

is considered, and an examination of the casts themselves affords no support whatever to this conclusion. Again, they have been regarded as the trail of a crustacean, but the absence of a central track, and the varying relations of the different groups, seem to preclude this explanation, though the fact that a great proportion of the casts are sunk in the matrix obliquely to the plane of the rock, appears in favour of it. But the hypothesis, that they are footprints of some unknown reptile, although it has found but little favour amongst geologists, harmonises in Mr. Grindley's opinion with the facts of the case better than any other yet proposed, and he thinks no sound objection has as yet been advanced against it. The idea of a creature of vast size prowling along the margin of the shore in search of food agrees in every respect with the trails, the difference in the size of the two pairs of casts composing the group of four, may be the result of a difference in the size of the hind and fore feet. The variation in the impressions would indicate a troop of animals of different ages and sizes.

In conclusion, the author stated that, though he was certainly of opinion that the markings were of reptilian origin, yet he was by no means unwilling to adopt any more reasonable explanation.

ABSTRACTS OF FOREIGN MEMOIRS.

I. ON CALAMITE-FRUITS FROM THE SPATHIC IRON-ORE NEAR HATTIGEN ON THE RUHR. BY RUDOLPH LUDWIG,

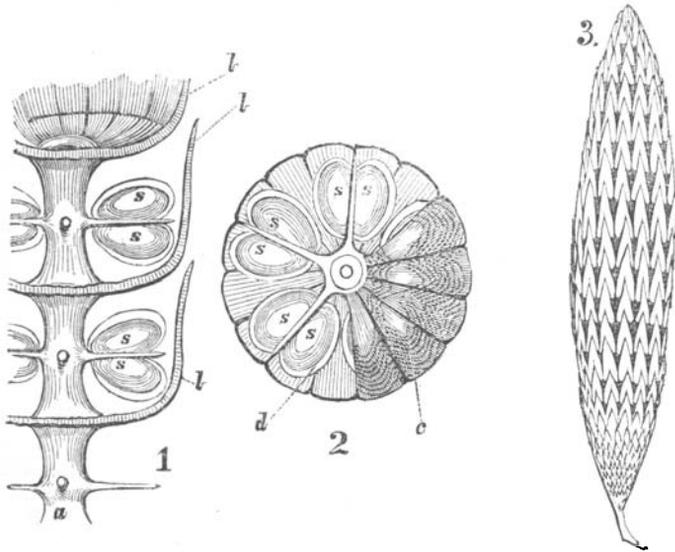
(CALAMITEN-FRÜCHTE AUS DEM SPATHEISENSTEIN BEI HATTIGEN AN DEM RUHR. VON RUDOLPH LUDWIG. *Palæontographica*, vol. x. pp. 11–16. Pl. 2.)

THE fossil which formed the subject of this memoir was obtained from a bed of spathic iron-ore occurring near Hattigen on the Ruhr, and had already been referred by Dr. Lottner* (who sent it to the author for examination) to the genus *Cyathocrinus*. Dr. Ludwig, however, determined that it was referable to the vegetable kingdom, and consisted of the fructifying spikes of a species of Calamite; he gives the following description of it:—the fossil consists of shortly stalked fruit-spikes lying in a whorl round the stem, having a cylindrical form, contracted above and below. The spikes are about seven centimètres in length and one in thickness; they consist of a number of closely packed, broad, short, and sharply pointed bracts arranged in a coronal manner upon circular, radially ribbed discs, attached to the hollow jointed stalk, so that as many as fifteen bracts form together a crown-like body, whose teeth exactly touch the middle rib of the bracts above. In this manner as many as from 20 to 25 cylindrical chambers, superimposed on one another are formed along the central column; they are imperfectly closed at the exterior margin, and each one contains five bunches of spore-capsules attached to the central stalk. The arrangement and

* Geognost. Skizze des Westphälischen Steinkohlengebirges. 1859, p. 154.

mode of attachment of these capsules are in the highest degree peculiar.

The spore-capsules themselves are in the form of a nut, or a flask, or an elongated egg, they have a strong shining shell, are nearly circular in transverse section, and have a scar on the inner end, which is somewhat bent, and thinner than the other. There are always four of these capsules arranged symmetrically round a short thorn-like stem, in a bladder-like integument. In each chamber



STRUCTURE OF FRUIT OF CALAMITE.

