

3.—ON THE OCCURRENCE OF FORAMINIFERA IN THE PERMO-CARBONIFEROUS ROCKS OF TASMANIA.

By WALTER HOWCHIN, F.G.S.

PLATES X. AND XI.

In 1889 Mr. Thos. Stephens, M.A., F.G.S., of Hobart, published a short note in the Proceedings of the Roy. Soc. of Tasmania (p. 54), on "Foraminifera in the Upper Palæozoic Rocks." The locality from which the foraminiferal rock was obtained was stated to be "the north-eastern district of Tasmania," and the testimony of Mr. R. Etheridge, jun., Government Geologist of New South Wales, was quoted to the effect that this was the first record of this division of the animal kingdom occurring in the Permo-Carboniferous rocks of Australia and Tasmania. In the same year Mr. Etheridge kindly forwarded to me samples of this interesting rock, together with two transparent slides which he had made by sectioning the stone. I have deferred until now any descriptions of these embedded forms, influenced by the hope that better material for their determination might be obtained; but, as this is not likely at present, it is perhaps better to publish a few notes on the subject which may draw the attention of geologists to the possible occurrence in other localities in Australia of foraminiferal rocks of this age.

Additional samples of the stone have been forwarded by Mr. Stephens, and, in answer to several queries, has kindly supplied the following particulars as to the stratigraphical position and locality of the rock in question:—"There is no particular name for the locality where I found the foraminiferal limestone some years ago; but it is on the right bank of the River Piper, not very far from a place called Lilydale. There are other outcrops of the same formation, or one very near it, in the neighborhood, but it was only in the one place that I was able to detect the foraminiferal remains. So far as I remember, they were only found associated with the characteristic fossils of the Permo-Carboniferous beds, which were present in great variety; but there was no sufficient exposure of any section to show the thickness of these fossiliferous bands. . . . The rock belongs to the marine beds near the base of our Permo-Carboniferous Series, and is associated with coal measures, containing a bed of free-burning shale, which appears to be on the same geological horizon as the Tasmanite of our Mersey district."

The rock in question is a dark-colored, compact limestone, exhibiting on its weathered faces gastropods, bivalves, fronds of polyzoa, &c., in bass-relief. When a fractured face of the stone is closely examined, it is seen to be largely composed of minute foraminiferal shells. Very few of these break clear of the matrix, so as to expose their exterior surface, but suffer fracture when the

stone is broken, and are therefore chiefly seen in section, the white lines of the chambers showing up very distinctly on the dark ground of the stone in which they are set.

The prevailing foraminifer (which occurs in this bed in astonishing numbers) undoubtedly belongs to the genus *Nubecularia*. This is evident, not only from its exhibiting the mode of growth characteristic of the genus, but is confirmed by the transparent sections, which show the test to be imperforate, whilst the objects give by transmitted light the dark-brown color that is eminently characteristic of the porcellaneous group to which *Nubecularia* belongs. The minuteness of the objects, coupled with the hardness of the matrix, renders it almost impossible to obtain examples of this form in a free condition, and it is not easy to mark off with clearness specific distinctions where the data are limited almost entirely to transparent sections. This is especially the case when dealing with a genus of so protean a habit of growth as the one under discussion; yet for reasons assigned below we have thought it advisable to give a varietal value to the features which distinguish these remote geological representatives of the genus from the closely-related modern *Nubecularia lucifuga*. It is with pleasure that I associate the name of Mr. Thomas Stephens, M.A., F.G.S., with this interesting foraminifer, for reasons that will be apparent.

NUBECULARIA LUCIFUGA, VAR. *STEPHENSII*, VAR. NOV.

Habit of growth closely resembling the type. Initial chamber, globular. Subsequent chambers, elongated and slightly inflated. Chambers arranged, either on a spiralline plan, in rectilinear order, or in irregular acervaline masses. Walls of the test, thin, uniform in thickness, and sharply defined in outline. Septal divisions marked on exterior surface by sunken lines.

A comparison of transparent sections of recent examples of *N. lucifuga*, and the form now under description, reveals a striking difference in the partitional walls. In the recent examples the walls are thick, irregular, and sometimes membranous, whilst the fossil form preserves a remarkably uniform thickness in its septal partitions. In existing examples the sutural lines are generally more or less obscured by an excessive deposit of shell substance on the exterior surface. The Tasmanian specimens, on the other hand, do not thicken the periphery by secondary deposits of shell substance, as is frequently the case with living forms. The present descriptions can only be taken as provisional. Should a portion of the rock in which they are contained be discovered sufficiently friable to yield the *Nubecularia* in a free condition, it may be found that they are practically identical with the recent species, or the differentiation may receive a higher value, requiring a specific rather than a varietal distinction from the existing species.

The geological range of the genus is extensive, although it has apparently found its maximum development in existing seas, and

in no part of the world does it appear more at home than on some of the Australian coasts. Messrs. Jones and Parker have figured two species of *Nubecularia* from the Upper Triassic clays of Chellaston, Derbyshire. It occurs sparingly in later Mesozoic and Tertiary formations of England and the Continent, and the author has obtained about half a dozen small examples of *N. lucifuga* from the Carboniferous limestone shales of Northumberland (M.S.), which is the lowest position in which it has been recorded in the geological series.

