

It is hardly necessary to say, that the age of these primæval men, and of the above mentioned climate, stretches far beyond that of the lake dwellings. In none of these lake settlements have any remains been found of arctic wild and apparently domesticated animals, as at Schussenried. Even in the oldest lake dwellings the animals which are companions of men, do not differ in species from those of the present day. No one, however, can believe that the Schussenspring was merely an isolated station of these primæval-men. Flint knives are found in various places scattered over our country, just as in the district of the Dordogne, and seem to have escaped the inquisitive eyes of our archæologists who have hitherto considered Roman roads and Celtic tumuli the earliest remains of our country. These implements of flint occur very commonly around the Schussenspring, and may be collected in considerable quantities when the ground is newly turned up, and this to such an extent as to be well known to the manufacturers of instruments for tobacco smokers.

There can be no doubt that numerous other places in Upper Swabia, besides Schussenried might serve to illustrate the grade of civilization of our ancestors. But the same cause which has preserved these relics—viz., the water, which protected them from the atmosphere renders the investigation of them in general very difficult. For how seldom is a trench nineteen feet deep excavated under the bed of a pond, and this in soft mud, as at Schussenried? and even when such works are undertaken, it is very rarely the case that a keen observer of nature is at hand like Mr. Valet, of Schussenried, who by utilizing the discoveries of chance has rendered incalculable service to science.

DR. OSCAR FRAAS.

STUTTGART, 7th October, 1866.

NOTICES OF MEMOIRS

I.—NOTES ON THE GEOLOGY OF WESTERN AUSTRALIA.

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

(Continued from the November No. p. 506.)

The occurrence of felspathic dykes in the granite is quite in accordance with the experience derived from other regions, both in and beyond Australia, as on Bathurst Plains and in other instances in New South Wales, where there is no doubt as to relative age. Moreover, as in other granitic regions, so in that under review, the edges of the boss-like mass can be shown to have been subjected to the influence of the forces by which it has been denuded. Referring still to Mr. Lefroy's testimony, we find an eroded surface in $31^{\circ} 53' S.$, and $117^{\circ} 31' E.$, and a pot-holed surface in $31^{\circ} 29' S.$ and $120^{\circ} 11' E.$; whilst, at what must have been the limits of the boss, we have the regular association of gneiss, chlorite, mica, and clay slates on the surface, and at the edges of Mr. Lefroy's and Mr.

Hunt's country; and, according to Gregory, at the Mounts Barren on the south coast, and on the flanks of the Darling Range, as well as at the heads of the Lyons and Gascoyne Rivers on the north-west.

Mr. Lefroy gives the localities in which he found the relics of old sedimentary formations, as gneiss or mica-schist in $29^{\circ} 50' S.$, $122^{\circ} 3' E.$, and in $29^{\circ} 53' S.$, $121^{\circ} 21' E.$ In $31^{\circ} 8' S.$ and $119^{\circ} 49' E.$, a talcose slate occurred; and quartziferous schists are mentioned in $31^{\circ} 8' S.$, $119^{\circ} 49' E.$ as well as metamorphic slates in $30^{\circ} 5' S.$ and $121^{\circ} E.$; the slates being *polished* in $29^{\circ} 53' S.$, and $121^{\circ} 21' E.$ So that, incorporating Mr. Lefroy's experience with that recorded in Mr. Hunt's map, we may assert, that over an area of very nearly 9000 square miles those gentlemen have established the fact, that fragmentary ancient or metamorphic schists occur at repeated intervals, whilst Mr. Lefroy states that a kind of dip or slope of the surface of the granite exists to the southward, and Mr. Hunt gives reason to believe, that the granite rises into loftier elevation towards the north, and, so far as I can decipher from the collection forwarded to me, has an extreme termination somewhere about $122^{\circ} E.$, near the limits of his exploration.

The agreement between Mr. Lefroy and Mr. Hunt is considerable as to the occurrence of the overlying rocks in fragmentary beds. Thus, No. 4 in Mr. Hunt's collection is a gneissose rock, and Nos. 1, 2, 3, and 13 are clay slates, all of which have an air of great antiquity, and correspond in texture and composition with rocks of the same name in the Lower Silurian series.

