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BY

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AND

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7. The Lower Middle Devonian Rugose Corals of the Murrumbidgee and Goodradigbee Rivers, N. S. W.

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Art. VII.—*Note on a Collection of Fossils from Queenstown, Tasmania.*

By DOROTHY HILL, M.Sc., Ph.D., and A. B. EDWARDS, Ph.D., D.I.C.

[Read 11th July, 1940; issued separately 1st February, 1941.]

In a recently published outline of the geology of the Mount Lyell Mining Field, Tasmania (Edwards, 1939), the sediments of the Queen River Series, which forms the most westerly of the "four, more or less parallel, north-south trending tracts" of rocks in that district, were considered to be of Upper Silurian age. This conclusion was based upon the determination of fossils found at two localities, namely, (i) some poorly preserved brachiopod casts in what appeared to be an erratic block of the Queen River Series, in the bed of Linda Creek, at the road bridge a little upstream from its confluence with the King River; and (ii) some corals from the limestone in the old flux quarry on the west side of the Strahan road, west of the smelters. Mr. R. B. Withers, who examined the specimens, named a number of the fossils, and expressed the opinion that they indicated for the Queen River Series "an age comparable with the Yeringian Series of the Silurian in Victoria." He suggested, however, that the corals from the old flux quarry should be submitted to Dr. Dorothy Hill for more expert determination.

This was done, and Dr. Hill's identifications, which follow, are such as to place the Queen River Series in the Upper Ordovician or the Lower Silurian, rather than in the Upper Silurian. This change in determination and in age relation applies only to the fossils from the limestone quarry. As the sequel will show, there is every reason to believe that the determination of the brachiopod casts as Yeringian forms is correct.

Significance of the Discovery.

The conglomerates of the West Coast Range are generally accepted as representing the base of the Silurian in Tasmania, and so long as the Queen River Series is regarded as younger than them, it is necessary to postulate that the West Coast Range Conglomerates were raised to their present position relative to the Queen River Series by a great fault of Palaeozoic age, and that the igneous rocks forming the porphyry-schist belt of the Mount Lyell field were intruded along this fault zone. On this view the western scarp of the West Coast Range is to be regarded as an exhumed fault-line scarp. This still holds even if the Queen River Series is regarded as Lower Silurian.

If, however, the Queen River Series is of Upper Ordovician age, it is no longer necessary to postulate such a fault, and the West Coast Range Conglomerates have not necessarily undergone elevation, although some faulting may have occurred along their margin. The West Coast Range, on this view, is simply a feature of differential erosion, resulting from the highly resistant nature of the conglomerates. The fact that beds containing fossils of Silurian age over-lie the West Coast Range Conglomerates at the north end of Lake Margaret, and that an erratic block containing casts of brachiopods of Upper Silurian age has been found in the Linda Valley, and is probably derived from beds now eroded, but once overlying the conglomerates, does not disturb this new interpretation. It is necessary, however, to revise one's conception of the factor controlling the intrusion of the Queen River Porphyries, and the Mount Lyell Schists derived from them. These must be regarded as having been intruded along an unconformity.

It is unfortunate that, in the present state of stratigraphic knowledge, the precise age of these beds remains uncertain, so that no decision can be reached as to which of the conceptions outlined above is correct.

Description of the Fossils.

The preservation of all the fossils in this collection is poor, and one must remain uncertain of the finer structures; photographic figures of the thin sections used in the study are impossible. *Tetradium tasmaniense* Chapman, previously described from Zeehan, has been particularly affected; the interior has been entirely recrystallized into rhombohedral crystals of calcite, and Mr. E. V. Robinson has determined that the exterior has been replaced by or coated with gypsum and small amounts of associated calcium carbonate.

Age of the Fauna.

The fauna contains *Alveolites* sp., *Protarea* cf. *richmondensis* Foerste, *Acidolites* sp., and *Tetradium tasmaniense* Chapman. *Alveolites* ranges from the Middle Ordovician to the Upper Devonian. *Protarea* is known in America from the Trenton and Richmond formations, in Estland from E to F_2, in Sweden in the *Leptaena* limestone, and in Norway in 5a and 5b. *Acidolites* occurs in the *Leptaena* limestone and the F beds of the Baltic, and in the Valentian of Gotland. *Tetradium* is known from the Chazy to the Richmond in N. America, and from the Craighead limestone (Ordovician) in Scotland. This suggests that the age of the Queenstown limestone is probably Trenton or Richmond in the American succession, and F, 5, and *Leptaena* limestone in the various Baltic successions. The Richmond, all or parts of

F, 5, and the *Leptaena* limestone are placed by some in the Upper Ordovician and by others in the Valentian (Lower Silurian. For references see Jones and Hill, 1940, p. 185).

