

NOTES REGARDING THE EXISTENCE OF LOWER
COAL MEASURES AT PORT CYGNET AND
HAREFIELD.

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PORT CYGNET.

Recently the author has had an opportunity for examining the geological features of the country lying between Port Cygnet, Garden Island Creek, Mount Cygnet, and Long Bay. The evidences gathered have enabled him to determine that the Mount Cygnet coal measures are the equivalents of the Adventure Bay group, and consequently they must be classed with the upper division of the lower coal measures. The plant remains associated with the coal seam are very abundant, although almost restricted to one form, viz., *Vertebraria australis*. The only other associate discovered rarely is a dwarf form of *Gangamopteris*, probably identical with *G. spathulata*, M'Coy. The absence of *Næggerathiopsis*, *Glossopteris*, and *Schizoneura*, of the lower division—so common in the Mersey on the one hand—and the absence of *Phyllothea* and *Sphenopteris*, so common in the upper division of the lower coal measures, as in the Newcastle coal beds of New South Wales—on the other hand—suggest that the Mount Cygnet beds form an intermediate group; the typical plant, *Vertebraria australis*, of the group indicating the closer affinity with the Newcastle group. The coal beds of Mount Cygnet immediately overlie the upper palæozoic marine beds, and conform with them in the dip to the south. This position is the exact parallel of the Adventure Bay coal measures. There is evidently a very great stratigraphical break, therefore, between the Mount Cygnet coal measures and those of the Sandfly under Mount Grey, lying against the same greenstone axis at a greater height a few miles to the north.

The crest of Mount Cygnet is composed of greenstone, as in the main spur forming the divide running southward from the slopes of Mount Wellington to its termination near Three Hut Point. From Mr. Ford's mill at Garden Island Creek it presents a low, rounded, conical appearance, rising to a height of about 900 feet from a horizontal sandstone

terrace, the remains of which are also found forming escarpments here and there against the neighbouring greenstone spurs on both sides of the main divide. Some of these sandstones of the lower coal measures are found in a nearly horizontal position or with a slight dip to the south, at an altitude of nearly 600 feet along the cuttings of the Garden Island Creek tramway, leading upwards in the direction of The Gap to Long Bay.

The higher ridges are clothed with the prevailing trees of the blue-gum (*Eucalyptus globulus*), some of which attain immense proportions. The lower butt of one of these giants pointed out to the writer by Mr. Ford measured about 55 feet in circumference.

The coal seam of Mount Cygnet is worked by an inclined adit or drive on the northern slope, near the bed of one of the tributaries of Gardner's Creek, and the coal is carried a distance of about two miles westward by a wooden tramway to the jetty at the township of Welsh, near Port Cygnet.

The main drive from the creek level follows the seam of coal, which averages about 2 feet 8 inches thick, at an angle of about 1 in 6, dipping S.S.E. into the mount. The extreme length reached by this main drive at present is about $6\frac{1}{2}$ chains, and in this distance two step faults running east and west have been met with successively, throwing down the seam 2 feet 3 inches and 2 feet respectively without materially affecting the angle of dip. The coal measures have been pierced near this spot by several bores, and the evidence collected shows that they are frequently faulted and dislocated to a very considerable extent. The slopes along the valley have been subjected to much denudation, and hence it is difficult to predict, with anything approaching certainty, the exact position where the coal seam may be struck, even in the immediate vicinity of the present workings. It is also impossible to say, at present, whether there is more than the one seam, as no bore has yet pierced beyond the first one met with, and in each case the seam so reached appears to be identical with the one now being worked; for although the levels at which the coal seam was struck are extremely variable, the differences in absolute level are no more than might be occasioned by the angle of dip, and especially by the numerous faults and dislocations.

The seam at Mount Cygnet is invariably overlaid by a greyish flaggy sandstone, which, according to the extent of denudation, may be found from a few feet to 100 or 200 feet in thickness. Thus, although the seam at the workings crop out in the creek, a shaft cut to it about two chains from this

point on the slope of the hill shows the following section in a downward direction:—

	ft. in.	ft. in.
Grey flaggy sandstones, with occasional carbonaceous streaks	60	0
Shaly parting	0	1
Coal, slaty and anthracitic... ..	2	8
Coal glance, brilliant lustre	0	8 to 10
Greyish-black arenaceous and carbonaceous clod, very trace	0	4 to 0 18
Dark brownish clod and shales, full of impression of <i>Vertebraria australis</i> , <i>Gangamopteris spathulata</i>	} Unknown thickness.	