SPIROLOCULINA (?) PLANULATA (LAMK.).

The transparent rock sections exhibit a few *Spiroloculinae*, cut at various angles, and apparently all of the same species. One of these can be seen on Plate X., near the central line and one-fourth distance from the bottom, the line of section cutting the object transversely nearly through the centre of the test. The segments (about eleven in number) are narrow, of rounded contour, increasing slowly in size with the growth; the final chambers enlarge suddenly, and on one side there is an appearance of a carinate ridge running longitudinally along the exterior periphery. No other example of *Spiroloculina* in the sections exhibit the carinate feature, and it may be only a defect in grinding the object. It is impossible to determine the specific relationship of this form with any certainty on the slender data at command. It somewhat resembles (so far as can be judged from the section) the neater varieties of *S. planulata*, and to this species we have provisionally referred it. Messrs. Parker and Jones have observed the presence of this species in the Lower Lias of Warwickshire, which has been, up to the present, the earliest geological record of the occurrence of the genus.

(?) CORUNSPIRA INVOLVENS (REUSS).

There are one or two very small planospiral shells that can be recognised in the transparent slides. Considered morphologically they may belong to one or other of three genera—*Cornuspira* (in which the shell is porcellaneous and imperforate), *Spirallina* (with the test hyaline and perforate), or *Ammodiscus* (an arenaceous foraminifer). The last-mentioned is a common form in the Carboniferous limestone of Europe, from which about eight species have been determined. The analogous form in the Permian-Carboniferous rocks of Tasmania is evidently calcareous in structure, and must therefore be referred to one of the two former genera. The minuteness of the objects and the infiltration of mineral matter, to which they have been subjected, make it most difficult to decide on the existence or absence of perforation in the test. It is probable that, for similar reasons, great uncertainty exists as to the distribution of these respective forms in a fossil condition. They have not always been clearly distinguished by

observers, and it is difficult to say with exactness the respective geological range of the two genera. The oldest record for *Spirallina* is in the Lower Tertiary (or Eocene), and is limited at this horizon to the rocks of South Australia and Victoria, whilst fossils attributed to *Cornuspira* have been noted by several observers in the Liassic rocks of England and the Continent. In Eocene strata, and later, *Cornuspira* is an extremely common form in both hemispheres. *Cornuspira involvens* is the simplest and commonest member of the genus, and, in the absence of any clear evidence of perforation, we think it better to classify the objects under consideration as above.*

NODOSARIA (?) RADICULA (LINNÉ).

It is evident from the sections that some Nodosarian form is not uncommon in the rock. They have been cut at various angles. When taken in transverse section they exhibit a perfectly circular outline; others are inclined to the plane of the section, and show a limited number of chambers cut obliquely; and in two instances the longitudinal axis of the object and the plane of section have been nearly coincident. As far as can be judged, the test is straight, or nearly so. The best example is shown on Plate X., near the top, where it will be seen that eight rectilinear segments have been included, with a slight indication of a ninth chamber. The segments are sub-globular, tapering, and with slight septal constrictions. These features point to *N. radícula*, to which the species may be provisionally assigned. This species has been already recorded from the Permian of Durham and Germany. The section figured of this form by Mr. Brady ("Carboniferous and Permian-Foraminifera," Pl. X., Fig. 9) from the magnesian limestone (Upper Permian) of Durham agrees very closely with the one reproduced from the Permo-Carboniferous of Tasmania, the line of section through the object in the last-named not being quite so central as in the case of Mr. Brady's figure. Another member of the genus, *N. farcimen*, also possesses a very high antiquity in the geological series, occurring not only in the magnesian limestone of Durham, but was discovered by the author† in the "D. Limestone" (Lower Carboniferous) of Northumberland, in which it was very rare. This is the oldest record for the genus.

Scanty as is the material at our disposal for determining the foraminiferal fauna of the Permo-Carboniferous rocks of Australia, it is of special interest, so far as it goes, as being the first instance in which there has been any record of Palæozoic foraminifera in

* In a letter to me, Mr. Stephens says:—"When breaking up a large block of the rock when I first came across it, a quite perfect foraminifer dropped out, shaped something like a small *Euomphalus*, and about the size of a small pin's head. This, unfortunately, got lost, and I never found another specimen like it." This description applies with great appropriateness to *Cornuspira involvens*.

† "Additions to the Knowledge of Carboniferous Foraminifera," by W. Howchin, F.G.S., Jour. Roy. Micro. Soc., August, 1888. Pl. IX., Fig. 21.

Australian geology. The extraordinary prevalence of *Nubecularia* in the rock—a form which hitherto has been considered more a modern than ancient type of Protozoa—is a notable fact. Moreover, in the Upper Palæozoic rocks of Australia, judging from the Tasmanian evidence, there is an apparent absence of the arenaceous and sub-arenaceous types, which are the characteristic forms of the Carboniferous foraminifera of the Northern Hemisphere, and their places are taken by genera which construct calcareous and hyaline tests, types that are more characteristic of related faunæ of Secondary and Tertiary age. It must, however, be remembered that the data at present are extremely slender on which to base any broad generalisations, and a more extended examination of rocks of this age may bring to light a closer affinity between the foraminiferal fauna of the Upper Palæozoics of the two hemispheres than appears at present.