MADREPORARIA TABULATA.

Genus ALVEOLITES Lamarck.

Alveolites Lamarck, 1801, p. 375; for references, genolectotype, etc., see Lecompte, 1939, p. 17.

DIAGNOSIS.—Massive or branching Tabulata, with corallites essentially compressed, of sub-triangular, semi-lunar, reniform or sometimes sub-rectangular section, opening typically obliquely to the surface, with thin, complete tabulae and large mural pores.

REMARKS.—Probably *Paleoalveolites* Okulitch (1935, p. 64, geno-type *Tetradium carterense* Bassler) from the Carters limestone (= Black River, = ? Caradoc) is a synonym of this genus, which otherwise extends from the Lower Silurian to the Upper Devonian. Okulitch considered a columella to be present in his genotype, but later (1938, p. 96) placed a second species, without columella, in his genus.

ALVEOLITES SP.

(Plate VII., fig. 1.)

Favosites cf. *grandipora* Eth. fil, Withers *in* Edwards, 1939, p. 69, Queenstown.

MATERIAL.—One fragment from the old flux quarry, Queenstown.

DESCRIPTION.—The fragment shows two groups of corallites, one encrusting the other. The transverse section shows semi-lunar or reniform corallites, their average dimensions being 0.5 mm. in the longer diameter, and 0.25 in the shorter diameter; and the corallites run parallel for at least 15 mm., the length of the fragment. Mural pores are very numerous and rather large, and pierce any or all of the walls or angles of the corallites. Septal spines were not observed with certainty. Tabulae are present, but are distant, thin and concave.

REMARKS.—I know of no species with which this might be closely compared. Its corallites are smaller than those of *Paleoalveolites paquettensis* Okulitch (1938, p. 96) from the Black River formation (= Caradoc) of Canada, and it has very numerous mural pores.

MADREPORARIA HELIOLITIDA.

Genus PROTAREA Edwards and Haime.

Protarea Edwards and Haime, 1851, p. 146; Lindstrom, 1899, p. 109.

GENOLECTOTYPE (chosen Bassler, 1915, p. 1043).—*Porites? vetusta* Hall, 1847, p. 71, pl. xxv., figs. 5*a*, *b*; lower part of the Trenton limestone, near its junction with the Black River limestone, Watertown, Jefferson Co.

DIAGNOSIS.—Lamellar or encrusting Heliolitida without reticulum, with tabularia in which the walls and the twelve septa consist of large trabeculae in contact, and with free trabeculae rising from the floor of the calices.

REMARKS.—According to Foerste (1909, p. 211) and Troedsson (1928, p. 116), the specimens used by Edwards and Haime when they founded *Protarea* on *Porites? vetusta* were not conspecific with the type specimen of *Porites? vetusta* Hall. Foerste described this type as consisting apparently of a succession of lamellae varying from 1 to 2 mm. in thickness, and more or less free from each other in places. There are usually about five corallites in a width of 5 mm., although sometimes the corallites are wider. The vertical tubules between the corallites are fairly distinct under a lens. The calices are rather deep, and the septa scarcely reach half-way to the centre. Foerste, and Troedsson considered that the Baltic and Richmond specimens used by Edwards and Haime and by Lindstrom differed in having no reticulum (i.e. no vertical tubules between the tabularia). For the Richmond forms without reticulum Foerste proposed the name *Protarea richmondensis*. Troedsson considered it probable that the true *vetusta*, thin sections of which have never been figured, was generically different from *P. richmondensis*, and suggested that it might belong to *Protrochiscolithus* Troedsson. Bassler however named *Porites? vetusta* Hall, and not *P. vetusta* of Edwards and Haime quite definitely as genotype of *Protarea*, by giving a bibliographic citation; and it therefore seems that if different generic names are to be used for *vetusta* and *richmondensis*, the new one should be applied to *richmondensis*. Failing figures of thin sections of Hall's holotype of *vetusta*, the genus is here retained with Edwards and Haime's interpretation, i.e., without reticulum. It occurs in the Trenton and Richmond of North America, the *Leptaena* limestone of Sweden, in E, F_1 and F_2 in Estland, and in 5a and 5b in Norway.