Fig. 1. Vertical Section of part of Fruit-spike :—*a*. Axis of Spike ; *b. b.*, Bracts ; *s. s.*, Spore-capsules.

Fig. 2. Transverse Section of the same :—*c*. Floor of cell, partly removed to show Spore-capsules (*s. s.*) and integument (*d*).

Fig. 3. Entire Fruit-spike of Calamite.

five of such bunches are disposed round the central stalk, so that it contains 20 capsules. The thorn-like axes of the bunches are placed perpendicularly above those in the chamber below ; they are hollow at the lower end, and are attached to short pegs projecting from the fibrous wood-substance of the central stalk.—H. M. J.

II.—INTRODUCTION TO ‘VESTIGES OF THE ICE-PERIOD,’ BY L. P. HOLMSTRÖM.*

By Dr. OTTO TORELL.

IN the year 1836 Sefström published his memoir on the direction of the Ice-grooves in Sweden. He made very exact observations on the fact, scarcely noticed before, that the Swedish mountains are

* Translated and communicated by Magister Lindström of Wisby, Island of Gotland.

polished on the surface, and scratched or furrowed by some violent external agency. In order to explain this phenomenon and those connected with it, he supposed that a flood or deluge ("rullstens flod," literally "flood of the rolled stones") had overwhelmed all Scandinavia, passing from North to South, carrying along with it great quantities of stones and gravel, and that the subjacent mountains had been ground and furrowed in the direction of the current, 'just as a polished slab of marble is furrowed by sand grains that are pressed in a continuous straight direction on its surface.'

After having examined the vestiges of the glacial epoch, Dr. Torell embodied the results he had arrived at in an academical treatise, published in 1858 ('The Mollusk-fauna of Spitzsbergen'), and there described the facts which, in his opinion, prove that all Scandinavia was once covered by snow and ice. During the progress of these researches he was led to results which had not been expected when the above paper was written; and he could not find anything supporting them in previous papers. He did not then suppose that the ice which had covered the mainland of Scandinavia had stretched farther than the coasts and the nearest adjacent islands. He tried to explain this by the fact that, during the Glacial epoch, the land was higher than it now is, and the islands close to the shores must then have been united with the mainland.

It has been known, since the beginning of this century, that a large part of Northern Europe is, as it were, overstrewn with 'erratic blocks,' the origin of which all naturalists agreed to seek in Scandinavia. The general opinion then was, that these stones had been carried from Scandinavia on ice-floes, and then deposited on the bottom of the extensive sea supposed to have stretched from the White Sea to the German Ocean.

In a paper which Dr. Torell communicated last year to the Royal Academy of Sciences in Stockholm, he endeavoured to show that the hypothesis of such an ocean was contradictory to facts, and that the transport of the blocks resulted from the large continental ice-covering of Scandinavia having spread over all the region where the erratic blocks are found. He showed how the known fact, that the blocks from various parts of Scandinavia have a different distribution beyond that region, could only be explained by the theory of their transport on a coherent and uninterruptedly progressing ice-field. A necessary supposition in support of this explanation was, that Denmark during this period must have been united with Scandinavia, and the author tried to prove that supposition. Continued researches made it apparent that several minor epochs or divisions could be discerned in the great Glacial period:—

1. There are no facts which enable us to trace the extent of Scandinavian land-ice before it reached its greatest distribution. This extension may even now be determined by the boundary-line of the erratic blocks, and the period of its existence may be considered the first part of the Glacial period.

2. In the second epoch the mass of the ice was considerably diminished. The Russian Waldai heights were no longer transgressed,

but, through their opposition, gave the moving ice on the Russian side of the Baltic a direction from North to South. This is evident from the route taken by the Silurian and Devonian blocks from Eisland and Liffland, and by the direction of the grooves in the Russian provinces near the Baltic.

3. The third division begins with the continued decrease of the ice which now moved in the basin of the Baltic. Finland was probably still completely or partly covered with ice. The ice also filled the basin of the Baltic, but was in the East checked by the resistance of the Russian and German Baltic shores. Ice, in consequence of its plasticity, always moves in the direction of least resistance, so that it must during this period have followed the median axis of the Baltic; thence a considerable south-west deviation was caused, and numbers of blocks from the island of Gothland were carried to Groeningen in Holland and Jever in Oldenburg. The islands of Aland, Dags, Gothland, and Bornholm, as well as Faxö on Seeland, were grooved and furrowed in directions somewhat corresponding with that indicated. But it was not only the islands that were covered and polished; the thickness of the ice was evidently so considerable that certain parts of the mainland of Sweden were overwhelmed by that moving from the Baltic. Dr. Torell showed by the direction of the furrows in Upland and Sodermanland that they had their origin from the Baltic, not from the mountain-ridge between Sweden and Norway. He also supposed that the eastern part Scania had been covered by Baltic ice.