It is probable that the seam extends to the Garden Island Creek vicinity, where, judging from the prevailing dip, it may yet be found possibly at a much greater depth. It is interesting to observe that the writer also found what appears to be the sandstones of the system abutting against the greenstone axis at about the same vertical height on the eastern slope above Long Bay.

The study of the rocks about Port Cygnet presents very many interesting features. The low rounded hills in the neighbourhood of the township are, for the most part, composed of an intrusive felspar porphyry, there largely used for road metal. The felspar porphyries are very beautiful and extremely variable. The triclinic crystals of felspar with microscopical striated surfaces are most variable in size, colour, and abundance. The crystals are grey, white, yellow, or flesh-tinted, embedded in a pasty mass; sometimes normal in size, and thickly and uniformly distributed, at other times large and sparsely distributed. Intimately associated with the more pronounced forms of felspar porphyries is to be found a close-grained dark-greenish metamorphic rock of a chloritic appearance, streaked and marbled with greenish-white lines and blotches; nests of pyrites occurring in great abundance in the centres of the larger greenish-white blotches.

At Lymington, in the same locality, gold in an alluvial form has been worked with more or less success in the valleys associated with this porphyritic rock, and it is a question of much interest to ascertain by careful experiment whether the pyrites of the metamorphic rocks associated with the porphyry may not also be auriferous. Apparently no other rocks of an auriferous character are now to be found in the vicinity.

Traversing these felspar porphyries and associated metamorphic rocks southward in the direction of the lower coal

measures at Mount Cygnet, the following rocks are to be met with in ascending order:—

1. Felspar porphyries and associated metamorphic rocks.
2. Dark-blue, friable, shaly mudstones of Upper Palæozoic Age, quietly reposing upon the denuded surfaces of No. 1, dipping at an angle of 15deg. S.S.E.
3. Spirifer zone* of the Upper Pal. marine beds succeeding No. 2 along the course of Gardner's Creek, same dip as No. 3.
4. Fenestella beds* succeeding No. 3, same dip as Nos. 2-13.
5. Lower coal measures, succeeding No. 4, still bearing the same angle of dip.

The distance from No. 1 to No. 5 in a straight line may be roughly estimated at about three miles.

It will be seen, therefore, that the relation of the lower coal measures to the marine beds at Mount Cygnet corresponds closely to that of the Adventure Bay coal measures immediately to the south, towards which they dip.

*Species identical with the common forms at Variety Bay.

HAREFIELD, FINGAL BASIN.

Under the direction of Mr. Bateman a trial bore by means of the diamond drill was sunk recently at Harefield to a depth of about 723 feet in search of coal seams. Sections of this bore were submitted to the writer from time to time, and from the evidence of contained plant impressions and other fossils, it was clearly revealed that a thin deposit of the lower coal measures existed below the marine beds of Upper Palæozoic Age and directly reposing upon the common soft clay states of the district of Upper Silurian Age.

The following is an abstract of the principal rocks passed through in this bore:—

<i>Mesozoic.</i>	ft. in.
Surface soil, black clay, and drift	... 3 0
Sandstone 7 0
Shale 16 6
Sandstone 0 8
Coal 3 6
White band 0 10
Coal 1 3
Shale 2 1
Sandstone, with thin coal flakes...	... 12 0
Coarse sandstone 17 6

<i>Mesozoic.</i>	ft. in.	ft. in.
Sandstone	5 2	
Shale and coal	0 8	
Sandstone	15 7	
Shale and coal	1 0	
Coarse sandstone	1 0	
Shale	7 6	
Coal, with thin partings of sandstone ...	3 6	
Sandstone, with streaks of coal ...	18 0	
Black shale, including 2in. of coal ...	7 6	
Sandstone, with coal flakes	3 3	
Coal	2 9	
Black shale	7 0	
Fireclay and shale	2 6	
Black and blue shales, including 8in. coal and 1 foot of sandstone	6 6	
Sandstone, with coal flakes	1 8	
Sandstone	19 8	
Coal and black shale	0 6	
Grey sandstone	16 6	
Shale and fireclay	15 0	
Sandstone, with coal flakes	5 8	
Blue shale	3 6	
Coal	0 5	
Hard sandstone	1 4	
Black shale	3 6	
Sandstone	2 3	
Black shale and coal	0 4	
Dark sandstone	1 6	
Black and blue shales, including two thin partings of coal and one of sandstone	11 3	
Shale, with layers of sandstone	5 7	
Shale, including 1 foot coal	11 1	
Sandstone	5 0	
Dark shale and fossil wood	0 2	
Shale and fireclay	6 2	
Sandstone	1 0	
Shale coal and fossil wood	0 4	
Sandstone	2 0	
Shales, with fern impressions forming base of mesozoic rocks	2 0	

264 0

Carboniferous (Upper Pal.).

