol, Vol.6, No.4. 1978.
pp.299-306, text-figs. 1-4.

Quaternary till and peat deposits are scattered over the North Crop area and the Neath and Tawe Valleys were overdeepened by glacial action and have fairly thick layers of alluvium.

The main structural elements of South Wales are the E-W folds of the main coalfield, and Gower and southwest Dyfed; the NW-SE faults of the coalfield; and the NE-SW fault zones, which cut across the north-western edge of the coalfield. The North Crop of the coalfield forms the northern limb of the main synform, the dips are gentle, ranging from 5° to 30° southwards but generally about 15° to 20°. This limb is cut by a number of NNW-SSE and NW-SE dextral wrench faults and normal faults, usually with westerly downthrows and two powerful NE-SW shear zones, the Vale of Neath and Swansea Valley Disturbances.

The Neath Disturbance crosses the coalfield from Bryniau Gleision (7km NNE of Merthyr Tydfil) to Glynneath and may extend from the Woolhope area in the north-east to Swansea Bay in the south-west (Owen 1954). The main structural elements of the Neath Disturbance are: impersistent NE-SW folds, which plunge south-westwards; the Dinas Fault, which is a NE-SW sinistral wrench fault with a displacement of 1,200 m; the Coed-Hir Fault, which is a NE-SW normal fault with a consistent southerly downthrow; and a large number of NW-SE faults, some of which have acted as dextral wrench faults, some as normal faults and some showing both wrench and normal movements.



Text-fig.1. The geology of the area around Craig-y-nos, at the head of the Tawe Valley.
C. Craig-y-nos FG. Fan Gihirych

TABLE 1 Succession at the upper end of the Tawe Valley

			Thickness in metres
CARBONIFEROUS	WESTPHALIAN	Part of Upper Coal Measures, Pennant Sandstone - Rhondda and Llynfi Beds	400
		Middle Coal Measures	420
		Lower Coal Measures ("Farewell Rock" 40 m at base)	400
		Gastrioceras subcrenatum Marine Band	
	NAMURIAN	Shale Group	90
		Basal Grit	75
		Unconformity	
	DINANTIAN	D_3 zone shales and limestones	0 - 3
		D_2 zone cherty limestones	2 - 24
		D_1 zone oolites	12 - 18
		S_2 zone dark-grey limestones	60 - 150
		Unconformity	
		K zone shales and limestones	20 - 30
DEVONIAN	UPPER O.R.S.	Grey Grits	0 - 60
		Plateau Beds	6 - 25
		Unconformity	
	LOWER O.R.S.	Brownstones	425
		Senni Beds	300

The Swansea Valley Disturbance is a similar line of faulting lying some 8 to 10 km north-west of the Neath Disturbance. This fault zone extends from Blaen Senni to Clydach and may extend north-eastwards to the Clee Hills and south-westwards to Swansea Bay (Weaver 1975). The main structural elements of the Swansea Valley belt are: NE-SW folds; a number of NE-SW faults, the main one of which, the Swansea Valley Fault, has a sinistral wrench component varying between 200 and 530 m; and a number of important NNW-SSE and NW-SE faults, some of which show wrench movements, some vertical movements and some both wrench and vertical movements.