As Sefström's observations on Scania were insufficient, Mr. Holmsröm, exhorted by Dr. Torell, undertook the researches on the direction of the grooves in Scania, and the results seem to confirm the views of Dr. Torell. The prevailing direction of the furrows in Scania is from North-east to South-west.

4. The land-ice did not pass the confines of Scandinavia, but retreated more and towards the central mountain-ridge.

5. Then came the last epoch, when only the large mountain-valleys were filled with glaciers, the diminution of which may still be seen in the traces of their existence that they have left in their moraines. During this last epoch the present Scandinavia was depressed, or subsided, north of Scania; the Yoldia-clays and shell-banks were deposited, filled with the remains of a Glacial fauna now vanished. Our large lakes were changed into bays, where the animals of the Glacial sea lived. The land was again elevated, and the bays again became lakes, Professor Lovén having discovered in them the remnants of a Glacial fauna.

6. As the elevation continued, the climate was changed to that now prevailing, and the present geological epoch began.

III.—GLYPTODON CLAVIPES.

THE COMPTEs RENDUS, September 18th, records an interesting paper by Marcel de Serres on *Glyptodon clavipes*, an almost

entire skeleton of which has been set up by him in the Museum of Comparative Anatomy in Paris. This is the most complete example yet seen in Europe. The head is entire, and is remarkable for its great vertical depth, nearly equalling the lateral measurement (as 37 to 40). This elevation of the head is principally due to the large size of the maxillary bones.

The cervical vertebræ indicate an abnormal and probably unique condition, some of the elements being absent. M. Serres remarks that such a condition is without analogy at the present day.

The persistence of the dental bulbs, the great size of the lower jaw, and the zygomatic arch, furnished with a strong spur which greatly increased the surface for the attachment of the masseter muscle, show that the *Glyptodon clavipes* was even better adapted than the elephant for a vegetable feeder.—E. F.

REVIEWS.

I.—ON SOME FORAMINIFERA FROM THE NORTH ATLANTIC AND ARCTIC OCEANS, INCLUDING DAVIS'S STRAITS AND BAFFIN'S BAY. By W. KITCHEN PARKER, F.Z.S., and Professor T. RUPERT JONES, F.G.S. 4to. 1865. (From the Phil. Trans. 1865, pp. 325-341. 8 Plates.)

THIS Memoir, communicated to the Royal Society by Professor Huxley, F.R.S., in 1864, has for its chief object the description of a certain group of Foraminifera, constituting the Foraminiferal portion of the fauna of a distinct Natural-history Province. Another object that the authors set before them was the careful discrimination of such forms, and groups of forms, among the Foraminifera as show strict zoological relationship, however much masked by dissimilarity of shape, but really recognisable by similarity of structure, among numerous puzzling gradations of equivalency, modified by varying conditions of growth, according to depth, saltness, and warmth of water.

The materials for the work were derived from (1st) Soundings in Baffin's Bay, made during one of Parry's Voyages; (2nd) Dredgings in Davis's Straits, among the Hunde Islands, by Dr. P. C. Sutherland; (3rdly) Dredgings on the Coast of Norway, by Messrs. MacAndrew and Lucas Barrett; and (4thly) Soundings in the North Atlantic, taken by Commander Dayman when exploring the Atlantic floor for the Telegraph-line.

Some of these materials belong to what Naturalists term the 'Arctic Province;' but the North Atlantic belongs chiefly to the 'Celtic Province,' and Captain Dayman's soundings supply illustrations of its abyssal fauna. Its littoral fauna on the east is to be found around the British Isles, and Messrs. Parker and Jones (with Mr. H. B. Brady's help) drew up a corrected list of the British Foraminifera for this part of their subject. The western, or American 'littoral' of the 'Celtic Province,' is called the 'Virginian;' and from this Dr. Bailey has figured and described some Forami-