

A, A', anterior and posterior ocluser muscular impressions.  
V, muscular markings.

I am indebted to Professor Hall, of New York, for these beautiful examples of his genus *Strophodonta*.

17. *Orthisina anomala*, Schlotheim, Sp. Exterior of the *ventral* valve, and area of the dorsal valve. E, area. D, pseudo-deltidium. F, foramen.  
17a. Exterior of the *dorsal* valve.
18. „ *anomala*. Interior of the *dorsal* valve. A, A', ocluser muscular impressions.
19. „ *anomala*. Interior of the *ventral* valve. These beautiful specimens were kindly given to me by Professor Dr. Schmidt, of Dorpat, and were obtained from the Silurian limestone in the neighbourhood of Reval.
20. „ *anomala*. A fragment of the interior of the ventral valve, from a specimen in the collection of Signor Michelotti, of Turin. For this drawing I am indebted to Professor Suess, of Vienna.

## ON THE UPPER LUDLOW TILESTONES.

By GEORGE E. ROBERTS, of Kidderminster.

THE Tilestone passage-beds between the Upper Ludlow rocks and those cornstones, now established as the natural base of the Old Red Sandstone, are, from the interesting character of their animal contents, attracting the greatest interest. I think it would be of value if the pages of the GEOLOGIST were open to detailed descriptions of the lithological character and fossils of these "Tilestones," as exposed in different parts of Shropshire, Worcestershire, and Herefordshire. A comparison may thus be instituted which would greatly aid our comprehension of them.

The Upper Tilestone series displayed in my own neighbourhood, is thus described in the new edition of "Siluria":—

"In the red ground, two miles north of Bewdley, near Trimpey, in Worcestershire, greyish coloured sandy grits and cornstones rise out in undulations, the cornstones charged with the *Cephalaspis Lyellii*, *Pteraspis Lloydii*; and the underlying grits with *P. Banksii*, *Pterygotus gigas*,\* and eggs of this crustacean [?] (*Parka decipiens*) &c. with many remains of plants, including the small Lycopodiaceous sporangia."

This condensed matter I will now give in detail; for as every fossil

\* *P. Ludensis*, vide corrigenda.

found in the quarries has come before me, I have been able to secure the most important, and to take such notes of the others as would be of interest.

Trimpley is evidently connected in its physical elevation with the great upthrow of Palæozoic strata, along the line of which lie the Abberley and Malvern ranges. Of this ridge-line it would seem to be the northern limit. No true Silurian bed, however, is exposed along the strike of its anticline; but as the lowest measures of the Upper Tilestones, which form its backbone, are the exact equivalents of those resting against the north end of the Abberley Hill, micaceous shales, but fifty feet removed from Aymestry limestone, we can assume their presence not far beneath the axial line of the hill.

The ridge is flanked with true Old Red Cornstones, containing *Pteraspis Lloydii*, and *P. Lewisii*, *Cephalaspis Lyellii*, and defensive spines of *Ctenacanthus* or a related species. These fish-remains are coloured blue and purple by phosphate of iron, and glisten like enamel. Beneath these beds, somewhat unconformably, lie the Tilestones. Lithologically, they are grey flagstones, interstratified with bands of brashy cornstone (this, as far as I can yet learn, is a feature peculiar to the Trimpley beds). Fish and crustacean remains occur equally in both flagstones and cornstones, but the plant-remains form bands of themselves, intermediate between them. Beneath these lie micaceous shales, having surfaces bearing tidal ripple-markings and hollows. In the sheltered parts of these I have found *Pterygotean* ova (*Parka decipiens*) and a few drifted plants, but no fish or crustacean remains. These beds, at Abberley, cover up sandy grits, at the base of which I detected the Downton plant-beds, which contain the earliest land-plants.

To return to the Upper Tilestones: the fish-remains I have met with are these,—*Cephalaspis Lyellii*, heads only, but in very fine preservation; *Pteraspis Lloydii*, *P. Banksii*, *P. Lewisii*, and *P. rostratus*. Fragmentary remains are very abundant, but good and well-defined shields (I know not what else to call them) are rarely met with. The triplex character of the plates composing these defensive bony shells are beautifully preserved in nearly every specimen I have seen. I believe the Kington *Pteraspides* are remarkable for the want of these ornamental layers. *Ctenacanthus* (?) spines, and fragments of

that substance of osseous character, supposed to belong to that *Onchus*, the spines of which (*O. Murchisoni* and *O. tenuistriatus*) are common in this bed. I believe, however, that these once supposed fish-defences will settle down into spines from the trifid tail of a crustacean; possibly the same *Ceratiocaris* whose curious structure, as displayed by the *Lesmahago* specimens, has been still further elucidated from the Upper and Lower Ludlow beds of Leintwardine and Burrington (near Ludlow). So that the fragments of *solid bone* given us by this deposit will have to look out for a new alliance.

Trimpley has been justly celebrated for its *Pterygoti*. The figures in the forthcoming Monograph by Mr. Salter (Geological Survey, Decade 10, pl. xiv. figs. 11, 12, 13), are taken from Trimpley specimens, valuable as giving portions of this remarkable Phyllopodous Crustacean not met with elsewhere. *Pterygotus Ludensis* and *P. problematicus* are the species of which I have found remains. Patches of the carbonized skin of *Eurypterus* I have also met with.

The plant remains are abundant, but their character is so far destroyed by carbonization that little or nothing can be made of them. Some of them may have had a growth *in situ*, upon the dimly seen shores of that ancient estuary, but of the greater portion of the remains we can speak but in the words of Hugh Miller, who describes their Scotch equivalents as being drifted from highlands of the period, "irregularly grooved stems, branching into boughs at acute angles, seeming miniature resemblances to the trunks of gnarled oaks and elms." There is nothing certain about them, and no special character visible. The spores of *Lycopodiaceæ*, however, are well preserved, and have such pretty polished surfaces that casual observers have carried away from the quarries all they could find. All that I have seen are identical in form.

This ends my list of Trimpley fossils. I should be glad to learn the fossil fauna and flora of their equivalent beds in other districts.

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