Neither Mr. Hunt nor Mr. Lefroy indicate any formation intermediate between these schists and what are probably Tertiary deposits. But it must be remembered that near Mount Barren on the South, and near Champion Bay on the north-west side of the imagined granitic boss, a Carboniferous formation exists, succeeded in the latter neighbourhood by Secondary formations ranging as high as Cretaceous. Regarded in this light, we have the relics in consecutive order of the members of the geological scale without any anomaly; and quite in agreement, when looked at in a broad view, with the features of other, though more limited regions.

In regular order we ought to have the coming in of the Tertiary formations. Such appear to be indicated by Nos. 29, 35, and 37 in Mr. Hunt's collection, as well as in some others, and by the mention on his map of drift gypsum in $119^{\circ} 30' E.$, a mineral of some importance further to the east in the low regions of the northern, north-western, and western part of South Australia.

Besides the above indications, we have in Mr. Hunt's collection a very numerous series of aluminous deposits of various colours, which, at my request to him, have been submitted to analysis by Mr. Theodor Staiger, of Hobart Town. His chemical determination agrees remarkably with the conclusions I have come to, on different grounds.

Similar deposits, sometimes resembling chalk, are well known in the settled parts of Western Australia and in New South Wales, and

have often been noticed by explorers. In some cases there appears a close relationship between them and igneous rocks, with which silicates of alumina are connected; but in the cases now under notice the origin seems to be of a distinct kind.

Whether these deposits are Recent or Tertiary, they appear to owe their origin to the decomposition of felspathic granite, or such slates as No. 13; nor is the occurrence of felspathic clays, such as *kaolin*, unknown elsewhere in Australia, for the latter exists in abundance in connection with the granite of the You Yangs, near Geelong, in Victoria, from the decomposition of which it has resulted. Nevertheless, some of the Lake Lefroy beds in Mr. Hunt's list have been altered by the action of some more recent igneous agent, but of this no external evidence exists except in a minute fragment of some dioritic rocks entangled in No. 5, though of the fact of metamorphism there is distinct evidence in Nos. 16, 28, 29, 32, 33, 34, 35, 36.

Mr. Lefroy has positively declared, that no basalt or greenstone exists in all the extensive region described by him; we can, therefore, only regard the indications referred to as belonging to some other locality from which they have been drifted, and as pointing to a further succession of geological formations to the eastward or north-eastward of the 122nd meridian, and a gradual approach to the features and phenomena of the lower portions of the South Australian territory.

The frequency of the salt-lakes and samphire-lagoons, mentioned as occupying much of the country, as well as in similar tracts of Australia where flats occur in a hilly region, and the presence of lime in No. 5, favour the notion that the marine Tertiary beds of the Great Bight and South Australia are not far distant to the eastward of "Hunt's furthest," and of these I shall find something more to say.

I may now remark, that the quartz specimens, Nos. 14 and 31, and the mention of quartz hills on the map, about eighty miles to the westward, and again fifty miles south-west of that locality, as well as traces of a vein in No. 1 imply, that the granites and slates are in the same condition as those of auriferous tracts in Australia, whilst the presence of iron pyrites in No. 4 and of the iron in Nos. 5 and 15 serve to establish a similar inference as to the age of granite.

But the only economic value of the production here discussed seems to belong to the iron and to the clays, of which latter deposits some certainly belong to the fire-brick and porcelain species.

The thinness of the coating of slates, clays, etc., would imply, probably, a very limited supply of these products, which in many cases only serve to fill in the gullies and hollows formed by erosion on the granite, as in $31^{\circ} 29' S.$, $120^{\circ} 11' E.$, where that rock is potholed and supports a mass not more than 100 feet thick. The superficial red clay, the ferruginous red gravel, the sandy patches, the rotten soft schists, the deposits of fine white sandstone, the fragments of soft slates, all mentioned by Mr. Lefroy, are so many additional reasons for concluding that the region traversed by the 122nd meridian is covered by a capping of the upper beds that along the

Bight, and towards the coast southwardly, are succeeded by those marine beds, at the base of which, according to Flinders and Eyre, white aluminous beds lie below the shelly deposits, and repose on granite. Those I have little hesitation in comparing with the aluminous beds near Lake Lefroy, an extension of which is also indicated at several points to the westward in the journal of Mr. Lefroy.

