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## Chapter 35 Coal-mining

### Its history

How the existence of Coal Measures in the alluvial Vale of Maldraeth, then for the most part an inlet of the sea, was first discovered has not been ascertained. Possibly the Carboniferous Limestone may have been recognised, and have suggested it. At Trefdraeth an actual outcrop of the Glantraeth coal may have been struck in the course of farm-draining. But the Coal Measures have been known for ages. A licence to mine for coal at Berw was granted by the Crown to one Llewelyn ap Rhys ap Tudor (a scion of the subsequently royal house) in the year 1450. This expired in 1532, and then King Henry VIII. granted a 40 years' lease of the mines at Esgeifiog to William Sackville for a rent of £7 8s. 8d., 'with lycens to take and sell carbones marittimos'. Several more leases for Berw mining were granted in the course of the sixteenth century, the last of them (which was for a mine by Llanfihangel Esgeifiog Church) being transferred in 1596 to Owen Holland of Berw, a name still preserved in the district as 'Holland Arms'. The agreement states that 'the said Holland, his heirs and assigns, may att all times make and digge up so many coal pittes as the said Owen Holland shall think fitte', but provides that 'no pitt shall be dug in a cornfield without warning the tenant before the corn be sown'. About the year 1610 one Chedle of Lledwigan diverted the course of the Cefni river, which brought about a flooding of the mines, and led to litigation, but mining seems to have been resumed, for there is a reference to it as late as 1642. No more details have been obtained concerning that period, and it is probable that floods recurred and put an end to the work.

Mining seems then to have been abandoned for a long time, and the existence of the coal well nigh forgotten. Lentin, describing the treatment of the ores at Parys Mountain, writes, in 1799, that coal (Steinkohle) had to be 'brought by sea from the neighbouring parts of England and from South Wales, because none has been found in the Island itself'. It is clear, moreover, that by 'Steinkohlen' he means coal in general, not anthracite in particular, for he presently remarks that the roasting of the ores had, 'for lack of brushwood' ('aus Mangel an Holz'), to be carried out with 'Steinkohlen'.

A few years after Lentin's visit, however, the coalfield was rediscovered (very likely by means of the old records that have just been quoted), and the first of the modern mines was opened about the year 1810. A company of local farmers had a pit sunk not far from Glantraeth, and raised coal for many years. It was not of good quality, and so they sank another pit near Ty n-y-ffiat. They moved their machinery thither, and it is said that all the horses of the district were collected to drag one big boiler to the new pit. The quality of coal was much the same, but there was a great local demand for it, and 'the roads were blocked with herds of donkeys each with his load of about a bushel and a half'. After a while this mine also was abandoned. An English company then sank a pit near Pencrug, where the supply and quality were again the same; but this mine continued in work till 1868 or 1870. Another company opened a pit close to this about 1828, and continued working a little longer than the others. This was the last pit of any consequence worked in Trefdraeth. A lease taken out in 1874 was not worked. Soon after the discovery at Trefdraeth, coal was rediscovered near Holland Arms, the Berw mine, were opened again, and worked until about 1865, when the waters broke in and flooded them once more. The chimney of their Old Engine Shaft is still a feature in the landscape. The mines along the slopes to the north-east are said to have been reopened rather later, though worked as late as 1870. After the Berw sinkings came those at Morfa-mawr in the midst of the marsh, worked from about 1850 till 1875. Since that time no coal seems to have been obtained, but a good many borings have been made from time to time, and one is now (1911) in progress.

### Output and quality

The output of Berw mine in 1850 was about 2,300 tons, that of the whole coalfield in 1857 about 4,500 tons. Little information is forthcoming as to quality. The Glantraeth seam is said to be small slack, breaking up'. Two feet of the Morfa-mawr 8-foot seam are reported to have been 'good', though elsewhere stigmatised as of 'poor quality'. A recent note on the 2-foot 3-inch seam of Berw describes it as 20 inches fine steam-coal, with six inches cannel ' at the top. The 9-foot seam of Berw, and a few thin ones, are termed 'Glo-pux', *i.e.* 'coal in lumps. and unworkable'. All that was raised appears to have been used for household purposes alone. Although metallurgy was in active progress at Parys Mountain for some time after the rediscovery of the coal, none seems to have been sent there, probably because of the difficulties

of transport over-land at that time.