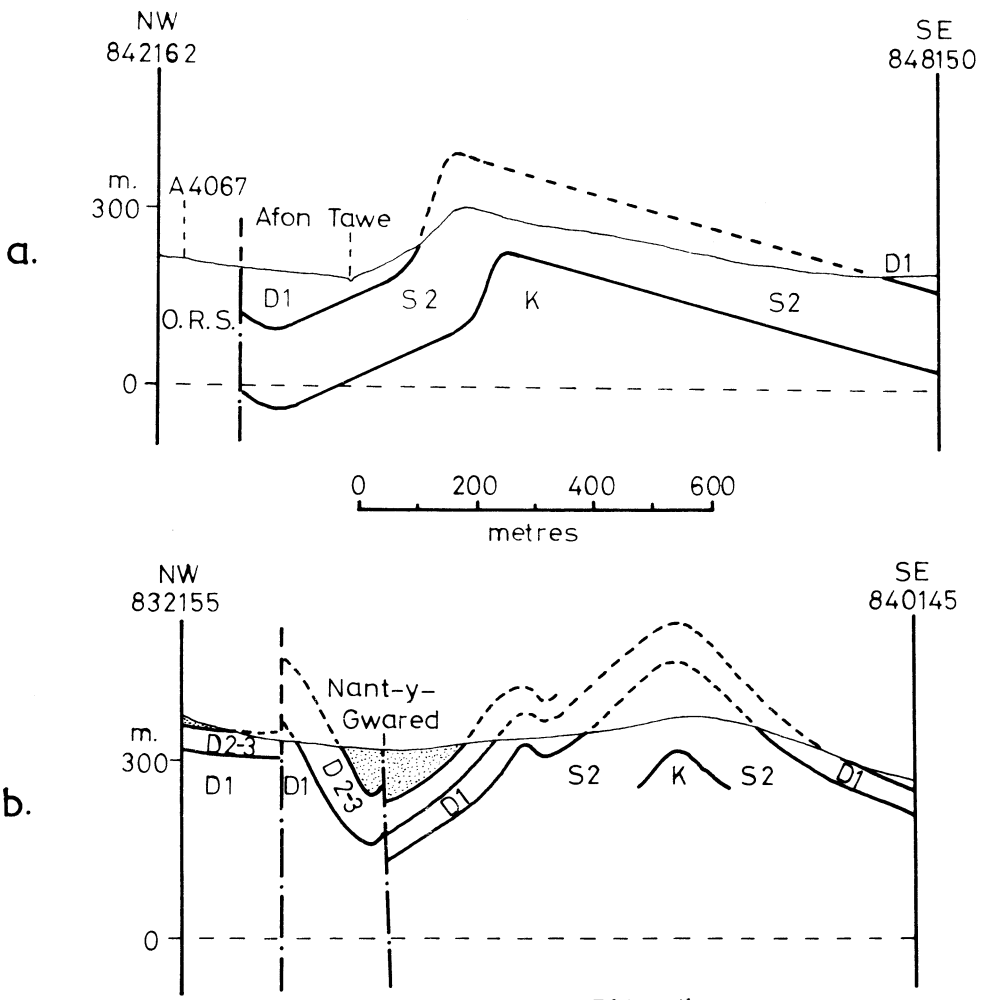
Saturday A study was made of the Devonian (Old Red Sandstone) and Lower Carboniferous successions exposed in the upper part of the Tawe Valley. The party assembled at Bwlch Bryn-rhudd (SN 869196) at the head of the Tawe Valley. From this point the general features of the area are seen, in particular, the folding of the Carboniferous rocks on Cribarth (SN 830142) and the line of the main fault zone of the Swansea Valley Disturbance (text-fig.1). In the road cutting at Bwlch Bryn-rhudd the Brownstones (table 1 above) of the Lower Old Red Sandstone were examined. They consist of red-brown sandstones, siltstones, mudstones and a well developed mud flake conglomerate. Cross-bedding and ripple marks were considered to indicate river deposition, a muddy horizon having been ripped up by a river carrying sand to produce the mud flake conglomerate.

Proceeding north-eastwards towards Heol Senni the party visited a large disused quarry excavated in the Senni Beds (SN 914222). These were seen to be composed of grey and greenish-grey micaceous sandstones and siltstones with some thin shaly and some conglomeritic horizons. Some of the conglomerates contained numerous rounded fragments of a light grey, micritic

limestone. The possible provenance of these fragments was discussed and it was noted that the nearest, present day, surface outcrops of limestones older than the Old Red Sandstone were in the Welsh Borderland, Silurian sequences. The possibility of other limestone outcrops, since eroded, was also discussed. Abundant mica in the sandstones gave them a mirror finish on fresh surfaces. Within the more silty horizons prolific, fairly well preserved, psilopsid plants were found.