That gentleman was led to a somewhat similar view from a section of a gully in $31^{\circ} 29' S.$, $120^{\circ} 11' E.$, about sixty-five miles W.S.W. of Hunt's "White Hills." The evidence already obtained leads, therefore, to the conclusion, that not far from Mr. Hunt's furthest, a change takes place where Tertiary beds become prevalent. The following considerations will strengthen the probability of this view :—

Mr. Hunt's eastern limit seems to have been about half-way between York and the *high* cliffs of the Bight (*Bundah*), and about 120 miles from the extension of the outlying Tertiary Bight limestone, near the Salt Lakes west of Esperance Bay, (*Eyre*), in the neighbourhood of which on Middle Island (*Flinders*) the granite is covered by a crust of calcareous matter; and about 170 or 180 miles from the spot, near Point Culver, where the limestone becomes covered by the superficial sandy and ironstone detritus which, according to the aborigines, is the general character of the country between Lefroy's and Hunt's furthest and the sea, of which twenty-five miles seems to have been seen by the latter observer from the last elevated land on the 122nd meridian.

It may be remarked here, that the projections of granite along the coast which forms an arc between 118° and $136^{\circ} E.$, and of which the chord is strictly the parallel of $35^{\circ} S.$, are all more or less covered with a calcareous crust before mentioned, of which evidence exists in King George's Sound and Cape Arid to the west, and from Cape Radstock to Cape Catastrophe to the east. This is by itself an interesting fact, as showing how vast an area has been destroyed. By a rough but tolerably careful calculation I find that the water-area, allowing for the winding of the coast, is not under 144,000 square miles, and if the *average* thickness of the removed Tertiary beds was that of the Bight Cliffs, viz., 300 feet, the enormous mass of removed matter is upwards of 1200 billions of cubic feet. (See note, p. 000.)

Coupling with this the bearing of Mr. Hunt's specimen No. 5 it is only a fair inference that, at the limit indicated, the explorers were on the edge of the Bight formation, the head of which is on the parallel of Mount Eaton, between Lake Cowan and Lake Lefroy. We may therefore presume that a change of country, assimilated to that of the western part of South Australia, there begins, the distance from the frontier being only 630 miles.

There is one further deduction which, until refuted by discoveries of another kind, has a considerable interest for the geographer.

Looking to the facts exposed at the Bight and on the north west coast, between Mount Blaze and Cape Joubert, and to the facts discovered

by Mr. A. C. Gregory on Sturt Creek, and by Mr. F. T. Gregory about 500 miles to the westward and southward of the former, where he had indications of an evident great water-channel, we may conclude that there is a presumption in favour of a probable Strait between the Bight and the north-west Coast, now filled in by Tertiary, Post-pliocene, and Recent accumulations; and the features disclosed on Stuart's line of route agree with what may be considered the north-east side of a region traversed by such a Strait, whilst the features of Lefroy's and Hunt's territory equally agree with the south-west or opposite side of the Strait. Between the most eastern granite near the Russell Range on the south coast and that at Fowler's Bay, the distance is nearly the same as that between the respective extreme limits of the desert discovered by the Messrs. Gregory, so that there is much to justify the conclusion, so far as the present evidence goes. And if such an hypothesis be adopted, then it follows, that to the north-east and north of "Hunt's furthest," the country would be low-lying and desert also, so far as the watershed of streams crossed by Stuart, which are but 200 miles from the supposed eastern bank of the assumed Strait.

This view will explain in some degree the occurrence of the lakes and watercourses, the drainage of which Mr. Lefroy says is scarcely perceptible in any direction.

As the height of the cliffs at the Bight is not more than 600 feet, unless there is a much greater elevation than that of the lakes, there could be no drainage to the sea, and accordingly no streams are found passing to the coast from the north. The drainage, if any, should be to north-east or north from Hunt's furthest, if the idea of a Strait be correct, and in that case, probably, Mr. F. Gregory's "supposed" river from the interior would carry off all supplies falling into the hypothetical Strait.

A final remark remains. In Mr. Lefroy's Journal it is stated that no trace was found of any bituminous fluid such as was alleged to have been met with in the former expedition of Messrs. Dempster, and that no Carboniferous rocks exist in the country traversed. This, however, ought not to prevent further research, because it is now established that hydrocarbon fluids are not confined to the Carboniferous rocks, but rise from great depths below their horizon. Without venturing to form any opinion as to the fact stated, or as to its value, a further inquiry may be properly recommended.