## Details of the mines and seams

Records (most of which were kindly supplied by Lord Boston, the late Hon. Lady Neave, the late Lady Reade, Mr. T. Prichard acting on behalf of the Bodorgan Estates, and the Menai Colliery Company) of 24 shafts and borings, with a number of plans and sections, have now been obtained: from which, in a space of only some nine square miles, a tolerably clear picture might have been expected. But the positions of seven of the borings are not accurately known; and from the descriptions given it is often difficult to gather a clear idea of the nature of the beds, of the position of the base of the Red Measures, or even of the depths of Glacial Drift and Alluvium. The old workings do not seem to have been shown to Ramsay, or any of the boring-cores to any geologist. Many records have been lost altogether, and such as exist are not always consistent with each other. In addition to these difficulties; the absence of all surface features, the great accumulations of boulder-clay and marine alluvium, and the burial of a full half of the outcrop of the productive Coal Measures beneath the Red Measures, combine to render this little coalfield unusually obscure.

Summaries of what is known of the several tracts that have been mined or bored will now be given, after which all the recorded seams will be tabulated, in what appear to be their relative positions (p. 819), and a few general considerations put forward. For further detail's the documents themselves must be consulted. Copies of most of them are preserved in the offices of the Geological Survey—These include the following: 1. Certain plans. 2. Reductions of plans upon the six-inch maps. 3. A one-inch map upon which the positions of all the known shafts and borings are shown. 4. Horizontal sections at Glantraeth and Iterw mines. 5. Shaft and boring records, giving the details of the strata. 6. Twenty-two skeleton vertical sections (made by Mrs. Greenly) giving the positions of the coal seams in the several shafts and borings, in so far as they are known, all brought to one scale. Six of them are reproduced on page 817. All details given in this chapter should be read in connexion with the accounts of the Millstone Grit, Coal Measures, and Red Measures that will be found in Chapters 24–26, as well as with such parts of Chapters 22, 23, 27, 31, 32 as deal with the adjacent country.

## Holland Arms and Berw

In this district alone, and here only among the old workings to the north-west of Plâs Berw, are the succession and the structure known in any detail. A reduction from the plans will be found in (Figure 343), while the first two columns of the Table on p. 819, compiled from all available sources of information, may be regarded as reliable. Even Berw is not without its discrepancies. The 'Anglesey Colliery Company's Engine Shaft' (assigned on one plan to 'Taihirion Colliery', though certainly a Berw shaft) agrees, in so far as the four chief (the 3-foot, 4-foot, 6-foot, and 2-foot 3-inch) seams are concerned, with 'Berw Engine Pit', and is manifestly the 'Old Engine Shaft' shown in (Figure 343). The characters assigned to the intervening beds also agree for the most part, but in the 'Berw Engine Pit' record the 9-foot seam is omitted, and a 1-foot 6-inch seam inserted between the 4-foot and the 6-foot seams. It is evident, moreover, from the plan, that the nature of the western faults is uncertain. The larger of the two curiously curved faults is assigned, where it is crossed by the section of the mine (which runs north-east and south-west), a downthrow to the east of 408 feet, and the fault running nearly west-south-west which is tangential to it a downthrow to the south of 207 feet. The tract to the east and south of these two faults has been well worked, and the succession, as far down as the 2-foot 3-inch seam, shown in the Table, is based upon the evidence obtained therein. At the New Engine Shaft, however, which is situated 220 yards south-west by south from the Old Engine Shaft, a 1-foot seam is mentioned, about 30 feet above the 3-foot seam. The 9-foot seam is said by Ramsay to 'lie in lumps, and unworkable', just at the base of the Red Measures, and although, in one record, 15 feet of 'shale' are shown above it, they may be Red Measure marls. A tract on the north side of the tangential fault, the beds dipping at 18° or 20° towards it, was also worked. Here the 2-foot 3-inch and 6-foot seams appear to have been the only ones found, the latter having been worked, it is said, at a depth of 180 feet. In this part of the mine-section the base of the Red Measures is shown just below the horizon of the 4-foot seam, — this transgression being represented as quite sudden, and as coincident with the fault, indicating (provided the section be reliable) that the fault is partly earlier, partly later than the deposition of the Red Measures. The 2-foot 3-inch and 6-foot seams, and also the Red Measures base, are shown as out-cropping to the north, but as another fault is laid down on the plan, and two more are spoken of by Ramsay, this must be regarded as doubtful. Towards Llanfihangel Esgeifiog no definite records have been obtained, but it is unlikely that the upper seams can be taken in; though Ramsay considered it