PROTAREA RICHMONDENSIS Foerste.

Protarea richmondensis Foerste, 1909, p. 210, pl. iv., fig. 9. Richmond beds of Ohio and Indiana.

DIAGNOSIS.—Encrusting *Protarea* with four corallites in 5 mm., and with the trabeculae in the bottoms of the calices arranged somewhat irregularly.

PROTAREA cf. RICHMONDENSIS Foerste.

(Plate VII., fig. 2.)

Favosites cf. *Gothlandica* Lamarck; Withers in Edwards, 1939, p. 69, Queenstown.

REMARKS ON THE TASMANIAN SPECIMEN.—The Tasmanian specimen agrees very well with Foerste's description, except that there are only three calices in 5 mm. It cannot be ascertained however whether it is encrusting; it is certainly a thin expansion.

In Canada and the U.S.A. the species occurs in Richmond beds; Lindstrom figured as *P. vetusta* a specimen from the Wesenberg beds of Estland. The Tasmanian specimen from Queenstown has its calical surface replaced by gypsum, and part of this is swollen and distorted by subsequent decomposition of the gypsum.

Genus ACIDOLITES Lang, Smith and Thomas.

Acidolites Lang, Smith and Thomas, 1940, p. 13, *nom. nov.* for Jones and Hill, 1940, p. 184.

Acantholithus was preoccupied by Stimpson, 1858, for a crustacean.

GENOTYPE:—*Heliolites asteriscus* Roemer, see Lindstrom, 1899, p. 113, pl. xi., figs. 31-35, glacial drift of Sadewitz.

DIAGNOSIS.—Heliolitida with tubular reticulum, thickened walls, and spines on the tabulae.

REMARKS.—The genus differs from *Heliolites* itself only in the thickening of the walls, which is only less extreme than that in *Coccoseris* Eichwald (1860, genotype *Lophoseris ungerni* Eichwald, Lindstrom, 1899, p. 107, pl. xii., figs. 3-7, F_1 of Baltic), and in the more general occurrence of trabeculae on the tabulae. It may be that *Acidolithus* is better regarded as a synonym of *Coccoseris* but failing re-examination of the types, it seems wise to use *Acidolithus* for the less thickened members, although both genera have the same range in time, viz. Upper Ordovician and Lower Silurian of Europe.

ACANTHOLITHUS sp.

(Plate VII., figs. 3*a*, *b*.)

Cyathophyllum sp. Withers in Edwards, 1939, p. 69, Queenstown.

MATERIAL.—One specimen from the old flux quarry, Queenstown.

DESCRIPTION.—The corallum is 7 mm. thick, entirely surrounding a more or less cylindrical stem of *Tetradium tasmaniense*. On the surface calices about 0.5 mm. wide are 1 to 2 mm. apart, the intervening reticulum appearing minutely and closely papillate. Twelve septa line the calices, which sometimes show axial projections also. In vertical section the reticulum shows trabeculae continuous vertically, as thick as the distance between them, about 0.01 mm., connected by thin sola, the sola between neighbouring trabeculae continuing the same line, so that the whole corallum shows a number of concentric lines; this concentric structure is emphasized by a recurrent colouration of the corallum. The sola are close but the tabuli of the tabularia are very distant and concave. The septa appear to consist of long, upcurved spines, those of each of the twelve vertical series are so close as to form vertical laminae in some of the tabularia. In one case trabeculae were observed based on the upper surface of a tabula. In another tabularium there was a suggestion of a columella.

REMARKS.—The trabeculae of the reticulum are probably united to form polygonal tubuli, but no such outlines could be clearly seen in transverse section. The species does not appear to be close to any of the species described by Lindstrom, differing in the smaller size of its calices and in the indistinctness of the outlines of the tubuli, as also in the thinner walls. It resembles very closely the figures given by Lambe (1899, pl. v. figs. 8, 8a) of a specimen from the Trenton (Upper Ordovician) of Ottawa, Ontario, which he referred to *Protarea vetusta* Hall. The age it indicates would be that of the genus, F_1 or F_2 and Lower Valentian of the Baltic, i.e. Upper Ordovician or Lower Silurian.

GENUS INCERTAE SEDIS.

Genus TETRADIUM Safford.

Tetradium Dana, 1846, p. 701. *Nom. nud.*, as no species were named.
Tetradium Safford, 1856, p. 236.