In No. 25 of Mr. Hunt's collection we have a clay containing a small per-centage of some carbonaceous matter; but this fact is not in collision with the origin of such clay from Silurian slates, since it is well known that, in the rocks of that age, there is often an abundance of carbonaceous matter, though no such deposits of coal as occur in the Carboniferous formation. Yet, had there been any traces whatever of vegetable impressions, it might, in the absence of evidence to the contrary, have been inferred that such a clay belonged to a Carboniferous formation, and Mr. Staiger hinted at such a possibility. That, however, is very far from probable.

The quantity of saline matter contained in this and some other of

the associated silicates of alumina might lead to the inference that they had once formed the bottom of a marine lake or estuary, in which they were deposited from the decomposition of the rocks forming the shores; an inference supported by the present condition of the surface, viz., a series of saline lagoons and water-channels among hills and knolls, which would be insulated at no great depression of the horizon so as to admit the influx of the ocean, or other increase of the lakes in depth. But the existence of salt in some of these clays shows how, in certain instances, the saline nature of the lagoons and water-channels of the interior may be accounted for without reference to the ocean.

W. B. CLARKE.

ST. LEONARD'S, NEAR SYDNEY,
21st March, 1866.

By favour of the Colonial Secretary we publish the Rev. W. B. Clarke's remarks upon the Geological specimens brought in by Mr. Hunt from his last visit to the Eastern interior. We have on several occasions had to acknowledge the value of the remarks of Mr. Clarke upon the various specimens forwarded to him, but probably upon no occasion has his kindness been so valuable to the colony as on the present. So far as the specimens went they have enabled Mr. Clarke to give us a general idea of the constitution of that portion of the interior traversed by Mr. Lefroy and Mr. Hunt, and lead to the inevitable conclusion that in this great portion of our territory it is almost hopeless to look for any valuable addition to its mineral resources, unless possibly the specimens derived from the salt-lakes and their neighbourhood were too few to enable him to arrive at a definite conclusion. Mr. Clarke refers to the bitumen found by the Messrs. Dempster (of which we have the specimen still in our possession), and stated to have been found oozing from a granite rock; that may hereafter be worthy of more careful inspection, but at present, however valuable it might prove, it is too remote from the occupied districts to be available, with any chance of the deposits proving worth trying for in a commercial point of view. We have been particularly struck with the hypothesis ventured by Mr. Clarke, after considering Mr. Hunt's specimens and the geological data afforded by other observers, as to the possibility that the former had arrived at the western edge of a Strait running from the Great Bight to the North Coast. *From the various articles noticed by Mr. Hunt in the possession of the natives at his farthest Eastern point, such as pearl shell ornaments, etc.,* we have before observed they argued that an easy communication with the north on that parallel probably exists, and this undoubtedly would be the case if Mr. Clarke's hypothesis should prove to be a true one, and the country intervening would, there is no doubt, be one easily traversed, providing supplies of water are obtainable. From the knowledge we have lately gained as to the country lying between Nicol Bay and King's Sound, we now know, however, that no large river exists along the whole line, and if the desert with waves of sand which stopped Mr.

F. Gregory does border upon any large river, as he supposed, it must be the Fitzroy, which again we also know to be, at least in the present age, too small to have produced such appearances. This fact goes greatly in favour of Mr. Clarke's hypothesis of an ancient Strait.—*Editor of the "Perth Gazette."*

II.—QUARTERLY JOURNAL OF THE GEOLOGICAL SOCIETY OF LONDON.
Vol. XXII. Part. III. November, 1866.

IN noticing this part of the Geological Society's Journal, we must content ourselves with calling attention to the number and variety of the papers contained in it. There are thirty-three papers, besides several miscellaneous abstracts. It would occupy too much space to give an analysis of each of the former, the list alone of which would occupy nearly two pages, nor is it necessary, as abstracts of the whole of them have appeared in previous numbers of the GEOLOGICAL MAGAZINE, in the reports of the meetings of the Geological Society from March 21, to June 20, 1866.

We feel sure that no geologist could fail to find some one or more subjects of special interest to himself among these communications now published.