The party then travelled south-westwards along the A4067 towards Abercraf. A brief stop was made at Pont Gihirych (SN 887211) to observe the mid-Devonian unconformity between the Plateau Beds and the Brownstones on the Fan Hir (SN 832200) and Fan Gihirych (SN 886190) escarpments. Continuing south-westwards the party assembled at Pwll-coediog farm (SN 849164) and walked to Nant Byfre (SN 851164). In this stream section the Upper Old Red Sandstone Plateau Beds and Grey Grits succession was studied. The Plateau Beds were seen to be composed of red-brown sandstones and siltstones and were overlain by grey, quartz conglomerates and coarse, grey sandstones of the Grey Grits. In the Plateau Beds about 1 - 2 m below the base of the Grey Grits a thin horizon of friable sandstone, 40 mm thick, yielded plates of the armoured placoderm *Bothriolepis* and also specimens of the brachiopod *Cyrtospirifer verneuili*. About 4 m below this horizon another thin friable sandstone yielded additional fish plates. Some trace fossil burrows were also noted in the sandstones above this second fish bed.

After lunch the party assembled at Craig-y-nos Castle (SN 840154) and proceeded up the track on the north side of the A4067 to Nant-y-gwared farm. From the track the folding associated with the Swansea Valley Disturbance was observed on Craig-y-Rhiwarth (SN 844157 text-fig. 2a) and at the north-east end of Cribarth (SN 839151 text-fig. 2b). In a dry gully



Text-fig. 2. a. Section across Craig-y-Rhiwarth
b. Section across the north-eastern end of Cribarth

TABLE 2 Succession at the upper end of the Neath Valley

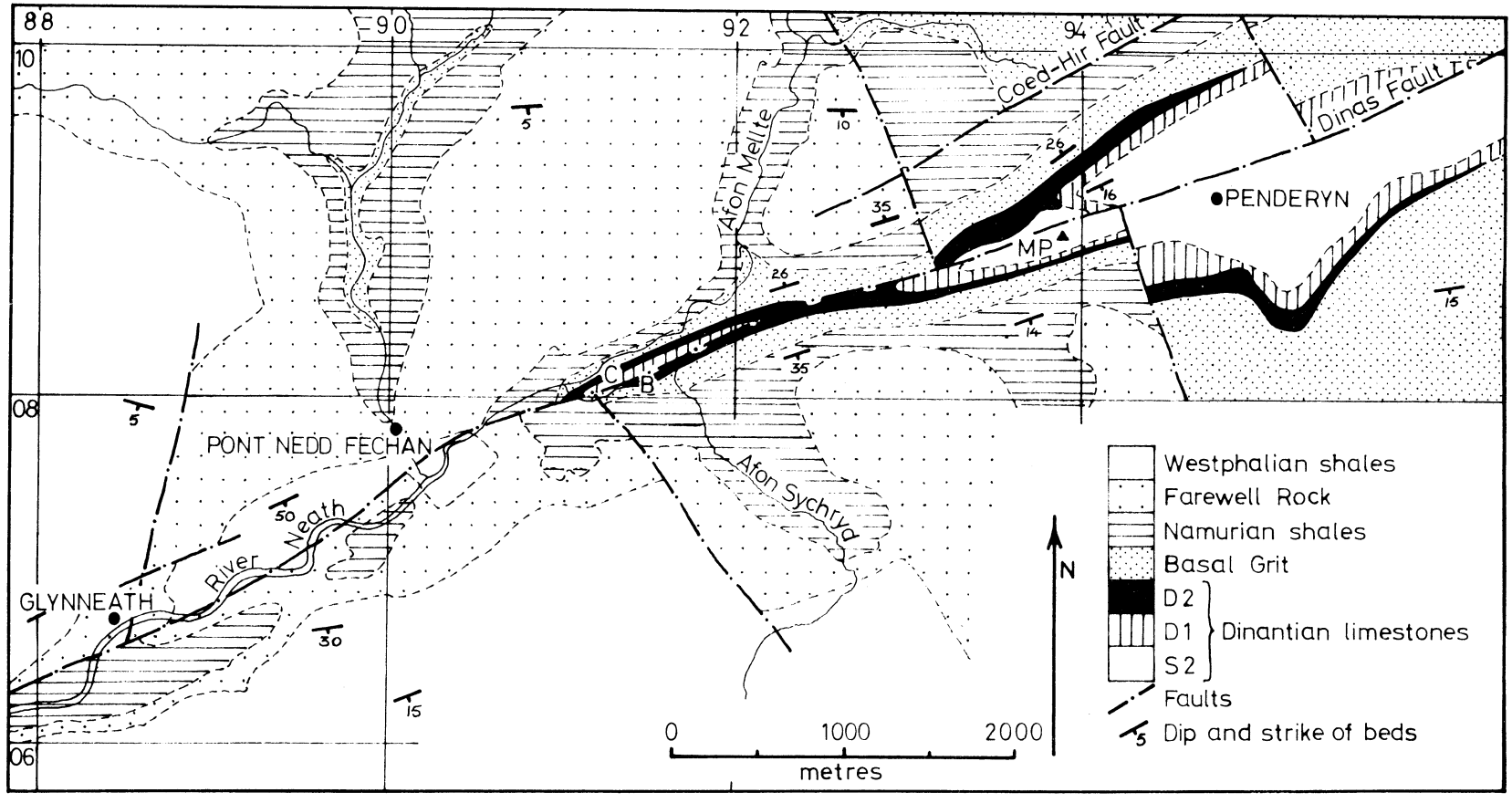
			Thickness in metres
CARBONIFEROUS	WESTPHALIAN	"Farewell Rock"	40 - 60
		Gastrioceras subcrenatum Marine Band	
	NAMURIAN	Shale Group	45 - 60
		Basal Grit	35 - 45
		Unconformity	
	DINANTIAN	D_2 Dark limestones	0 - 18
		D_1 Light oolite (Honeycomb Sandstone at base)	6 - 18
		S_2 Dark-grey limestones	90 - 120
		Z & C_2S_1 Rubbly limestones, oolite and dolomite	16 - 26
		K shales and limestones	24 - 30
DEVONIAN	UPPER O.R.S.	Grey Grits and Plateau Beds	45 - 60
		Unconformity	
	LOWER O.R.S.	Brownstones	at least 450