possible that the 6-foot coal might rise below the Red Measures for a little distance.

To the west of the curved fault, in a boring called 'No. 6' (300 yards south-west of the New Engine Shaft) a 1-foot 7-inch coal is recorded at a depth of 240 feet; and in 'No. 1' (467 yards further to the south-west) a 6-inch coal at a depth of 289 feet, and a 1-foot 2-inch coal at a depth of 314 feet, while a 'Taihirion' ('No. 1a') boring, which nearly coincides with it, reached a 3-foot coal at 443 feet. Five borings are stated to have been made in this tract, but the position of No. 4 is given differently in two different plans. All sources of information agree as to the existence of a fault coincident with a dyke, but they do not agree as to its position or as to its relation to the curved fault.

### **Morfa-mawr**

At this colliery, variously known (after the farm-lands) as that of 'Berw-uchaf' or 'Taihirion', some 70 feet of Red Measures were passed through, and then 60 feet of Coal Measures, beneath which was the 7-foot 6-inch (usually called the 8-foot) coal, described as being split by two partings. In some notes on one of the Berw plans, the following seams are said to exist at Morfa-mawr: 6-inch, 1-foot 6-inch, 2-foot, and 8-foot, in descending order, and the dip is given as '1 in 6'. An oil-shale is also recorded. The 8-foot seam has not been met with elsewhere, and may be impersistent, though Ramsay suggests that it may outcrop in the north-eastern part of the coalfield. A series of ten 'Taihirion' borings is also laid down on an old plan, distributed along more than two miles of strike, and the records of six of these have been preserved, but unfortunately their positions cannot now be identified with accuracy. Nos. '6 and 7' appear to be identical with the Hendregadog boring quoted on p. 676, where the Red Measures pierced by the others are also given. Only 'Nos. 1 and 1a' pierced any coal, and these did not reach the 8-foot seam. Both show a 1-foot 2-inch seam, which would appear to be the same in the two cases. No. '1a', which shows also a 3-foot coal, nearly coincides with the Berw boring 'No. 1'. But there is a much greater distance between its two seams than between the 1-foot and 3-foot seams of the upper part of the Berw succession, and it is not at all likely that the 3-foot seams are identical. If we may rely on the Berw records, the horizons pierced in these borings must underlie the lowest of the Berw coals; and would appear to occupy a position between those and the 8-foot seam, an interval to which a probable thickness of 300 feet was assigned by Ramsay. Between Morfa-mawr and the river a coal is said to crop out under 60 feet of superficial deposits, which gives a limit to the outcrop of the Red Measures. A dyke is reported to have been met with in this colliery as well as in Berw.