In the Miscellaneous part of the Journal are papers which we have not noticed before:—

1st. Abstracts of M. Dupont's researches among the caverns of the valley of the Lesse (see p. 564); a notice, by Chevalier von Hauer, of a new genus of Cephalopods, *Choristoceras*. It is somewhat similar in form to *Crioceras*, with the lobular ornamentation characteristic of *Ceratites*. Specimens of this new genus—to which the name *Marshii*, has been given in honour of Mr. O. C. Marsh, F.G.S., who first noticed its occurrence—have been discovered in Austria in a bed resting on Kössen strata and overlain by Liassic limestones.

2nd. The occurrence of the Marmot (*Arctomys marmota*) in a recent formation in Styria is noted.

3rd. A notice on the Gasteropods of St. Cassian, by Dr. Laube. This fauna possesses many species analogous to forms found in the Carboniferous Limestone, and is particularly interesting as being a "limit-fauna," comprehending representatives of a number of undoubtedly Palæozoic genera associated with others whose full development took place afterwards in the course of the Mesozoic Period.

III.—TABELLEN ZUR BESTIMMUNG DER MINERALIEN NACH ÄUSSEREN KENnzeICHEN (TABLES FOR THE DETERMINATION OF MINERALS BY EXTERNAL CHARACTERS). Herausgegeben von ALBIN WEISBACH, Professor an der Bergacademie zu Freiberg. Leipzig, 1866. pp. 109. Arthur Felix.

THE object of these Tables is to enable a person to find out what a mineral is by means of its physical characters. The author has lately succeeded the veteran Professor Breithaupt in the chair of Mineralogy at Freiberg, and is a son of the well-known Professor

of Mechanics at the same place. An extract from his preface will give a general idea of the book:—"If a mineral is to be determined by means of these Tables, the kind of lustre, degree of hardness, the streak, and also the colour, when the mineral has a metallic appearance, must be made out. If these characters are properly determined—and this is a very easy matter—the Tables show that the choice is confined to a small number of minerals, among which the right one can be fixed upon either at once, or after consulting some Handbook on Mineralogy, and can nearly always easily be found out if the crystalline form is plainly recognizable. If this characteristic is wanting, the determination is undoubtedly more difficult, or, rather, takes more time, especially if the mineral has a non-metallic lustre and a colourless streak. In such a case, the number of minerals suggested is sometimes very large, and it appears advisable to make use of the supplementary Tables, in which are given the behaviour of these minerals in the matrass, with water and hydrochloric acid." These Tables will be useful to the student, in making him pay more attention to the physical characters, for, with von Kobell's tables by his side, he is apt to trust too much to the chemical properties to be determined, and consequently, when called upon to determine a mineral without his blowpipe and re-agents, he may feel somewhat at sea. No doubt von Kobell's tables are most valuable (and it is to be regretted that the English translation is out of print), but, at the same time, it is well if the student accustom himself to determine minerals by even simpler means.

C. L. N. F.

REVIEWS.

I.—MEMOIRS OF THE GEOLOGICAL SURVEY OF GREAT BRITAIN, AND OF THE MUSEUM OF PRACTICAL GEOLOGY, Vol. III. THE GEOLOGY OF NORTH WALES, BY A. C. RAMSAY, F.R.S., WITH AN APPENDIX ON THE FOSSILS, BY J. W. SALTER, A.L.S., F.G.S. 8vo. pp. 381; Plates 28. (Longmans & Co.)

THIS long promised Work will be heartily welcomed, more especially by those geologists whose affections centre chiefly in Palæozoic rocks, and who are perhaps of opinion that the exploration of newer geological territories has of late years occupied somewhat exclusive attention. At the same time, however, the work before us will be scanned with interest by those who are so eager in their enquiries into the causes which have given rise to the contour of the land. Its appearance cannot fail to remind us of one, now alas! no more, whose ability, joined to his enthusiasm, few could rival—the late Sir Henry De la Beche. Under his direction the survey of North Wales was begun, and so many years have elapsed since then, that those of his associates who at that time were comparatively young as geologists, have now come to rank among our most eminent experts. Those to whom the greater share of the work in North Wales fell, are Professors Ramsay and Jukes, and Messrs. Aveline and Selwyn.