

Kansas, Texas, &c., also in South America (Brazil).* The Laurentian or fundamental gneiss of Scandinavia.† with its companion beds, so singularly resembles that of Canada that, although in another hemisphere, it may be said to be identical in every particular of any moment; and, to avoid useless repetition, we shall be content only to announce the fact, on the authority of Durocher, Keilhau, Scheerer, Naumann, and Macfarlane.‡

Nearly the same may be said of the fundamental gneiss of North-west Scotland and the Hebrides. It, too, has its marble bands, talcose and micaceous schists, its quartzites, hornblendes, &c. The gneiss which predominates and characterizes the group is usually massive and intensely crystallized. It is both micaceous and hornblende, as in Canada; the younger and very different palæozoic gneiss of the same part of the Scottish mainland is unconformable to it; and here are eruptive masses similar to those America, in the same attitudes.§

France contains much Laurentian, although hitherto that horizon has not been claimed for any of its crystalline deposits. It may turn out that one of the two granites of Brittany, the fine-grained and the porphyritic, is of this age, from its position and behaviour. The relations of the granite of La Vendée I cannot as yet master; but the hill-ranges of Forêt and Tarare in Central France seem to be Laurentian very distinctly,|| according to the descriptions of Elie de Beaumont and Gruner. Palæozoic fossiliferous beds (the Carboniferous, for instance) rest upon it unconformably, and are never penetrated by it; and this, while waiting for further information, entitles me to treat of the underlying rock as Laurentian. Similar conditions take place in the mountains of the Vosges, where we have again the fine and coarse granites of different ages. The first form is contemporaneous with gneiss, leptinite, and some schists, which support unconformably Coal-measures, Trias, &c.; while the newer and coarser rock breaks through every bed here named, and has engulfed masses of the gneiss.¶

TRANSLATIONS AND NOTICES OF MEMOIRS.

THE FOSSILIFEROUS NODULES IN THE POST-TERTIARY CLAY OF NORWAY. By Dr. M. SARS, Professor of Zoology, Christiania.

[Translated by the Rev. ROBERT BOOG WATSON, B.A., F.R.S.E.]

THE following is a summary of part of a paper by the celebrated Norwegian naturalist, Dr. M. Sars. It was published in the *Nyt Magazin for Naturvidenskaberne* (Christiania) for 1863, under

* D'Orbigny's *Amér. Mérid.* vol. iii. p. 222.

† Norway, Sweden, Lapland, and Finland.

‡ See also D. Forbes and Dahll, *Quart. Journ. Geol. Soc.*, vol. xi. p. 166, & *Misc.* p. 9.

§ Murchison, *Quart. Journ. Geol. Soc.*, vol. xiii. p. 30; vol. xvi. p. 216; and Murchison and Geikie, *op. cit.*, vol. xvii. p. 176-187.

|| *Explic. Carte Géol. France*, vol. i. p. 130; Gruner, *Géol. Loire, passim.*

¶ De Beaumont, *Explic. Carte Géol. Fr.*, vol. i. p. 327.

the title, A GEOLOGICAL AND ZOOLOGICAL JOURNEY IN THE SUMMER OF 1862.—R. B. W.

A characteristic of the marly clay which overlies the Boulder-clay of Norway is the presence of balls of hard marl, which, from their extraordinary rounded form, almost seem artificial, and in Sweden have obtained the name of 'Marlekor' (Marl-cows), 'Näckebröd' (Nick's bread), 'Imatrastene' (Imatra's stones). They are round, oval, kidney-shaped, biscuit-like, long and straight, or bent, sometimes oblique, and always more or less flattened. The edge is often irregular and jagged; but is sometimes smoothly rounded, and often shows distinct stratification, the laminae being always parallel with the flat sides. The nodules are very hard, strongly calcareous, internally blackish, bluish, or ash-grey, and contain numerous very small particles of mica. The exterior is always lighter in colour than the interior, and chiefly yellowish-grey.

