

REMARKS ON THE GEOLOGICAL STRUCTURE OF PART OF THE NORTH COAST OF TASMANIA, WITH SPECIAL REFERENCE TO THE TERTIARY MARINE BEDS NEAR TABLE CAPE.

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THE interesting collection of rocks and fossils recently presented to the Museum by Mr. Hainsworth, of Table Cape, calls for something more than a passing notice, and the occasion suggests a brief consideration of the succession of strata exhibited by the coast section from the Tamar to Circular Head.

Between the Tamar and Port Sorell, the Primary rocks are extensively developed. They consist chiefly of slates, schists, limestones, quartzite, and conglomerates, with a general strike to the N.N.W., and they are to be seen continually recurring with anticlinal and synclinal undulations along the whole line of coast from Badger Head almost to Cape Grim. So little is known of the palæontology of these rocks, that it is impossible to do more than hazard a conjecture as to their relative position or age; but they comprise representatives of rocks which show themselves near the Grampians in Western Victoria forming possibly the base of the Lower Silurian series or even of still older date, and they certainly range in an upward direction as high as Upper Silurian. Slight traces of gold have been found at various points, but there is a singular absence of the dykes and veins of true quartz, and other features which characterise the auriferous slates of similar age in other countries. Still, the absence of all trustworthy indications of the presence of gold in paying quantities has not deterred the "practical digger" from wasting his money and time in prospecting such localities as the head of Middle Arm on the Tamar, and even more unpromising spots. Very rich red and brown hæmatites, with other ores of iron, are met with at various points, and notably on the west bank of the Tamar, where they have been fully investigated and reported on by Mr. Gould. Thin veins of galena associated with sulphurets of copper and iron, and carbonates of copper, occur near the Leven, and though the surface indications in that particular locality are not encouraging, they may some day be found further inland developed in valuable lodes.

Resting unconformably on these Primary rocks and usually occupying the ancient valleys formed by their elevation are sandstones and shales containing thin seams of excellent coal. They are associated with calcareous beds containing *Spirifera*

Pachydomus and *Producta* in great abundance, with many other well-known Upper Palæozoic fossils. The resiniferous shale or dysodile of the Mersey, has also been proved by Mr. Gould to belong to this series. These coal measures have not yet been recognised as existing West of the Leven, having probably been removed by denudation. They may, however, be met with as the settlement of the land advances southwards from the coast.

The horizontally bedded conglomerates and breccias of very variable character and uncertain age which occur at intervals between Port Sorell and Table Cape appear to come next in geological order, but may belong to the last named series of rocks. They have occasionally been tilted and broken by intrusions of basalt, and perhaps of trap also, but this is less certain. They are chiefly composed of rolled pebbles and angular fragments of the Primary rocks and the plutonic rocks associated with them, and are usually held together by a strong silicious cement. At the mouth of the Inglis this formation is especially interesting. Large angular blocks of granite and porphyry, the former sometimes weighing several tons, together with rolled pebbles of many of the Primary rocks, are here seen embedded in a fine grained mudstone; this being evidently derived from the denudation of some of the softer slates, and deposited as mud on the margin or in the bed of some ancient river or estuary, which occupied a basin with nearly the same principal boundaries as the modern Inglis. These massive blocks of granite and other rocks which are not now found *in situ* within several miles of their present position, I consider to furnish more conclusive evidence of glacial agency in the geological history of Tasmania than I have met with elsewhere, and they strongly corroborate the testimony afforded by the seemingly erratic boulders which occur at various points in the basin of the South Esk. The age of this conglomerate is doubtful. It underlies unconformably the Tertiary freestone, which has been determined by Professor M'Coy to be of Miocene age, and it contains boulders derived from rocks which are certainly not older than the Lower Carboniferous or Devonian period. In the mudstone which forms the matrix of the transported boulders no fossils have yet been discovered, and the chance of finding them is occasionally lessened by the jointing and rude cleavage which sometimes traverses even the hard pebbles of chert, quartzite, &c., contained in it, and almost entirely destroys the traces of original bedding. It is right to mention that some detached portions of conglomerate, apparently belonging to the formation which I am now describing, have some of the peculiar characteristics of the conglomerate which belongs to

the Primary series; but they cannot be separated from the more recent formation without stronger evidence than can be obtained by the passing traveller.

Among the rolled pebbles which line portions of the beach near Table Cape, and have been derived from the disintegration of the conglomerates now under consideration, there have been found from time to time fragments of a hard compact shale, varying in colour from dark brown to dull black, and so closely resembling the so-called "kerosene shale" of Hartley in New South Wales, both in appearance, and behaviour under the simple tests to which I have subjected it, that they may be considered identical. Two specimens exhibiting the chief varieties, have been forwarded by Mr. Hainsworth, who rightly estimates the important results that would follow from the discovery of the original home of this shale, and has already devoted much of his leisure time to the exploration of the surrounding country in search of it, though hitherto without success. The entire absence of all the members of the Carboniferous series from which these waifs might have been derived is an adverse circumstance, and the occurrence of a single specimen would have attracted no attention. But the great difference between this shale and all the varieties of Tertiary lignite, which are common enough in Tasmania, and the discovery at different points of several specimens all identical in character, force us to the conclusion that it is of pre-Tertiary age, and that portions of the series from which it has come, though removed by denudation near the coast line, will one day be found at no great distance inland. The extraordinary toughness of the shale is worth noting. It is easily seen that it would long resist the destructive agencies which have played so important a part in the geological history of this and other countries, and might remain unaltered long after the accompanying sandstones had been ground down and borne away to fill the hollows of adjacent seas.*

I come now to the formation from which the interesting series of fossils now before us has been obtained. It varies in character from a breccia of coarse sand and broken shells to a fine-grained whitish sandstone, which has been used in

* The subjoined report of an assay of this shale by Mr. Cosmo Newbery, of Victoria, has since been furnished by Mr. Hainsworth :—

KEROSENE MINERAL FROM NORTH COAST OF TASMANIA.