### **Glantraeth and Malldraeth**

These are the workings in the Millstone Grit, the coal in which, called the 'Glantraeth seam' (p. 662), has been followed as far as Pen-crug-bach. An old section of the 'Marquis Colliery', situated on the north-west side of the river near Ty'n-y-fflat (with a scanty plan giving the positions of the three shafts), which has been preserved, is evidently not a measured but a sketch-section. Shales appear at the top, resting upon a massive sandstone (clearly the upper part of the Millstone Grit), and that upon alternating sandstone and shale. Three coals are shown in this alternating group, and it is not clear which of these is the 'Glantraeth Coal', elsewhere spoken of as a single 2-foot 3-inch seam. The upper shales are drawn as if unconformable to the massive sandstone, which dips at some 20°. The deepest shaft is given as 210 feet, which, according to local information, was the maximum depth of the Glantraeth sinkings. About the year 1903, a 200-foot boring was made near Fferam, about 200 yards out into the marsh; and a 135-foot boring about 300 yards 'higher into the mainland from edge of marsh'. The bottom of the latter cannot have been much above the limestone. Nothing but sandstone with seine shale appears to have been met with, except an ironstone about 15 feet from the bottom of the first one. A boring has also been made through the sand of the estuary about five-eighths of a mile south-west of the bridge at Malldraeth Yard, which, after passing through some sandstone, met with a six-inch ironstone, described as very tough. The depth is not stated, but the siderite of the Millstone Grit, mentioned on pp. 661–2, might be expected there at about 100 feet. A light yellow variety is said to have yielded 30 per cent., and a red variety 40 per cent. of 'iron', which is unusual in the Coal Measures, most of whose ironstones are very argillaceous.

### **Pen-y-bont end Tryddyn-isaf**

Three borings have recently been made on the south side of the main line of railway. On pp. 676–7 (where they are lettered 'N', and 'O') their positions are given, together with the depths of Red Measures which they pierced; while the details of the Coal Measures pierced by 'N' will be found on pp. 663–4. 'O', which we have called (p. 677) the Liangaffo

deep boring, is by far the deepest yet made in this coalfield, having been carried down to 1,309 feet by the end of the year 1912. In 'M' (where Red Measures are absent) the beds were horizontal to 214 feet, below which there was a dip of about 14°, suggesting an unconformity in the midst of the Coal Measures, already vaguely suggested in the Marquis Colliery section, though the horizons do not appear to correspond, and the change of dip may possibly be due to undetected faulting. The general character of the beds is the same in all three, some of the shales in the upper part of M being described as oily, while all record thin coals or cannels which may easily be impersistent. The thicker coals recorded are: a 1-foot 5-inch seam 'M' at 234 feet (about 20 feet below the supposed unconformity); a 2-foot 3-inch seam in 'N' at 762 feet; and a 2-foot 3-inch seam in 'O' at 880 feet. Yet the two latter cannot be identical, for though both borings (which, measured across the strike, are hardly 300 yards apart) show some 50–80 feet of grey sandstones, these are above the 2-foot 3-inch coal in 'N' and below it in 'O'. Nor is it easy to correlate them with other seams of that thickness. With lowering of the dip and possible faulting, the Glantraeth coal might be found in one or other of these positions, but even in N the overlying grey sandstones (p. 664) are far too much interbedded with shales to correspond to the massive Millstone Grit of the Marquis Colliery, unless that bed changes much more rapidly across than along the strike. The structural objections to correlating either of them with the 2-foot 3-inch seam of Berw appear to be insuperable. Even could they be overcome, other Berw seams would have been pierced in 'N', which they were not; while in 'O', not only would the Berw 6-foot seam be due to appear seven feet below the base of the Red Measures, but the intervening strata quite fail to correspond. On the other hand, the 8-foot seam of Morfa-mawr has not been met with in even the most easterly of these borings. In the table, therefore, the beds are conjecturally placed in the little-known interval between the Glantraeth and Morfa-mawr groups, but this must be regarded as merely provisional. Fossils, which might perhaps have thrown light upon the problem, do not appear to have been looked for; and the matter must await further investigation.

### Tabulation of the seams

The records contain, in all, mention of the following seams, tabulated below according to their districts, and as nearly as can be made out, in descending order; the general succession being added so as to show their approximate positions.

