THE KARIANDUSS DEPOSITS OF THE RIFT VALLEY

BY C. W. HOBLEY.

One of the most marked features of the geology of the Rift Valley is the occurrence of thick beds of a mealy friable rock varying in colour from pure white to light brown. The place where they first attracted attention was on the east side of Elmentaita Lake, where a small stream has carved its way through those deposits, and the Masai name this place Ol Kariandus, from the presence of this white rock. A little search will, however, demonstrate the existence of such deposits at many places both on the east and west flanks of the Rift Valley between Nakuru and the south extremity of the Kodong Valley. There are, for instance, large beds in the valley of the Endorit River, north-west of Eburu Mountain, and also in the valleys between Ngong Mountain and the Kodong River. Its occurrence is also reported from the vicinity of Sugeta, north of Baringo. Altogether, the deposits of this material in the Rift Valley must amount to millions of tons.

The proper name of this substance is *Diatomite*, and it is a siliceous deposit principally of organic origin, which is found in many other parts of the world, and is mainly composed of the skeletons, technically called *frustules*, of minute lowly plants called Diatoms, belonging to the order Diatomaceae or Bacillariaceae. These plants are among the most rudimentary form of life and rarely measure more than $\frac{1}{200}$th of an inch in length. They consist of single cells of grey and brown protoplasm enclosed in a flinty casing formed of two portions, which fit together like a box and its lid. They are to be found in most fresh-water ponds, and especially flourish in mossy marshes such as one finds on the Aberdare Range, and they form a kind of scum on the water. With the flinty casing it may be a matter of surprise that such tiny atoms manage to float, but it is believed that they are able to do this by means of a certain amount of oil contained in their structure. Diatoms multiply with great rapidity and in spite of the flint envelope conjugation takes place, which in these lowly organisms brings new vigour to the stock. At death the shells sink to the bottom of the water and slowly form a siliceous deposit, and this is the basis of our Diatomite.

Diatoms form an enormous family, one that is said to number several thousand species. Myriads live in the sea as well as in fresh water, and in the great depths of the ocean there are enormous deposits of ooze formed of the skeletons of diatoms, globigerina and radiolaria, the last two, however, being classed among the animal kingdom.

Diatoms are known to belong to the vegetable kingdom by the presence of chlorophyll, a tiny fragment of which colours each cell green or brown, and it is upon this chlorophyll that their life depends, for it has the power of absorbing carbon dioxide from the air, picking out the carbon and with it building up the cell substance of the diatom, rejecting the oxygen. Any other nutriment the cell requires is obtained by absorbing various salts which happen to be in a state of solution in the water in which its habitat lies. On the other hand, diatoms possess a faculty which is usually looked upon as a peculiarity of the animal kingdom, namely, that of motion; its method of progression is a mystery, but is possibly due to the movements of tiny cilia microscopically invisible. The pace is so slow compared with that with which it will naturally drift by wind or currents that it is not easy to see what the organism gains by such feeble motive powers. It has, however, been suggested that its power of motion may prevent it being covered with mud when it sinks to the bottom of a pool, and it also may enable it to retire below the surface where the upper layers of water are disturbed by a strong breeze.

The next question one probably asks is why such enormous deposits of diatomaceous clay should be found in the Rift Valley, and this can, I think, be explained to a great extent. From Tertiary times onwards the Rift Valley has been the scene of tremendous volcanic activity, and the eruptive matter has uniformly been of what geologists call an acidic type, that is to say, the lavas and ashes ejected from the volcanoes contain a preponderance of silica (SiO_2). For convenience of classification all volcanic materials containing over 60 per cent. of SiO_2 are classed as acidic rocks, and all containing below that percentage are classed as basic. Now the bulk of the silica in these lavas and ashes is amorphous, that is to say, not in a crystalline form, and any crystalline silica there may be is probably in what is known as the tridymite form, a form which usually occurs in tiny crystals in rocks of the character now being discussed. Now certain forms of amorphous silica, and also the crystalline form known as tridymite, are soluble to a varying extent in carbonate of soda solution. Professor Gregory has called attention to the high percentage of soda-carrying minerals in many of the lavas he collected in his journey through this area, and although proper analyses of the rocks have rarely been made, we know that the Rift Valley region abounds in soda deposits, *vide* the Magadi Lake and the similar deposits north of Baringo. Lakes Hannington, Nakuru, and Elmentaita are so heavily impregnated with soda salts as to be undrinkable. The water of Lake Naivasha too is impregnated with soda in a lesser degree. We also know that at one period of the history of the Rift Valley, Lake Naivasha stretched from near Gil-gil to the slopes of Longenot, and south of that again formerly occurred what Gregory calls Lake Suess; Nakuru and Elmentaita also about that time coalesced into one huge lake covering the Elmentaita Plains. We thus have all the conditions and materials at hand necessary for the formation of these great beds of diatomite; picture Suswa, Longenot and Eburu all periodically in active eruption, and in addition to lava flows ejecting great clouds of volcanic dust and streams of mud mainly composed of siliceous fragments. This is almost certain to have been, as is the case in all volcanoes of this kind; the steam tearing its way through the magma which formed the flows of obsidian and trachytic tuffs would naturally blow large quantities into a state of very fine division, and this would be spread far and wide by the wind and also carried into the lakes by the torrential downpours which always accompany volcanic activity. The soda-laden water would dissolve the silica and place it ready for the diatoms to work upon, and with such rich material to build with one can quite see that this form of life could flourish with great luxuriance. All these lakes have greatly decreased in size since those days, and the walls of the Rift Valley have slowly risen owing to faulting, and consequently the beds of diatomaceous clay are now in many cases exposed high above the present lake levels.

