the inner layer is thick and granulated, the internal cast is covered with corresponding small punctæ. Barrande[1] was much puzzled with these different appearances of the cheeks and glabella, and did not offer any satisfactory explanation of them.

3. In the third group into which I have arranged the species according to their genal characters, the adults have no ocular ridges and no ocular tubercles, and the reticulating nervures seem also to have disappeared, the shell being smooth and the interlaminar surfaces showing no meshwork, though punctæ or minute granulations may be present. But in some of the largest specimens of *T. concentricus* from the Onny River there are faint relics of the meshwork. The internal casts as well as the external surface of the shell only show minute pits or granules as a rule. In the young of *T. concentricus* the ocular ridge and ocellus of the species of Group 2 are present, according to Beecher, so that their loss seems to be a secondary modification or a suppression of larval characters; for the stratigraphically later group of *T. seticornis* possesses them.

(*To be concluded in our next Number.*)

NOTICES OF MEMOIRS.

I.—The Heterangiums of the British Coal-measures. By Dr. D. H. Scott, For. Sec. R. S.

WILLIAMSON, in his published papers, only recognized two British species of Heterangium, *Grievii* and *H. tiliæoïdes*. Under the former name he included not only the Lower Carboniferous plant from Burntisland, on which the species was founded, but also certain Coal-measure forms from Dulesgate. In the joint work by Williamson and the present author the same nomenclature was adopted, but a second form from Dulesgate was also described under the provisional name *H. cylindricum*.

H. tiliæoïdes, a Coal-measure species from Halifax, remarkable for the great development and perfect preservation of the phlœm, has been kept distinct ever since its first discovery in 1886.

The enormous difference of age between the Burntisland and the Dulesgate plants rendered their specific identity highly improbable, and the latter has been separated under the name *H. Lomaxii*, originally suggested by Williamson himself, after the name of the discoverer, though not published. *H. Lomaxii* is characterized by the great distinctness of the primary xylem-strands, by their nearly exarch structure, with little primary centrifugal wood, by the abundant secretory sacs of the stele, and by the rather scattered leaves.

In the Dulesgate material several forms of Heterangium stem have been found in association; it is unlikely that they are specifically distinct—they more probably represent axes of different orders. The provisional species *H. cylindricum* differs in no important respect from *H. Lomaxii*, to which it should be reduced.

[1] Barrande, *Syst. Silur. Bohême*, vol. i, Trilob., p. 622; ibid., Suppl., p. 47.

A very fine Heterangium from Shore was discovered by Mr. Lomax and his son in 1912. It is of large size, at least 17 mm. in diameter, though without secondary growth. The plant was originally compared with the so-called *H. cylindricum*, but is at least as close to *H. tiliæoïdes*. The feature which at first seemed to be most striking is the fact that four distinct leaf-trace bundles enter the base of the leaf, each of them dividing into two in the petiole. This is certainly the best example yet found of a polydesmic petiole in Heterangium, and shows an interesting approach to the Medulloseæ in this respect. We may also compare Dr. Gordon's new genus *Rhetinangium*. However, there is reason to believe that most of the British Coal-measure Heterangiums were polydesmic. In *H. tiliæoïdes* there are four distinct bundles in the petiole, and the same was the case in *H. Lomaxii*.

In all these plants two bundles start from the stele to form the leaf-trace, dividing into four, at least in some cases, before entering the leaf-base. Only in a very small stem from Dulesgate (not associated with *H. Lomaxii*) did a single bundle leave the stele (as in the Burntisland species), dividing into two on its outward course. This little stem has nothing to connect it with any other form and may be distinguished as *H. minimum*.

H. tiliæoïdes is maintained as a distinct species, mainly on the ground of its highly developed phlœm with dilated medullary rays. In the behaviour of the leaf-traces it comes very near the Shore plant, which may, for the present at least, be kept distinct under the name *H. shorense*.

II.—Note on the Geology of Porcupine.[1] By J. B. Tyrrell.

I HAVE been asked on two or three occasions whether I consider that the gold-bearing quartz veins in Porcupine are formed by the filling of fissures or by replacement of the rock in which they occur, and I have told individual members of an instance where bodies of quartz were undoubtedly introduced into similar pre-Cambrian rocks by metasomatic replacement, but some others among those present might be interested in hearing of the instance, so I will mention it. In the West Shining Tree country greenstones showing strongly marked ovoidal or pillow structure, similar to that so common in the amygdaloidal basalts of this district, are particularly abundant, and here and there through the greenstone quartz veins occur, some of which have been determined to contain gold. The individual ovoids or pillows are packed closely together, but there are angular portions of the greenstone in between them, and, as a rule, the rock inside the pillows and in the angular areas outside of them are almost precisely similar in character. In one place, however, the angular areas are entirely converted into quartz, which, as far as I could see, was precisely similar to the quartz in the veins near by. As these angular areas had originally been greenstone, we have in them a clearly marked example of a metasomatic replacement

[1] Extract from the Monthly Bulletin of the Canadian Mining Institute, June, 1915, pp. 397–8.

of the greenstone by quartz, but whether the veins in the vicinity were also formed by a similar replacement or not, I have no definite proof, but I believe that replacement took a large share in their formation. A number of the members here may think that such questions have no bearing on mining problems, and I have often heard men say that they did not care how the gold got into the rocks, that all they were interested in was where it was. Now the world has advanced too far to ignore the causes of things; if those things are to be clearly understood and if you are to clearly understand the bodies of ore which you are working you cannot afford to ignore the question of the causes which lead to the formation of those ore bodies, since a knowledge of those causes may enable you to correctly predict the extensions of those ore bodies or may point you to where other similar ore bodies occur.

REVIEWS.

I.—Geology of the Federated Malay States. Geologists' Annual Report for the year 1914. By J. B. Scrivenor, Geologist F.M.S.

EARLIER reports, e.g. that for the period September, 1903, to January, 1907 (reviewed in the Geological Magazine, 1907, pp. 565–7), have given British geologists an opportunity of becoming acquainted with the general geology of the Federated Malay States, while Mr. Scrivenor's finely illustrated report, *The Geology and Mining Industry of the Kinta District, Perak* (1913), has described the district which is most interesting and important both geologically and economically. The present report, which deals principally with economic questions, is a record of steady progress, though it does not include any startling discoveries. There is only a brief reference to the field work of Mr. Scrivenor in mapping the Batang Padang district. Such work is bound to be carried out under many difficulties in view of the climate and of the dense vegetation which covers so much of this country.

Mr. Scrivenor took the opportunity of accompanying the district officer of Upper Perak in a journey to the little-known region near the headwaters of the Perak River. He briefly describes the country as an area of granite at no great elevation, supporting masses of altered bedded rock with quartz porphyry and basic volcanic rocks.

The report shows that the chemist, Mr. C. Salter, has been occupied with economic work, chiefly assays for minerals, but including also a number of analyses. It is satisfactory to learn that Mr. Scrivenor is getting together a collection of photographs illustrating the geology of the country.

The author describes a successful attempt to replace the diamond by local corundum for drilling purposes. A consignment of kaolin was shipped to Europe in order to ascertain if it could be used for pottery. Unfortunately, owing to the War, half the consignment failed to reach its destination.

Not much further information is given concerning the greatest industry of the peninsula, that of tin-mining, and no further light is