Generalized succession	Berw Workings		Berw West Workings		Morfa-mawr		Pen-y-bont and Tyddyn-isaf		Glantraeth			
	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches	Feet	Inches		
Coal	9	0	(9	0)	—	—	—	—	—	—	—	—
Shale	51	0	1	0	—	—	—	—	—	—	—	—
Coal	3	0	3	0	—	—	—	—	—	—	—	—
Shale	63	0	—	—	—	—	—	—	—	—	—	—
Coal	4	0	4	0	—	—	—	—	—	—	—	—
Sandstone and Shale	75	0	—	—	—	—	—	—	—	—	—	—
Coal	1	6	(1	6)	—	—	—	—	—	—	—	—
Shale	43	0	—	—	—	—	—	—	—	—	—	—
Coal	6	0	6	0	—	—	—	—	—	—	—	—
Sandstone and Shale	90	0	—	—	—	—	—	—	—	—	—	—
Coal	2	3	2	3	1	7	—	—	—	—	—	—
Sandstone and Shale	—	—	—	—	1	2	1	2	—	—	—	—
Sandstone and Shale	300 [combined with above/below]	0	—	—	—	—	3	0	—	—	—	—

Sandstone and Shale	—	—	—	—	—	—	2	0	—	—	—	—
Coal	8	0	—	—	—	—	8	0	—	—	—	—
Sandstone and Shale	—	—	—	—	—	—	—	—	2	3	—	—
Sandstone and Shale	450	[combined with above/below]	0	—	—	—	—	—	2	3	—	—
Sandstone and Shale	—	—	—	—	—	—	—	—	1	5	—	—
Millstone Grit	200	0	—	—	—	—	—	—	—	—	—	—
Coal	2	3	—	—	—	—	—	—	—	—	2	3
Millstone Grit	200	3	—	—	—	—	—	—	—	—	—	—

The succession as far down as the 2-foot 3-inch seam of Berw is tolerably reliable, and so is that in the Millstone Grit, but between these positions can be given only in general terms: Of the seams tabulated, the only ones that appear to have been worked, at any rate with any success, are the 3-foot, 4-foot, 6-foot, and 2-foot 3-inch seams of Berw, the 8-foot seam of Morfa-mawr, and the Glantraeth seam. Those placed in brackets are described as 'Glo pux', that is 'coal in lumps, unworkable'.

The principal seams appear to be on definite palontological horizons (see Chapter 24), but time true positions of the others are uncertain. Those of the borings west of Berw, and the thinner seams of Morfa-mawr, are probably on various horizons between the Berw seams and the 8-foot seam, but it is not at all certain that those of the same thicknesses really correspond. So far as can be made out, those in the new borings to the south of the main line of railway are likely to be lower down. The truth is that the beds between the three principal horizons (of Berw, Morfa-mawr, and Glantraeth, defined in Chapter 24) are very imperfectly known, and reliable correlations within them are not yet possible. The position of the Glantraeth coal in the Millstone Grit is fairly definite, but whether it be one seam or three is not clear. Nor is there any reliable information as to whether it, or the 8-foot seam of Morfa-mawr, persist to the north-east end of the Coalfield. Some thin ironstones and oil-shales have also been met with in the borings, but their positions are, for the same reason, uncertain.

### Structure of the coalfield

The steady widening of the coalfield indicates that it is a syncline longitudinally bisected by the Berw boundary-fault, and deepening south-westwards, so that higher and higher beds might have been expected towards the south-eastern side of the south-west end. They do not, however, appear to have been met with in the Llangaffo deep boring, which may be due either to concealed faults or to a lowering of the general dip. If the dips given in the boring near Pen-y-bont are to be relied upon, there would appear to be an unconformity within the Productive Coal Measures themselves. See also below, concerning the relations of the Red Measures, combined with thickening of the Red Measures. Ramsay states that a fault with an upthrow to the south-west, in whose existence he is inclined to believe, and which may be identical with the Llangefni fault (p. 618), is reported to join the Berw fault somewhere to the west of Berw-uchaf. And the dip at Morfa-mawr is said in one account to be less than 10°, which is much lower than the average dip (Figure 343) at Berw. There is also reason to suspect the existence of two strike-faults at the north-east end of the valley. The position of the sandstone by the little stream to the north-west of Hirdrefaig is anomalous, and may be due to one such fault, though it is not likely to be large. But the anticline that brings up the Mona Complex at Bryn-gwallen must be a faulted one, and the faults may be considerable. The features are manifestly due to faulting, and no Carboniferous basal beds have been

