

ON THE REPTILE-BEARING SANDSTONES NEAR ELGIN, SCOTLAND*

Several times I had the opportunity to visit the interesting region of Elgin on the Moray Firth in N. Scotland for I was studying the reptiles occurring there. Mr. WILLIAM TAYLOR and Dr. W. MACKIE were kind enough to open the museum there and their private collections to me and the former has made the geology of the region known to me on different excursions.

The sandstones of that region were already known formerly by Devonian fish remains. Increased interest turned on them however when in 1851 reptile remains were found in the upper part. Soon it became obvious that these finds belonged to a much younger time than the Devonian. The sandstones which were younger than Devonian were held for Triassic. The certainty of the parallel has its basis in that the fossil-bearing sandstone occurrences do not connect but are scattered far apart in small patches. Only the fossil content could give information on the age.

The adjoining map (p. 618) should set the localities in perspective. First I will briefly discuss the separate occurrences.

Lossiemouth: North of Elgin, sandstone from Lossiemouth to Burghead parallel to the coast forms a narrow, low but sometimes steep range of hills. In the W. parts near Masons Haugh, Cummingstown among other places one recognises numerous footprints in the sandstone. There it is held for Permian. Reptiles occur in this range only near Lossiemouth. The quarries run from the harbour on the S. side of the hill to the region of the school house. In recent years and now, only the most western part of the extensive old quarry was being worked. The sandstone is strongly fissured and hardly allows layering to be recognised; it is fine-grained, tough to hard with more or less argillaceous and iron-bearing cement; its colour is white to yellow. This is the stone which is extracted from the quarry in which reptiles are also found. The latter have been found in blasting in the harbour, 20' below water, under the present station site in the E. and W. quarry. This is the so-called *Stagonolepis* sandstone, as it is named after the most frequent fossil. In the W. quarry one sees under it well-bedded, tough red sandstone and thin bedded, red argillaceous sandstone. Whether these two belong to the Trias or Old Red is uncertain. Below the base of the W. quarry a thin marl layer will have been exposed earlier which, like the whole Trias of Lossiemouth, dips NE; in it a plant cast was found once which is preserved now in the British Museum; it is an indeterminable stalk with several branchings. At the level of the hill where the school-house stands, thus about 50 m N of the W quarry, red sandstone was exposed in the construction, which Mr. TAYLOR holds for Old Red. The hill is bordered by the E-W running dislocations and probably also cut. In loose blocks one finds siliceous vesicular limestone with galena and pyrites which are interpreted as relics of denuded higher strata. It is named, particularly at the Spynie, cherty rock.

The fossils in the *Stagonolepis* sandstone of Lossiemouth are, as far as large bones are concerned, mostly preserved as white, slightly pulverised bone material; particularly in the small forms, the calcareous bone substance is partly leached out and only the pale cavity remains; but often the cavities are filled with a dusty, argillaceous, ferruginous substance

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which is frequently so firmly fused with the stone that it can be exposed neither as a cavity nor a cast.

Spynie: Spynie lies 3 English miles S of Lossiemouth and 2 miles N of Elgin. The small E-W extended hill (parallel to that of Lossiemouth, caused by the same system of dislocations) has its name from the ruins of Spynie Palace. The beds dip as at Lossiemouth approximately 20°NE, as one can recognise from the over layering of different rocks. The quarries have been abandoned for a long time. In one of the pits a 20 m high sandstone wall is preserved. The *Stagonolepis* sandstone at Lossiemouth is unstratified and strongly fissured. Above the mentioned high sandstone wall lie numerous large and small blocks of oolitic, partly silicified limestone with chalcedony bands around; in places the rock shows vesicular structure and contains pyrites. This is the transition to the purely siliceous vesicular limestone; this stands about 100 m E of here near the ruins of Spynie Palace at the same level. It lies above the *Stagonolepis* sandstone.

Findrassie: The quarries of Findrassie are named after the country seat of the same name. Findrassie lies about 2 English miles NNW of Elgin on the N slope of the range of hills that run from Elgin to Mosstowie in a north-westerly direction and which are nearly completely formed by Old Red which dips about 5-10°S. A little E of Findrassie lie the extensive abandoned quarries which are now largely covered and overgrown. The sandstone is grey-yellow and soft and contains no pebbles; it is rather uniformly stratified. The higher rising slope from the former quarries consists of very hard, pebble-bearing, quartz sandstones. In definite *Stagonolepis* sandstone pebbles do not occur; once only has a small pebble been found near Lossiemouth. Also pebbles do not occur in the Old Red of the region, as Mr. TAYLOR assured me. On the other hand, they are characteristic of the Permian sandstone of the neighbouring Cuttie's Hillock. I suggest that this slope also belongs to the Permian and that it is separated from the Trias of the quarry by an ENE running fault. The terrigenous material there makes the idea all the more likely. In the Trias of Findrassie *Stagonolepis* and *Dasygnathus* have been found. Earlier there was also quoted from here a *Ceratodus* tooth, but it was based on a mistake, for the tooth comes from New Spynie, an entirely different locality, in which Old Red occurs (on Quarrywood Hill, west of Cuttie's Hillock).

