Art. XIX.—*The Tripolite Deposits of Lilicur.*

A Monograph, by F. M. Krause, F.G.S.

[Read 9th December, 1886.]

Although the occurrence of randanite in the neighbourhood of Talbot was made known through hand specimens more than twenty years ago, there has been hitherto a seemingly insurmountable difficulty in fixing the precise locality, while no information whatever could be obtained respecting the extent and mode of occurrence of the deposit. Recently some fresh discoveries were announced, and within the last month (September, 1886) samples have been sent to the School of Mines, Ballarat, from four or five different places, described as being situate between Clunes and Eddington. As the several specimens bore in their composition and structure a marked resemblance to each other, the suggestion was hazarded that a connected seam of this mineral would probably be found to spread from Stony Creek to the Loddon—a meridianal distance of upwards of twenty-six miles. Naturally, such an extent would bespeak for the deposit a marine origin, an assumption which is, however, contradicted by the otherwise well-understood physiography of the district. A closer examination of the actual features in connection with the occurrence of these randanite beds seemed to me the more desirable, as, apart from its geological aspect, the question has a not-unimportant practical bearing from the economic value attaching to the material itself.

The tract of country selected by me for examination lies between the village of Lilicur, on the Bet Bet Creek, and the western watershed of the Daisy Hill Creek, five miles westerly of Amherst, and is particularly favourably conditioned by reason of the numerous sections, both natural and artificial, which it affords.

For the better understanding of the local conditions under which the randanite deposits were formed, and before entering into a description of the actual features observed, it will be well, perhaps, to state briefly what is known of

GEOLOGICAL SKETCH MAP OF PART OF LILICUR - COUNTY OF TALBOT

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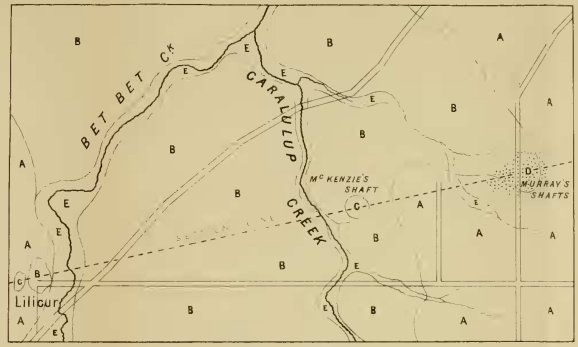
A Lower Silurian — B Newer Volcanic — C Tripolite deposits

D Upper Pliocene capping — E Post Pliocene



Scale

40 chains to 1 inch

GEOLOGICAL SKETCH SECTION FROM LILICUR TOWARDS AMHERST

Section Line N. 78° E. 2¾ Miles

the nature of similar diatomaceous deposits generally. Considered from a mineralogical standpoint, the Lilicur material agrees with the variety *Randanite* of the Auvergne, in France—*i.e.*, it is an opal, consisting essentially of hydrated silica, with about 6 per cent. of alumina and lime. As a rock-forming substance it is known by petrologists as *tripolite*. Examined under the microscope, it is found to be almost entirely made up of the frustula of diatoms. The more familiar name, "*infusorial earth*," implying, as it does, a zoogenic rock, was given under a misapprehension of the true nature of the organism of those microscopic bodies.

Diatomaceæ, or *bacillaria*, form a suborder of the thallophyta unicellularia, and may be concisely characterised as single-celled algæ with silicious valves. They are aquatic plants, thriving alike in fresh, brackish, or salt water; under the Equator, or in the Polar regions; on the bed of the ocean, under a covering of 27,000 feet of water, or ice-bound among the glaciers of the highest mountains. The individual diatom is constructed of a germ nucleus, surrounded by a watery plasma, which is contained within a silicious envelope. Propagation takes place by partition along the centre of the nucleus and the entire cell. The period during which the diatom remains in an undivided state has been variously estimated at from six to forty hours; taking twenty-four hours as the average, it will be seen that a single diatom is capable of multiplying to the extent of upwards of a thousand million within the space of a month.

On the death of the plant the empty frustules fall to the bottom of the basin in which it grew. Here, being mainly composed of silica, and therefore practically unaffected by decomposition, they accumulate, building up layer upon layer, often over considerable areas, and, under favourable conditions, actually filling up the entire space within the basin originally occupied by water.

