

M. D'Omalins D'Halloy's account of the Geology of Belgium appended to his work¹ "Abrégé de Geologie," contains the following notice of the above formation :—

"Le Lambeau entre Spa et Francorchamps a cela de remarquable qu' il se trouve à une altitude de près de 600 mètres, tandis que les autres dépôts crétacés de la Belgique n' atteignent pas 300 mètres. Ou ne l'a connu pendant longtemps que par des silex jaunâtres épars sur le sol et dans lesquels M. Dareux avait observé l' *Echinocoris vulgaris*, mais M. Malaise vient d' y découvrir une petite couche de craie blanche contenant la *Belemnitella mucronata*."

In addition to the above-mentioned fossils, I found in a few hours nineteen distinct genera and species of testacea and echinodermata :

Pecten quinquecostatus, and two other species ; *Terebratula* ; two species of *Rhynchonella* ; two species of *Echinoderms*, etc., etc. The great variety of these, contained in so small a space, seems a strong argument in favour of transport from another area of considerably greater extent.

NOTICES OF MEMOIRS

I.—FOSSIL MEDUSÆ.

PROFESSOR HÆCKEL, of Jena, who, in 1865, called attention to the existence of well-preserved *Medusæ* in the lithographic slates of Eichstadt, belonging to the families *Æquoridæ* and *Trachynemidæ*, has recently published² a notice of two other species of *Medusæ* so well preserved, that the family to which they belong can be ascertained without doubt. They are from the same locality, and belong to the *Discophoræ*, and to the family *Rhizostemidæ*. The restoration which Professor Hæckel has been able to make from the specimens in his possession, is quite satisfactory, and the attention of geologists having been called to this subject, we may expect further interesting researches into the ancient history of *Acalephæ*, since it is well known that even at the present time a kind of petrification of jelly-fishes, when thrown upon sandy beaches, readily takes place.

A. A.

II.—NOTES ON THE GEOLOGY OF WESTERN AUSTRALIA.

By the Rev. W. B. CLARKE, M.A., F.G.S., etc.

THE following is one of a series of papers, contributed by Mr. Clarke to the Government of Western Australia, on the geology of the country east of the settled districts. It was communicated by the Colonial Secretary to the "Perth Gazette and Western Australia Times," and is now reprinted as containing the

¹ "Abrégé de Geologie," p. 534.

² Leonhard und Geinitz's Neus Jahrbuch, 1866, Heft 3, p. 257.

first connected account of the geology of a territory new to science :—¹

DESCRIPTION OF MR. HUNT'S SPECIMENS EAST OF YORK, W. A., BETWEEN 31° AND 31° 12' S. LAT. AND BETWEEN 121° 12' AND 121° 22' E. LONG. ON THE N.W. OF LOWER LAKE LEFROY, COLLECTED IN 1865.

A.—From Well near Camp 25.

1. Grey soft micaceous clay slate filled with minute white particles ; 12 feet deep.
2. Soft bluish grey glossy slate ; 15 feet.

B.—From surface of the Gully-bed.

3. Brownish-blue ferruginous slate, full of iron and white glossy particles.

4. A gneissiform grey-bedded and jointed foliated but hard rock, with *used* mica, and a small proportion of quartz in a felspathic base, holding numerous cubic crystals of bisulphuret of iron decomposing into hydrated iron, as in the trap rocks of the Harding River.

5. Ironstone-conglomerate, consisting of numerous shining black water-worn rudely crystalline particles of magnetic iron, which in some examples possess *polarity* ; brownish-red hydrated oxide of iron ; small clear crystalline bits of quartz ; opaque quartz, and one or two particles of trap, all cemented by a hard cellular mineral effervescing with hydrochloric acid. Presumed to be of Tertiary or recent origin, arising from a calcareous spring producing tufa and collecting small loose stones from the surface of a water-course.

C.—From Red Hill Gully.

6. Decomposed granite.
7. Decomposed granite, with a slight saline taste.
8. Brownish white coarse deposit.²
9. Brown and white bedded deposit ; decomposed slate or granite.
10. Ferruginous sandy deposit, probably decomposed granite.
11. White crumbly kaolin-like deposit.
12. Coarser, red and yellow deposit.
13. White soft clay-slate, perhaps the source of some of the preceding five samples.
14. Cavernous ferruginous quartz, part of a vein, probably from granite.

D.—From Stony Hill.

15. Hydrated iron, not magnetic.
16. Semi-opal.
17. Hardened white deposit, hydro-magnesite.

E.—From Tank near Stony Hill ; 4 feet below surface.

18. White soft, nearly pure alumina.

F.—From Ridge 8 miles due East of Saddle Hill.

19. Drift-pebble of air-and-water-worn *concretionary* rock ; siliceous in composition and probably formed in some soft deposit—or,

¹ From the "Perth Gazette and Western Australia Times," Friday, April 20, 1866.

² This word "deposit" explains the sedimentary nature of the substances which are properly "silicates of alumina."

being soft originally, altered by silicification. Although imagination may give an idea of organic form, it is pretty certain that soft mud drying might take and retain just such a structure. Its polished surface implies drifting and exposure.

G.—From *White Peaks* Lat. $31^{\circ} 2' 30''$ S., Long. $121^{\circ} 12' E.$

20. White silicate of alumina.
21. White [*? porcelain*] clay. Not sufficiently tested.
22. Pink bedded deposit.
23. Yellow deposit.
24. Fine bluish white deposit with black points of (*?*) iron, a silicate of alumina.
25. Greyish blue soft deposit, a tolerably good fire clay; a silicate of alumina, with common salt, magnesia and lime in small proportions.
26. White and yellowish sandy aluminous deposit.

H.—From *Saddle Hills*.