The origin of these lumps had been variously attributed to hardened nodules derived directly from the Silurian limestones, or to concretionary action in the marl.

No trace of organic remains had been found in them, but Dr. Sars has at last obtained from them fossils which determine at once the time and mode of their formation. At the mouth of the Rauma River, which flows through the famous Romsdal, and falls in at Veblungnes at the head of the Romsdal Fjord, immense quantities of these nodules are to be found, both in the marl itself, and washed out of it by the river. Of these many contain no visible organic remains; not a few, however, enclose a fossil. Dr. Sars gathered over a hundred such. The enclosed organisms are in a markedly different condition from such as are found in the Glacial formation. These latter are usually so little altered as hardly to be distinguishable from living specimens. The organic remains in the concretions, on the other hand, are completely penetrated by mineral, especially calcareous, matter; and they have perfectly the appearance of having been derived from some much older formation; so far from this being the case, however, all the organic remains belong to living species.

The most frequent organisms are shells of Molluscs, such as *Yoldia* (syn. *Leda*) *pygmaea* and *Nucula tenuis* (var. *expansa*), which are characteristic of the Norwegian marls. Both of these are often found with their valves united; still oftener heaped together in masses, or packed one on another in great numbers in the spherical, oval, or elliptical, more rarely in the long, kidney- or biscuit-shaped nodules. Occasionally a single *Tellina proxima* occurs in a nodule. In one long elliptical concretion lay the internal calcareous stem of a species of *Pennatula* or *Virgularia*, extending exactly through the longer axis of the nodule. In another very long, thin, and slightly curved concretion was a species of Worm, also stretched in the length of the stone. Very remarkable was the discovery of a Chætopode, or setose Annelid, in long straight elliptical nodules of the marl. Seven of these were found; one specimen in each concretion, and lying exactly in the longer axis of the stone. Finally, there was found a part of the back-bone of a Fish, which

occupied the longer axis of a long slightly curved, but broken, concretion.

The marl extends up the Rauma for three or four miles. About three miles up Fish-remains seem to be frequent in the concretions; and some remains of Fishes of the family *Gadoidei*, among which is an entire *Merlangus*, preserved in the museum at Christiania, have probably been derived from this quarter.

Other similar concretions Dr. Sars procured from the Guuldal, in all respects like the former. In these he found: 1. A Chætopode, of the same species as that from Romsdal, occupying exactly the longer axis of an oval nodule. 2. A Chætopode, of another species, much longer than the former, found in the two fragments of an almost cylindrical concretion. 3. Seven specimens of *Osmerus arcticus* (*Salmo*), O. Fabricius (*Mallotus Groenlandicus*, Cuvier); all of which were entire. Each was in a separate nodule, long and narrow, generally nearly straight, but occasionally bent, slightly compressed on both sides, and a little rounded at the edge. The Fishes are from $4\frac{1}{2}$ to $5\frac{1}{4}$ inches long, and perfectly preserved. The back-bone is blackened and brightly lustrous; the other bones light-brown and slightly lustrous; and all are as hard as stone, except the thin shell-like bone of the head, the operculum, and the extremities of the rays of the fins, which are membranous and elastic. The operculum is light-bluish-grey, lustrous, and beset with numerous very small, but not adjacent, round black specks, as is also the case in some specimens from Greenland. The number of rays in the fins could be counted, and exactly tallies with Nilssen's and Krøyer's description of the living Fish.