It may be asked why the soda-laden water did not redissolve the dead skeletons of the diatoms, but this is probably due to the organic material which helps to cement together the skeleton, and also to the presence of an admixture of aluminous matter which continually washed down into the lakes and helped to bury the siliceous fragments.

A few remarks as to the economic aspects of these deposits may not be amiss.

Diatomite is used for various industrial purposes, amongst others to mix with nitro-glycerine to form dynamite; the kind used for this purpose usually comes from Prussia, and is called *Kieselguhr*. Owing, however, to the invention of more powerful and safer explosives this is a decreasing need.

One of its greatest uses is as a polishing material for metal work; it is known under the commercial name of Tripoli, from the country whence it was originally introduced. Some of the polishing soaps also contain diatomaceous earth. It is also used for making the so-called 'candles' of the more modern filters. It is a first-class non-conductor of heat, and mixed with a modicum of clay is made into bricks for lining fireproof rooms, as a lining for stoves, furnaces, &c. It might also be used to great advantage to make tiles for houses in tropical countries. It is also used in the manufacture of water glass or silicate of soda and artificial meerschaum. Its value commercially depends on the amount of silica it contains, its white colour, its absorbent qualities, and the fineness with which it is ground.

The analyses of samples from different parts of the world give results varying from 75 per cent. to 90 per cent. of silica and 3 per cent. to 10 per cent. of alumina, the balance being made up of small percentages of iron, potash, soda, and organic matter. Its value commercially in its crude state is only £3 to £4 per ton, but if properly sifted and ground, and of uniform high quality, it would be worth three or four times this amount. The present consumption in England is said to be about 3000 tons per annum. The great difficulty in shipping this material for long distances lies in its lightness, which causes shipping firms to take it only by measurement.

I am indebted to the *Imperial Institute Bulletin* for most of the facts regarding the commercial aspect of the product.

TROUT IN BRITISH EAST AFRICA

BY F. J. JACKSON.

Readers of this journal will doubtless be interested to hear that whilst camped on the Aberdare Range on August 28 last, I succeeded in catching five trout, and rising five or six others. The fish were all taken with a small grouse wing fly and within a distance of 150 yards down stream of the footbridge that crosses the Gura stream, and within a very short distance of the site of the hatchery, which was further up stream. The stream itself is little more than 2 feet in width, except here and there where it widens out into small pools of perhaps 4 feet in width. The fish, all brown trout, varied from 8 to $6\frac{7}{8}$ inches in length, and were little over a quarter of a pound in weight, and were probably hatched out from the same consignment of ova.

As I saw nothing larger or smaller than these fish and was anxious to obtain evidence of others, Mr. Guy Baker of the Forestry Department very kindly undertook to try to obtain further evidence. Mr. Baker's efforts were successful, and he sent me a small brown trout $5\frac{1}{4}$ inches in length, and another of 9 inches. This latter appears to differ from the brown trout in being much more silvery, besides having a rounder and proportionately shorter head, and it may be a rainbow trout. But what is of still more interest, as tending to show that it is probable that the fish have already begun to breed, is a photograph by Mr. Baker of a fish 15 inches in length and $15\frac{3}{4}$ oz. in weight.

Mr. Baker informs me that all his fish were caught with a fly, and within three miles of the site of the hatchery.

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