found to skirt the inlier, between which and the necessary position of the Millstone Grit there is not room for the thickness of the Limestone Series that is known to exist in that district. Very likely the two boundary-faults neutralise each other to some extent when they meet, but the dips of the limestones near the road by Hirdrefaig indicate that a fracture continues, with a downthrow to the south-east.

### **The relations of the Red Measures**

The effects of the unconformity at the base of the Red Measures, evidence of which is given on pp. 672–3, are of economic importance. The boring-records on pp. 676–7, especially the great depth (700 feet) of these beds found in the Llangaffo deep boring, indicate that they are thickening rapidly towards the sea. Even in the northern part of the Berw mines, their base is said to be just below the 4-foot, and at Morfa-mawr to be only 60 feet above the 8-foot coal, while in the south-western borings it would appear to have passed below that seam. The absence of the upper parts of the Productive Coal Measures, remarked on above, and indicated (pp. 666–7) by the fossil evidence, may therefore be ascribed to their having been removed by erosion before the Red Measures were deposited. The condition of the 9-foot seam at Berw (pp. 815, 820) is suggestive of such erosion. But some seams at lower horizons are described as being in the same condition. Since Chapter 25 was written, confirmation of this view has been obtained in the Flintshire Coalfield, where Mr. Wedd *Sum. Prog. Geol. Surv.* for 1912, pp. 14, 15. finds that an important part of the productive measures, including the main and two lower coals, has been removed by erosion, and that its place is occupied by an unconformable barren red series whose characters correspond to those of the beds described in that chapter. Further (Figure 304) and pp. 670, 672–3), there is every reason to believe that in the Menai country the Productive Coal Measures were swept away altogether, and that the Red Measures repose directly upon the Carboniferous Limestone. The contents of the Llanfair-is-gaer and other conglomerates (pp. 669–70) even suggest that, in the west, where the Limestone was thin or absent, the Sub-Carboniferous floor itself was laid bare. The presence of the Red Measures, therefore, is no proof whatever of the presence of the productive series. Nor must anyone be misled by any thin coals that may, as reported (p. 673), exist in the former. Two such coals, one of which is a foot thick, are known in them at Flint (*loc. cit.*), and yet the series is described by Mr. Wedd as 'barren'.

### **Concluding considerations**

In any undertakings in this coalfield, the said unconformity, and two other matters of the first importance, should never be overlooked. The whole valley is heavily waterlogged. It is really an arm of the sea, and it receives in addition the drainage of a large part of the Island. Very little of the outcrop of the Coal Measures is above sea-level. This difficulty was met with in all the old mines, and all future ones must be prepared to encounter it. Secondly, from the very great displacement of the Berw fault (pp. 680–1), which bounds the coalfield on the south-east, it is probable that the Coal Measures are a good deal more fractured than is at present realised. Unknown faults, therefore, are to be expected, possibly in considerable numbers, and some of them, possibly, of considerable magnitude. From the obscurity of the ground, they give no indications at the surface, and will have to be investigated at the expense of the undertakings.

A time will come when the greater coalfields of Britain have been far more exhaustively worked than they are at present, and the development of such fields as this one will no doubt then be pursued with eagerness and become a real public benefit. Perhaps, in the interests of the community at large, postponement until then might be the wisest policy. In the meantime, if any works are undertaken in it they should be conducted with very great caution.