(SN 836155) running north-westwards from the farm a near vertical sequence of Carboniferous Basal Grit and D and S_2 zone limestones is seen. The inclination of the beds at this locality has been produced by the faulting. The Basal Grit is seen to be composed of coarse siliceous sandstones and quartz conglomerates. They are underlain by black calcareous shales and thin limestones of the D_3 zone, which are poorly exposed. Better exposure of these beds is found in the stream section, about 125 m south-west of the farm, where they yielded various brachiopods including *Eomarginifera longispina*, zaphrentid corals and crinoidal debris. Specimens of the trilobite *Griffithides* c f. *barkei* have also been found at this locality. In the dry gully the D_2 zone limestones are well exposed and consist of black siliceous limestones with nodules of chert. These are underlain by the D_1 light grey oolitic limestone, which is faulted against S_2 zone grey, crystalline limestones, yielding *Composita sp.* and some solitary corals.

The party travelled to Penwyllt (SN 854158) on the eastern side of the Tawe Valley and examined the limestone sequence and overlying Basal Grit in a line of quarries extending from SN 856160 to SN 855151. The most northerly of these quarries displayed the uppermost part of the K zone limestones and thin shales and the basal part of the S_2 zone limestones. Although the Z, C_1 and C_2S_1 zones are absent the junction between the S_2 and K zones appears to be conformable. About 2 m above the base of the S_2 zone a band of corals, about 0.3 m thick, showed good examples of *Lithostrotion martini* in life position. Other corals were collected from these limestones including *L. junceum* and *Syringopora*. Many brachiopods were also found including the zone fossil *Composita ficoides*. Walking southwards the party passed the main working quarry, which is in the middle part of the S_2 zone, and visited two small quarries, the first in the D_2 cherty limestones and the second in the Basal Grit. Heavy rain did not encourage a lengthy stay at these last exposures, but a well developed channel running N-S was observed in the Basal Grit. It was noted that the Basal Grit sequence here exhibited carbonaceous shales interbedded with sandstones and conglomerates.