Upper Marine Beds.

Coarse and hard sandstone	13 2
Hard blue rock, with pebbles	16 6
Blue shale	40 5
Blue shale, with marine fossils	11 7
Blue shale	9 0
Conglomerate	2 0
Hard grey rock	6 6
Green sandstone	11 0
Conglomerate	1 0

	ft.	in.	ft.	in.
Fossiliferous limestone, with <i>Fenestella</i> , etc.	28	6		
Limestone and conglomerate	23	6		
Fossiliferous limestone and mudstones...	79	8		
Layers of mudstone shale and hard rock, with water-worn pebbles	13	7		
Hard grey rock, with pebbles	11	10		
Shale and sandstone	46	0		
Sandstone	8	8		
	—		313	0

Lower Coal Measures.

Conglomerate	1	0		
Soft shale	2	6		
Conglomerate	3	1		
Hard white sandstone	1	8		
Grey sandstone, showing coal stains ...	7	0		
Hard black shale	3	6		
Sandstone	3	8		
Dark sandstones	5	7		
Conglomerate	0	10		
Hard dark sandstone	2	10		
Conglomerate	0	4		
Hard black shale	1	5		
Conglomerate and sandstone	1	10		
Shale ; impressions of <i>Schizoneura</i> (?) ...	0	2		
Coal	0	1		
Hard black shale	4	4		
Sandstone, full of coal stains	57	11		
	—		97	9

Upper Silurian.

Soft grey foliated slates, pierced to a depth of ... 40 0

Total... .. 714 9

The foregoing section is of the greatest interest, as it forms one of the best evidences yet obtained regarding the stratigraphic relation of rocks of the Fingal basin. The particulars were most carefully tabulated by Mr. Bateman at the close of each day, and may, therefore, be depended upon as being fairly accurate.

It is clear, although, unfortunately, no important coal seams were met with, that the lower coal measures exist in this district below the *Fenestella* limestones and mudstones of Upper Palæozoic Age, and the existence of a very thin coal seam together with shales containing plant impressions akin to the *Schizoneura* and possibly *Gangamopteris* of the Mersey District indicate that the beds are probably the equivalents of the lower coal measures of the Mersey. It is of interest to observe also that the Mersey coal measures also repose upon Silurian rock, although in the latter district limestones are probably of Lower Silurian Age.

The following summary may be of further interest in showing the parallelism between the rocks of the two districts:—

<i>Mesozoic Rocks.</i>	Bore at Tarleton.* DEPTH.	Bore at Harefield † DEPTH.
1. Upper coal measures, with Thinnfeldia, etc. <i>Carboniferous System.</i>	Apparently absent	About 270 feet.
2. Upper Marine beds, with limestones containing <i>Spirifera</i> and <i>Fenestella</i>	Apparently absent	327 feet.
3. Lower coal measures, with <i>Gangamopteris</i> , <i>Schizoneura</i> , etc.	About 200 feet	98 feet.
4. Lower Marine beds	170 feet	Apparently absent
<i>Devonian System.</i>	Apparently absent	Apparently absent
<i>Silurian System.</i>		
5. Upper Silurian slates, grits, etc.	Apparently absent	40 feet where depth of bore reached.
6. Lower Silurian limestone.	Pierced 36 feet when drill withdrawn	

* Mersey district.

† Fingal district.

It is probable that the lower coal measures of the Fingal district are of limited extent, as the sections to the west and north do not disclose their existence. To the east an important fault, throwing up the older rocks, cuts them off. It would seem, therefore, that it is only possible for them to show greater development in a southerly direction—that is, towards the Fingal Tier, where the upper coal measures of Mesozoic Age are again largely developed, abutting against or underlying the greenstone rocks which characterise the greater portion of the crest and upper levels of the tier.