GENOTYPE (by designation): *Tetradium fibratum* Safford, 1856, p. 237; Upper Ordovician of Tennessee, associated with *Favistella alveolata* (Goldfuss) and other Hudson River species.

DIAGNOSIS.—Colonies which are hemispherical, lamellar, branching, cateniform or in small bundles, consisting of long prismatic tubes, usually four-sided, a lamina projecting towards the axis from the middle line of each wall; when the laminae meet at the axis the original tube is divided into four. The walls are without pores, but the tubes may be divided transversely.

REMARKS.—Dana named no species when he proposed the genus, and so, according to Article 25b of the International Rules of Zoological Nomenclature, his genus is invalid; but he gave a good description, and said it was based on a specimen, whose number was not given, from an unknown locality, in Yale College, New Haven. Safford, the first to use the name with species, applied it to the same general group as Dana, and as he was the first author to use a recognisable genotype, the genus should be ascribed to him.

The genus has usually been included with the corals, and indeed the vertical laminae have somewhat the appearance of the septa of corals. Okulitch has reviewed the literature in which the genus has been placed in the Anthozoa, and has regarded them (1935, p. 72) as forming a separate Proto-anthozoan group, bridging the gap between the Tetracoralla and the Alcyonaria, which he later (1936, p. 378) called the Schizocoralla. The latest Canadian Geological Survey Memoir (202) on the Ordovician of Ontario and Quebec lists *Tetradium* as a Hydrozoan, and this may be right. I do not think the genus shows sufficient resemblances to the Anthozoa to justify placing it in that class. The laminae appear to be connected only with increase, in a similar way to the divisional laminae which grow out from the walls of the Rugose coral Stauria during increase; they do not appear to be

divisible into major and minor cycles like the septa in the Rugosa, nor into successive cycles as in the Hexacoralla; nor are they acanthine as in the Tabulata or the Heliolitida. The Tasmanian specimens are not sufficiently well preserved to throw any light on the microscopic structure of the genus.

Bassler has listed the American species of the genus (1915, p. 1264) and Chapman (1919, p. 8) has given diagnoses. Okulitch (1935) has recently re-described them. They are found in the north-east of the United States, and the east of Canada, in the Stones River (= Chazy), Black R., Trenton, and Richmond groups, i.e., from the Llanvirn to the Ashgill, and possibly into the Lower Silurian. Outside America the genus is recorded in the Ordovician Craighead limestone of Scotland, and our species was originally described from Zeehan in Tasmania.

Tetradium tasmaniense Chapman.

Tetradium tasmaniense Chapman, 1919, p. 8, pl.; Smelters-road, Zeehan, Tasmania, in a compact, blue-black limestone, the Gordon River limestone. Upper Ordovician or Lower Silurian.

Favosites aff. *Limitaris* Rominger; Withers *in* Edwards, 1939, p. 69, Queenstown.

? Campophyllum sp. Withers in Edwards, 1939, p. 69, Queenstown.

Types are in the National Museum, Melbourne.

Diagnosis.—*Tetradium* with branches about 11 mm. in diameter, but occasionally constricted, springing from an irregular base, with tubes four-sided, about 1.5 mm. in diameter, incompletely or completely quartered by vertical laminae springing from the middle of each wall, and with occasional thin tabulae.

Remarks on the Queenstown Specimens.—The branches are not regularly cylindrical, and vary in diameter from 7 mm. to 11 mm.; their entire surfaces consist of calical openings, about 3 in 4 mm., or 4 in 5 mm. The outline of the calices is frequently that of a four-petalled Tudor rose. The laminae tend to be thicker near the walls, and between them the walls are curved in transverse section. The course of the tubes in the branches is not known. It appears from Chapman's description of the Zeehan specimens that he saw no surfaces of the branch, but only sections of the internal parts of the branch. But from the measurements of both our specimens, and from the transverse section he figures, I think they are the same species. The Tasmanian species somewhat resembles *T. cellulosum* (Hall, 1847, p. 39, pl. ix.) from the Birdseye Limestone of New York, as the latter also is digitate or ramulose. Hall states that its branches anastomose, however, and this condition is not known in the Tasmanian species. Further, from Okulitch's description (1935, p. 54) of *T. cellulosum*, it would appear that the tubes were always parallel to the axis of the branch, and could not have opened on the surface of the branch. But Hall's description seems to allow that they did so open. Okulitch's description may not have been

based on Hall's type specimens. Our species would appear to be a branching modification of the massive *T. fibratum* group, which occurs in the Black River, Trenton, and Richmond of North America. Its age may thus be Middle or Upper Ordovician, or Lower Silurian, if the Richmond be regarded as Lower Silurian rather than Upper Ordovician.