The number of species of diatoms known exceeds 1500, and although the forms of some fresh-water genera bear a close resemblance to others of brackish, and even salt-water habitats, it is often possible to judge from the type of diatoms present whether a tripolite is of fluvial, lacustrine, or submarine origin. It can be easily conceived that in a lacustrine deposit, especially if the lake had no regular inlet (as those of Lilicur), the distinct genera are likely to be few in number, and often endemic, while an estuary or submarine bed would generally contain a large variety of both genera and species.

Diatomaceæ make their first appearance in specific areas of the Upper Chalk, increasing thence during Tertiary times, and gain their widest distribution, as well as greatest abundance, at the present day, many of the fossil species being identical with those now living.

Tripolite occurs in many parts of the globe, the most noted deposits being those of Tripoli, on the Mediterranean (whence the name); Mount Amiata, in Italy; Franzenbad, in Bohemia; and Richmond, in Virginia. The Richmond bed is described as the most extensive of any yet examined, its thickness being 40 feet.

In travelling between Creswick and the Loddon an observer will not fail to mark the occurrence, over an otherwise level tract, of numerous shallow depressions, varying in area from a few perches to a hundred acres and more—now isolated, and again clustered together in twos and threes or dozens within a square mile. Although more extensively existing on volcanic lands they are not absolutely confined to them, as they are occasionally met with on the clay drifts, which usually in this district fringe the lava sheets, as well as on neighbouring Silurian flats. On closer inspection we find that these depressed areas do not present a uniform appearance, for, although they are all covered with water during the greater part of the year, there are some which support a rankness of reeds and coarse grass, while others are free from vegetable growth, and even the scanty bottom layer of humus appears to be entirely deprived of organic matter. In the latter instance we invariably find on the floor and around the margin of the basin a deposit of bog iron ore (earthy limonite). In the marshy pools this ferruginous deposit is absent, although it is evident that there must be an abundance of hydrous peroxide of iron eliminated by the disintegration of the basalt. We have here a good example of the deoxidising action of humic acids generated by decaying vegetable matter. In the other case this deoxidising process has either never taken place, or, if formerly active, has now ceased. The hydrous ferric oxide is precipitated, and, mingling with particles of clay and sand, produces those earthy ironstone sappings and pebbly concretions so common on many parts of the plain. These deposits are still in progress of formation, and in course of time will, no doubt, completely obliterate the corrugations which at present mark the face of the land.

The topographical features at the close of the Pliocene period appear to have been, in many respects, analogous to those just described. The lava of Lilicur and Caralulup has been, in part at least, derived from Mount Mitchell, whence it descended, and by successive sheets filled a then existing river valley, the lower portion of which is now known to us as the *Homebush auriferous lead.* During and subsequent to these lava flows the surface of the country was in places pitted by shallow basins, which became harbours of bacillaria and receptacles for their frustules. Owing to the trifling extent and gentle slope of the area drained by the individual basin, the effect of erosion was exceedingly slight, and the amount of foreign sediment that was washed into the basin so minute as to be imperceptible. Nevertheless, in view of the eminently ferruginous character of the surface rock, the absence of ochreous matter in the body of the tripolite is noteworthy. The circumstance explains itself when it is borne in mind that a reducing agent in the form of humic acid was unquestionably produced by the decay of the organic parts of the diatoms themselves, and that this production was probably sufficiently copious to prevent, without the aid of other agencies, the settlement of any ferric oxide that may have entered the pool.

The principal tripolite bed in the district, as far as it has been explored, is that situate on Mr. M'Kenzie's farm, on allotment 15, section I, parish of Lilicur. The deposit completely fills a basin-shaped hollow in the basalt, the maximum depth being 17½ feet. The surface is level, and the contour, somewhat circular, with a mean diameter of about 500 feet, encloses an area of, approximately, 4½ acres. The quantity of tripolite in this basin (calculated from the above dimensions) is 1¼ million cube feet, which, taking the specific gravity at 1·91, represents a bulk of 66,500 tons. A shaft has been sunk near the centre of the deposit on to the bed rock (a highly vesicular basalt, in places reduced to a warke), and from it galleries have been driven in various directions along the basalt floor, which is remarkably even, and has a slight outward rise. The deposit itself has a tolerably horizontal—albeit somewhat waviform—stratification, and although strictly homogeneous in its structure, and of uniform snowy whiteness, the laminæ (more correctly speaking, the layers of growth, varying from half an inch to three inches in thickness, and extending from floor to roof) can be traced for many yards along the walls of the galleries and to