Finally, it may perhaps not be superfluous to add that the presence of dark shales in other formations has often led, to fruitless mining for coal, with severe loss to those concerned. A case of the kind, in Ordovician rocks near Carnarvon, is recorded by Ramsay. *'Geology North Wales' (Mem, Geol, Surv.)*, ed. 2, p. 198. Also, Sir A. Geikie's *Life of Ramsay*, p. 148. Dark shales of the Ordovician system occur in the immediate vicinity of the Anglesey Coalfield (pp. 434–5), especially towards the north-east, and should on no account be mistaken for the Coal Measures. Dark and carbonaceous beds, indeed (accounts of which will be found in this book), are not uncommon among the older rocks of Anglesey, which underlie the Coal Measures. Thin coaly seams may even, as we have seen, exist in the overlying Red Measures as well. But there is not a shred of evidence that workable coal exists in any part of the Island outside the Vale of Malldraeth.

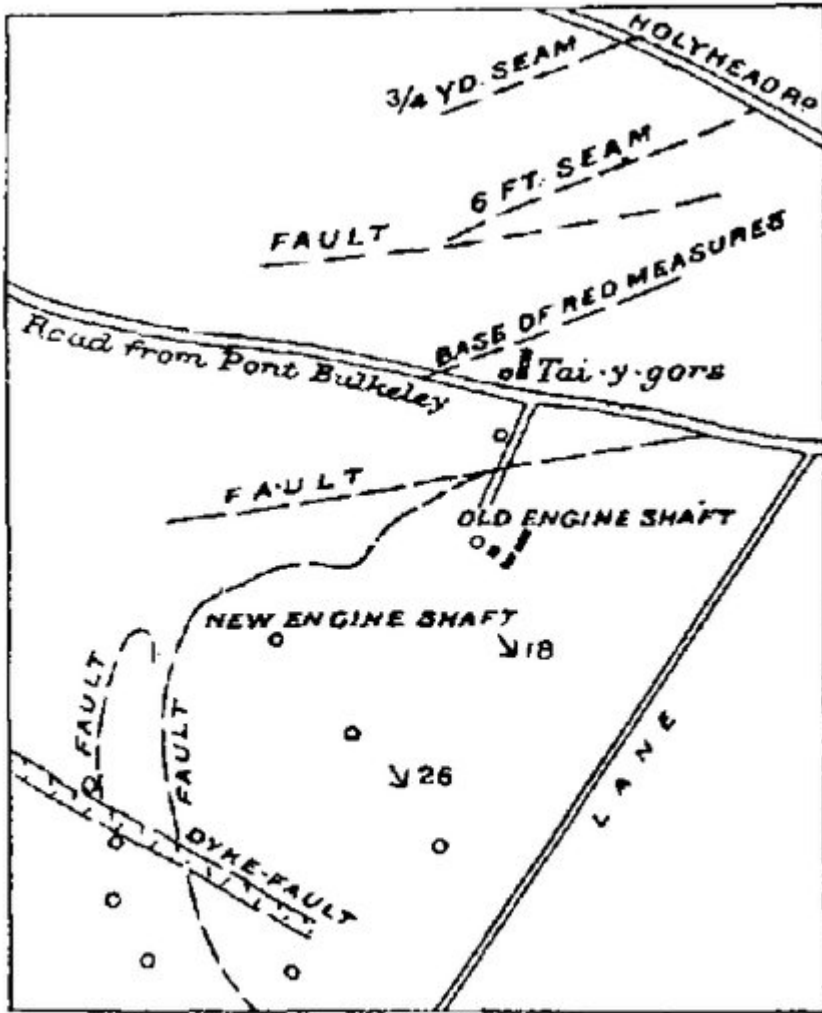


FIG. 343.

THE COAL MEASURES AT BERW.

(Figure 343) The Coal Measures at Berw. Scale: four inches = one mile.



**FIG. 304.**  
**POLYZOON FROM**  
**PEBBLE IN RED**  
**MEASURES. × 12.**

*(Figure 304) Polyzoon from pebble in Red Measures. × 12.*