DESCRIPTION OF PLATES.

The Plates exhibit portions of the transparent sections of the foraminiferal rock magnified twenty-six diameters.

Plate X.

- a.* Eight of the more conspicuous sections of *Nubecularia lucifuga*, var. *Stephensi*, var. nov., are marked *a.* The example in the upper left-hand corner is a flat parasitic form, the rest are investing.
- b.* Longitudinal section of *Nodosaria (?) radricula*, Linné.
- c.* Transverse section of *Spiroloculina (?) planulata*, Lamk, passing nearly through the centre of the test.

Plate XI.

- a.* Nine of the more conspicuous sections of *N. lucifuga*, var. *Stephensi*, cut at various angles, are marked *a.*



4.—A CENSUS OF THE FOSSIL FORAMINIFERA OF AUSTRALIA.

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It is intended by the present paper to tabulate a complete list of the fossil foraminifera of Australia so far as known at present.

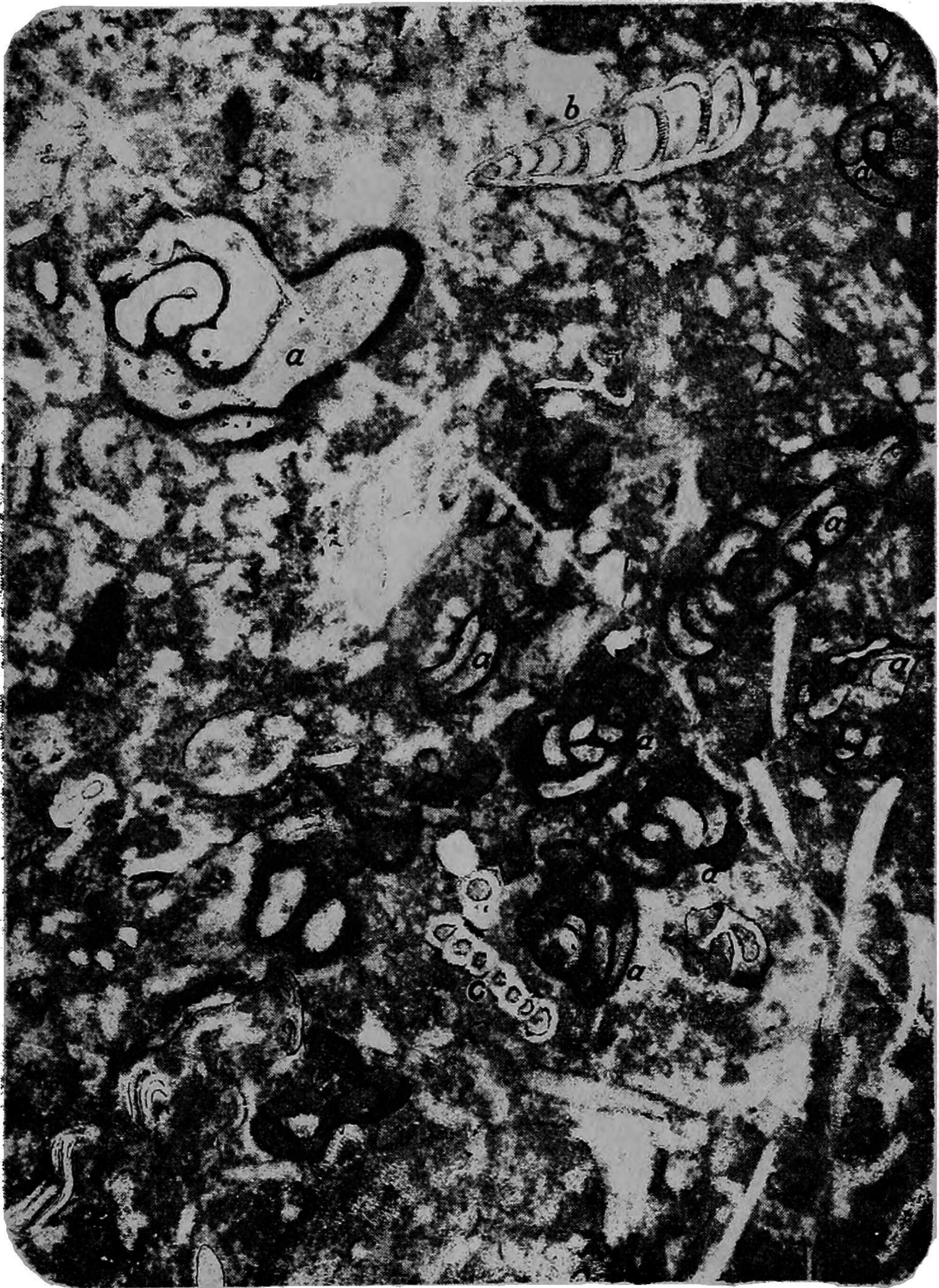


Plate XI.



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