Such skeletons of the *Osmerus arcticus*, inclosed in exactly similar marl-knots, have long been known in our museums under the Greenland name of 'Angmarset,' without anything being known of their particulars; and in the 'Boston Proceedings of Natural History' for 1851, pp. 29, 51, it is shortly stated that Mr. Logan had received a large number of fossil *Mallotus villosus*, which is the same fish, from the deposits near Bytown, not far from Ottawa, in Canada, at 180 feet above the sea-level; but in Europe they were hitherto unknown. It is therefore very interesting to know that they are also to be found in the Glacial formation of Norway, and that pretty frequently and universally distributed. In the Trondhjem Museum there are ten specimens of this Fish lying in a large piece of hard laminated clay. The *Osmerus*, as is well known, is an Arctic Fish occurring in incredible numbers in the Polar regions of the old and new world. Individual specimens have occasionally, though very rarely, been met with so far south as Finmark, and still more rarely at Söndmör, Bergen, or even the Christiania Fjord. In the Glacial epoch, however, it seems to have been diffused much further south than now.

In regard to the concretions containing these Fish, it is deserving of notice that there is always a single and entire fish in each nodule, and that the Fish, like the previously mentioned Annelids, occupies the whole longer axis of the concretion; and further, that the outer form, though roughly yet distinctly, answers to the shape of the fish

within; even the fins, the anal one in particular, being indicated by projections of the surface, so that the external form of the concretion is plainly due to the contained fossil. On the other hand, a broad very flat concretion, with an irregularly rounded circumference, contained some vertebræ and other bones of the same Fish.

4. *Yoldia (Leda) pygmæa*; in one case associated with an Annelid, in another with a Fish.

5. *Ophiura Sarsii*; one specimen in a thin flat concretion, slightly convex on both sides, and which, though very hard, seemed less calcareous than usual, and was internally of a lighter colour and contained much mica. The circumference was prolonged into five flat points of different sizes, but corresponding to the arms, and presenting some of the spines and plates, from the form of which the species is determined. Judging by the thickness of the arms, this specimen must have been as large as or larger than those found living by Dr. Sars in Finmark; and had fully attained the size of the living Greenland form, which, according to Lütken, has a body 27 mm. = 1.1 inch in diameter. Here, as in the case of the Fishes, the form of the concretion was obviously determined by the shape of its contents; and here, therefore, we have a further illustration of the singular manner in which, during the process of decomposition, the particles of carbonate of lime contained in the clay were drawn together by the influence of the organic body, and concentrated around it in a hardened mass.

Among other facts of interest which Dr. Sars mentions in connection with the Glacial formation is the distinct diminution southwards of the Arctic character of the strictly Arctic Shells present in the clays. As they extend further south they fall off both in frequency and in size. Thus the *Siphonodentalium vitreum* is found living in Finmark and fossil as far south as Christiania; and the living specimens from the north and those fossil from the south of Norway agree very closely in size, being from $\frac{2}{3}$ to $\frac{1}{2}$ inch (10 to 12 mm.) long, by $\frac{1}{10}$ inch ($2\frac{1}{2}$ mm.) broad at the base, whereas the fossil specimens from further north, in the neighbourhood of Trondhjem, are $\frac{3}{4}$ inch (20 mm.) long, and $\frac{1}{4}$ inch ($3\frac{3}{4}$ mm.) broad, and some seem to have attained even 1 or 1.1 inch in length, and $\frac{1}{2}$ inch in breadth.

On the other hand, it is a very curious fact that some shells extended further north in the Glacial epoch than they do now; thus *Scrobicularia piperata*, which has never in a living state been found further north than Florö in the Bergenstift, appears in the Glacial Clay at Surendal and at Trondhjem. *Pecten maximus*, too, which is unknown living further north than Christiansund, is found in the clay at Steenkjær, at the very head of the Trondhjem Fjord, and sixty miles north of that town.

SAGGIO SULLA COSTITUZIONE GEOLOGICA DELLA PROVINCIA DI PISA; del Prof. Cav. PAOLI SAVI. 1863. 4to. Pisa. pp. 42.

THIS account of the Geology of the neighbourhood of Pisa by its veteran Professor is accompanied by an elaborate general map, with excellent sections, and special maps of the neighbourhood of

VOL. I.—NO. IV. M