27. Ferruginous black and white quartz.
 28. Chalcedonic quartz or agate [*? from amygdaloid basalt*].
 29. Baked red and white fine conglomerate (a variety of so-called quartzite).
 30. A drift-portion of a black silicified substance like fossilised wood.
 31. Quartz like No. 14.
 32. Siliceous deposit, probably a *hot water* product.
 33. Jasperized rock, red and black, an altered clay or shale.
 34. Common opal, white with black streaks.
 35. Red and white sandstone, altered.
 36. Hyalite coloured by iron (*?*).
- I.—From *Bed of Gully near Red Hill*.
37. Fine ferruginous sandstone or grit, apparently a *Tertiary* rock.

Additional Remarks.

In this collection there is no granite; but, by reference to Mr. Hunt's map, it appears that the whole of the country traversed by him (as well as that previously described by Mr. Lefroy) extending to near the meridian of $122^{\circ} E.$ exhibits an abundance of granite; and that rocks of that class form the base of the whole region eastward of the Darling Range.

It would be interesting to compare the varieties of granite from this region; since Mr. Lefroy's descriptions lead to the conclusion, that it is not all of like composition, nor of one age.

Whilst admitting this, we cannot however adopt the opinion expressed by the latter gentleman, that the granite is the "primitive crust" laid bare—an opinion which is at variance with the general views of geologists of the present day, and is certainly not supported by some of the facts reported by him. The Protogine which he met with in $30^{\circ} 20' S.$, and $120^{\circ} 40' E.$, as well as the elvan dykes in $31^{\circ} 27' S.$, and $119^{\circ} 20' E.$, clearly imply metamorphisms or eruptions of a period subsequent to the formation of the

general mass; and, perhaps, subsequent researches will justify the suggestion, that the occurrence of granite over so wide an area in Western Australia, is due to a boss-like¹ elevation, certainly after the period of the older Palæozoic rocks, the traces of which, though limited in extent, are widely scattered and sufficiently repeated to sustain the conclusion, that they once existed probably over the whole granitic area; and that from the calcareous coating of the granite at King George's Sound and Recherche Archipelago some of it may be even of *Post-tertiary* elevation.

¹ The dome-like or boss-like form of granite is a feature of frequent occurrence. It is of concretionary origin, and distinguishes especially those hornblendic granites which are connected with auriferous deposits. But it occurs also in other granitic regions, as in the mountains of Central Asia. Where the great bosses meet there is generally a depression, which if repeated in a given direction, may give the idea of a fissure; this may also be the case where joints traverse the rock. Mr. Lefroy mentions *intumescences* of granite, a term well describing the nodular or concretionary structure. He also mentions that near the head of drainage to the westward, there is a dip of about 2 feet in the mile to the south-west. Eyre also mentions that nearer the coast the granite has a slope to the south-westward. A slope of 2 feet in a mile could scarcely occur except on the summit of a nearly level mass. That the granite in the region under discussion must have, occasionally at least, a true nodular structure, may be seen on the nearest part of the coast to Mr. Hunt's furthest, viz: about *Esperance Bay*, where the granite exfoliates in decomposition, peeling off in concentric layers like those of concretionary trap. Mr. Lefroy mentions similar features in 32° 0' S. and 118° 19' E. at Burra Kukkin. This particular species of granite is about *Esperance Bay* full of *garnets*, and garnetiferous granite is well known to be *not* of the most ancient class, and, besides the inferences from this fact, that the rocks must have considerable slopes is to be inferred from the fact that the cliffs of the Australian Bight have, in some places, a vertical thickness of 600 feet, resting on the edges of the granitic base, which begins to crop out on the west side of the great arc of the coast at about 124° E., and on the east side near Fowler's Bay about 132° E., giving to the hollow between the granitic intumescences a breadth of 500 miles. We may, therefore, safely assume that such a hollow is formed by the slopes of the great dome-like masses composing the granite base. That towards the ocean this concretionary or nodular structure may furnish slopes of enormous extent, may be gleaned from a fact stated to me by my friend the late Captain Owen Stanley, R.N., F.R.S., who in H. M. S. *Rattlesnake* obtained soundings when fairly inside the horns of the Bight, at a depth of *four miles*. That this is far from surprising may be considered by reference to the data given for the mass of strata supposed to be denuded, in the preceding remarks. For with a slope of the granite or other rock *not greater than one degree in the mile*, a depth of *more than four miles* would be reached along the versed sine of the Bight at a distance from the cliffs of 234 miles, which is within the chord along the 35th parallel. Deep as is this depression of the sea bottom, it is quite evident that the Tertiary and underlying deposits may obtain their present position without any extraordinary concurrence of circumstances. The great width of the Bay and the depth indicated for the ocean off the cliffs of Bundah, justify the probable opening of the Strait alluded to above. Nor can it be without interest to recollect that Flinders, on his survey of the Bight, stated his belief that the sea would be found behind them (vol. i. p. 97). He distinctly refers to a gradual subsiding of the sea, or sudden convulsion of nature, which, however, can have no bearing on the real facts of the case, and to the cylindrical sandy concretions of Bald Head, which have another and truer explanation than he supposed, and yet which, if interpreted in *his* way, would prove elevation of the coast, which is so far correct. At from 8 to 15 miles from the shore at the head of the Bight, the depth according to D'Entrecasteux and Flinders is from 27 to 30 fathoms English; the depression, therefore, observed by Stanley is much further out, and beyond the base of the Tertiary platform which extends from the head of the Bight on the south-west side to a parallel with the chord of the Bight about 140 miles south. There is room and depth enough to allow for other formations as well as the Tertiary, which, for want of researches, cannot, however, be proved.—W. B. C.

[To be concluded in our next number.]