On the return journey to Neath the party stopped briefly on the A4067 at Ystalyfera (SN 762078). From this vantage point the Upper Coal Measure, Pennant Sandstone Group, was observed to have slumped over the Middle Coal Measures on both sides of the valley. The most spectacular slump scars are seen on the south-east side of Mynydd Allt-y-grug, above the village of Godre'r-graig (SN 750070). Time did not permit a closer examination of the effects of this slumping in Godre'r-graig itself.

NOTE Permission must be sought from the farmers and quarry owners before visits are made to the localities listed above.

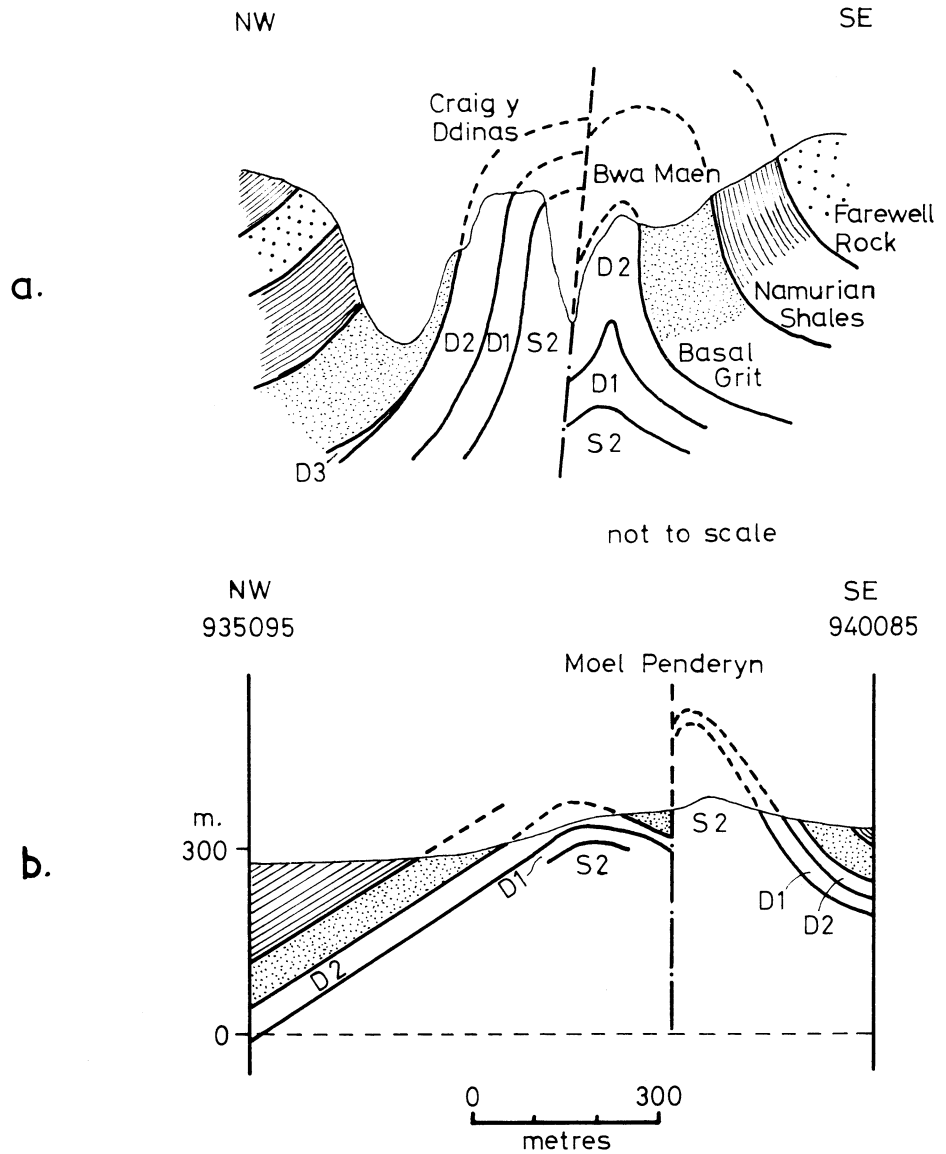


Text-fig. 3. The geology of the area between Glynneath and Penderyn, at the head of the Neath Valley (after Owen, 1954).