Burns freely with a yellow smoky flame, leaving a dark reddish brown ash. Contains iron pyrites. When heated in a closed vessel it melts, forming a fragile coke. A sample dried at 212° F. gives the following results :—

Water driven off at 230° F.	1.59
Volatile matter	67.36
Fixed Carbon	25.83
Ash	5.22
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					100.00

the district for building purposes. It has been recognised at various points within a radius of five or six miles from the mouth of the river, and in some places shows a precipitous face of nearly 100 feet above high water mark. Although there is no section visible showing the actual contact between these beds and the basalt, which occupies a large extent of the adjacent country, there is no reason to doubt their priority to it; indeed, Mr. Hainsworth has informed me of an instance where basalt is found capping a small isolated hill which I know to have been formed by denudation, and which the basalt could only have reached by flowing in a lava-like sheet from a higher adjacent summit before the denudation had commenced. It is, however, quite possible that the fossiliferous strata represent two distinct periods, and that a portion of those which appear to abut against the basalt without the slightest alteration in character or position, may one day prove to be of more recent date.

The Museum already contains a series of these Tertiary fossils, presented by different donors, but it is surpassed both in extent and variety by the collection now before us. The specimens are for the most part tolerably perfect, but some of the more delicate shells were so injured by pressure upon the decomposing matrix in which they were embedded that they could not be cleaned for purposes of identification, and had to be preserved in their rough state. The collection contains upwards of sixty species of Mollusca, representing the following genera:—*Strombus*, *Typhis*, *Fasciolaria*, *Cancellaria*, *Cassis*, *Fusus*, *Ancillaria*, *Conus*, *Pleurotomaria*, *Voluta*, *Mitra*, *Cypræa*, *Trivia*, *Natica*, *Potamides*, *Turritella*, *Siliquaria*, *Littorina*, *Trochus*, *Dentalium*, *Terebratula*, *Waldheimia*, *Rhynchonella* (?), *Ostrea*, *Pecten*, *Lima*, *Spondylus*, *Modiola*, *Arca*, *Limopsis*, *Cucullæa*, *Pectunculus*, *Trigonia*, *Chama*, *Cardium*, *Lucina*, *Cyprina*, *Cardita*, *Venus*, *Venerupis*, *Crassatella*, *Tellina*, *Pholadomya*, *Corbula*, with a few others which I have not been able to identify. The Echinida are represented by species of *Cidaris* and *Spatangus*, and there are also two or three species of corals.

Among the shells which are now extinct one of the most noticeable is "*Trigonia semiundulata*," (M'Coy). This shell has not been found elsewhere in Tasmania, but I have seen it in similar formations on the shores of Port Phillip. It is worthy of remark that the recent *Trigonia*, of which we have two representatives, has not been found at all in the Table Cape beds. There is also a good specimen of a *Cypræa*, which is found nowhere else in Tasmania, and seems to be intermediate between *C. eximia* and the recent *C. umbilicata*, both of which are here found as Tertiary fossils. The collection

includes a species of *Terebratula*, a *Trochus*, and a small *Voluta*, which I have not seen before.

There is further evidence afforded by leaf impressions in the sandstone, and fragments of lignite, to connect these beds very closely in geological age with the extensive Tertiary formation in and around Launceston, and on both banks of the Tamar, which I have also ascertained to be anterior to the great outflow of basalt, which extends from near Kerry Lodge to Evandale and the North Esk. They are also thus allied to the freshwater limestone which was formerly quarried in the outskirts of Hobart Town, and that which is still worked on the opposite side of the Derwent. These were described by Strzelecki many years ago, as the highest formation in geological sequence in Tasmania, and his description still holds good, the post-tertiary and alluvial deposits which are common in the basins of modern rivers, and on the existing coast-line, being of course excepted.

The igneous rocks of Table Cape, specimens of which have also been presented by Mr. Hainsworth, are exceedingly interesting, but can only receive a passing notice here. They present every variety from pumice-like scoriæ to fine-grained crystalline diorite, but may be classed under two distinct heads,—basalt and trap. The age of the latter and its exact relations to the sedimentary rocks it is not easy to fix, but a reference to a geological chart of the locality, prepared nearly ten years ago, when I was accidentally detained for two days in the neighbourhood, confirms the theory which I have latterly held of its being more recent than the conglomerate last described. It forms the projecting headland of Table Cape, and rises with a nearly vertical seaward face to a height of 583 feet. It is undoubtedly older than the Tertiary strata, and probably afforded a shelter under the lee of which they were quietly deposited during a long series of years; where, too, they rested undisturbed until the period of the tremendous eruption of basalt, which, breaking through the previously weakened crust at many points simultaneously, elevated a great portion of the land to its present level, and may be said to have closed the geological history of the North Coast.