Cuttie's Hillock: Quarrywood Hill, which extends between Elgin and Mosstowie, consists of Old Red with *Holoptychius*, which dips slightly to the S. Its upper surface forms extensively a similar and smooth level. It is piled up with definite terrigenous material with horizontal layering to c. 30 m thick Permian *Gordonia* sandstone. In the large pine woods it is exposed in several quarries, of which the best known, which is also the only one hitherto to yield fossils, is entirely at the level of Cuttie's Hillock (= "witches' hillock": formerly the place of execution lay here). From there one gets the best orographic view over the whole region. In one of the other quarries, ½ mile E of Cuttie's Hillock, the stone appears exactly the same as in the known locality. The sandstone is sometimes soft, sometimes very hard, of white to yellow colour. It contains bedded pebbles, abundantly or singly. Their size ranges from a pinhead to over fist size. They consist of white, transparent or red quartz. Their form is partly complete, partly half rolled. The sandstone has coarse cross-bedding and is strongly fissured. Near Cuttie's Hillock, blood-red quartz also occurs rarely, among the pebbles, which should occur on the N side of the Moray Firth. There are also crystalline slates among the pebbles. Several of the pebbles recall in their form dreikanter, but they are not of primary deposition, but are washed along. Many pebbles, first rolled and then split (probably as a result of insolation) are embedded in the sandstone; many are rolled after splitting or weakly polished by sand grinding and then imitate dreikanter, but are distinguished from them by their often

concave surfaces. The quarry of Cuttie's Hillock has yielded the Permian reptiles *Gordonia*, *Elginia*, and *Geikia*. Only 10 ft below the base of the quarry a plate of *Holoptychius* was found under a thick pebble layer. Thus the Devonian has already begun. A clear boundary between both sandstones was not clearly recognisable. In the old quarry which, to the W, meets the one being operated now, one sees on a surface dipping obliquely S, a peculiar series of tracks of 1.5-2 m length. The tracks stand close to each other in pairs. The separate track shows no toe impressions, but only horseshoe-shaped depressions of quite considerable size; around the lower edge of each track runs a small wall of sand. Therefore I thought it might be the tracks of an animal sinking deep into the sand of a sloping dune. The same sandstone, rich in pebbles and footprints, is found, as mentioned at the beginning, on the N coast from Burghead eastwards. There it is also regarded as Permian.

The following reptiles have been found in the different localities:

Lossiemouth: *Telerpeton elginense* MANTELL.
Brachyrhinodon Taylori HUENE.
Hyperodapedon Gordoni HUXLEY.
Stenometon Taylori BOULENGER.
Erpetosuchus Granti E. T. NEWTON.
Ornithosuchus Woodwardi “
Scleromochlus Taylori A. S. WOODWARD.
Stagonolepis Robertsoni AGASSIZ.
Saltopus elginensis HUENE.

Spynie: *Telerpeton elginense* MANTELL.
Hyperodapedon Gordoni HUXLEY.
Ornithosuchus Woodwardi E. T. NEWTON.
Stagonolepis Robertsoni AGASSIZ.

Findrassie: *Stagonolepis Robertsoni* AGASSIZ.
Dasygnathus longidens HUXLEY.

Cuttie's Hillock: *Gordonia Traquairi* E. T. NEWTON.
“ *Huxleyana* “
“ *Duffiana* “
“ *Juddiana* “
Geikia elginensis “
Elginia mirabilis “

BOULENGER gave this list (loc. cit. 1904); here it is expanded only a little. After HUXLEY had shown that these sandstones no longer belong to the Devonian, they were all placed in the Triassic. In 1894, TAYLOR first suggested that Permian deposits also fit in there; he says in “Natural Science” (A monthly review of scientific progress) Vol. IV, No. 28, 1894, p. 472, London, J. M. Dent & Co: “Might not *Elginia* and *Gordonia* be Permian?” This is all he said about it. Then in 1902 (loc. cit.), the sandstones of Cuttie's Hillock were ascribed a Permian age from their fossils, by the author, without knowledge of TAYLOR's notice, in contrast to the three other Trias localities; in 1904 BOULENGER did the same (loc. cit.). Since then it is certain that the sandstone of Lossiemouth, Spynie and Findrassie is Trias; the *Gordonia* sandstone of Cuttie's Hillock, Permian. In 1908 the author attempted to prove that the *Stagonolepis* sandstone has the age of the German Lettenkohle (loc. cit.).

Another Triassic locality lies near Elgin, only 1 mile N in the region of the road to Spynie, which is the Rhaetic grey marl limestone of Linksfield. As early as 1842, Patrick DUFF described ganoids and vertebrae and teeth of Plesiosauria and a “femur or thigh bone of a chelonian reptile” from there. The latter SEELEY redescribed later (Quart. Jour. Geol. Soc. London 1891, p. 164ff) as a crocodile humerus. Poorly preserved bivalves are also found in the limestone of Linksfield. The quarries have for a long time been out of use. This limestone is found only in a small hill piled up from the level; the possibility is not excluded that this entire occurrence is a glacially transported mass.

Sketch-Map 1: 181 000

To illustrate the position of the localities near Elgin.