B. Bwa Maen C. Craig y Ddinas MP. Moel Penderyn

Sunday A study was made of the Carboniferous sequences exposed in the upper part of the Neath Valley (text-fig. 3 and table 2). The party assembled at the Angel Hotel in Pont Nedd Fechan (SN 901077) and then walked up the right bank of the Nedd Fechan and examined the exposure of the basal Westphalian "Farewell Rock" and the upper Namurian shales and sandstones. Channeling, cross-bedding and load structures were observed in the "Farewell Rock" in a continuous section for about 150 m north of the Angel Hotel. At the base of the "Farewell Rock" sandstones, the *Gastrioceras subcrenatum* Marine Band, which marks the base of the Westphalian, was examined. Fragments of uncrushed *G. subcrenatum* were collected as well as bivalves including *Dunbarella sp.*; *Anthracoceras arcuatilobatum* has also been found at this locality. Within the overlying sandstones numerous plant fragments were observed, some of which were identified as *Calamites*. About 50 m upstream, underneath the prominent sandstone, the "Cumbriense Quartzite", a second marine horizon, *Gastrioceras cumbriense* Marine Band was investigated. This band yielded a rich fauna of *Gastrioceras sp.*, bivalves, brachiopods and plant fragments.

From here the party proceeded on foot along the right banks of the Afon Mellte and Afon Sychryd to Craig y Ddinas (SN 915079). In the exposures of Craig y Ddinas and Bwa Maen (bow of stone) and S_2 and D zone limestones are seen folded and steeply dipping along the line of the Dinas Fault (text-figs. 3 and 4a). Bwa Maen is seen to be an impressive anticline and like the folds along the Swansea Valley Disturbance it is related to the faulting of the Neath Disturbance.



Text-fig. 4. a. Section across Craig y Ddinas and Bwa Maen (after Owen *et al* 1965)
b. Section across Moel Penderyn

After lunch the party proceeded by car to Penderyn (SN 947089) and then on foot to Moel Penderyn (SN 939088) where a sequence of the S_2, D_1 and D_2 zone limestones and the lower part of the Basal Grit was examined on the north side of the anticline (text-fig. 4b). The S_2 limestones are exposed in two large quarries near the farm. They are composed of dark-grey limestones in the lower part of the sequence, becoming lighter in colour near the top with the development of pisolitic and oolitic horizons. The upper 20 m of these limestones yielded a rich fauna of corals and brachiopods including *Syringopora*, *Lithostrotion* and *Composita*. The base of the D_1 zone is marked by a calcareous sandstone known as the "Honeycomb Sandstone" (0.5 m thick), which weathers to give a honeycombed appearance. This horizon, which is found over a large part of the north crop of the coalfield, indicates the influx of detritus probably resulting from uplift of the land area to the north. The overlying D_1 zone limestones consist of light grey oolites with bands of productid brachiopods, mainly *Linoproductus hemisphaericus*. Continuing north westwards, outcrops of the D_2 zone dark grey limestones are seen above the track. One specimen of the trilobite *Griffithides sp.* and a number of productids were collected from these limestones. No exposure is seen of the D_3 zone and the Basal Grit quartzites and quartz conglomerates appear to lie directly on the D_2 zone limestones.

The party walked southwards over the northern side of Moel Penderyn into a large quarry, where the S_2 zone limestones are faulted against the Basal Grit (text-figs. 3 and 4b), along the line of the Dinas Fault. The Basal Grit at this locality is highly sheared and shattered.

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