CEPHALOPODS.

Rhizophyllum sp. Withers *in* Edwards, 1939, p. 69, Queenstown.

These specimens, which are nautiloid cephalopods, are being investigated by Dr. F. W. Whitehouse.

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Explanation to Plate.

PLATE VII.

All figures approximately × 1.8 diameters.

All specimens are from the old flux quarry, now disused, at the northern end of Queenstown on the western side of the Strahan road, before it climbs out of the valley of the Queen R., half a mile N. of the railway crossing. They were collected by Dr. A. B. Edwards and are at present in the collection of the University of Queensland. The age of the limestone is Trenton or Richmond; i.e., Upper Ordovician or, if the alternative view of the age of the Richmond be accepted, Lower Silurian.

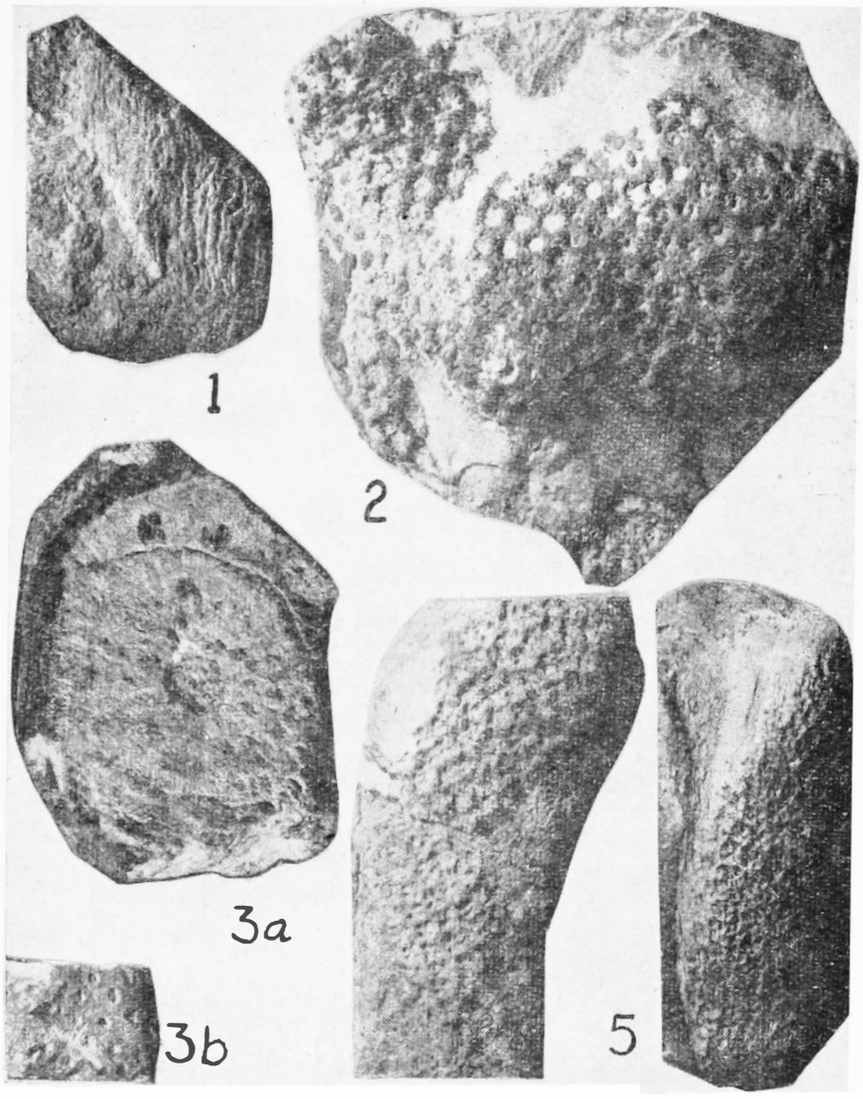
FIG. 1.—*Alveolites* sp. F.4287.

FIG. 2.—*Protarea* cf. *richmondensis* Foerste F.4288.

FIG. 3.—*Acidolites* sp. F.4289.

FIG. 4.—*Tetradium tasmaniense* Chapman F.4290.

FIG. 5.—T. *tasmaniense* F.4291.


1
2
3a
3b
5