TABULATA AND HELIOLITIDA FROM THE WELLINGTON DISTRICT, N.S.W.

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(Communicated by Dr. Ida A. Brown.)

With Plate I.

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SUMMARY.

The paper describes some corals collected in 1942 by Miss Basnett and Miss Colditz of Sydney University. Five species of Favosites, one of Heliolites and one of Propora are described, the genus Pleurodictyum is discussed and a new species described.

The fossils are from six different localities, and while the collections are too small in some cases to give positive evidence of the age, some indication can be given.

The corals obtained from various localities are as follow:

(A) Por. 82, Par. Mickety Mulga.
   Favosites goldfussi d'Orbigny, F. basalticus (Goldfuss) var. moonbiensis Etheridge, Pleurodictyum bifidum sp. nov. The first of these ranges from the Lower to Middle Devonian, the second Middle Devonian, and is especially characteristic of the Nemingha and Moore Creek Limestones. Age: Middle Devonian.

(B) Por. 206, Par. Mickety Mulga.
   Pleurodictyum bifidum sp. nov. Age: Probably Middle Devonian.

(C) Dubbo Road, 12 MILES FROM WELLINGTON.
   Favosites bryani Jones. This form is very characteristic of the lower Middle Devonian Murrumbidgee beds and is also found in the Lower Devonian Garra beds.

(D) Por. 241, Par. Mickety Mulga, Wellington, N.S.W.
   Propora sp. No deduction as to age.

(E) Por. 50, Par. Curra.
   Favosites bryani. Age: Lower Middle Devonian or Lower Devonian.

(F) Por. 119, Par. Veech.
   Favosites sp. sp. nov.? No deduction as to age can be drawn.

(G) Willowtree Creek, Attunga.

(H) One quarter mile N.E. of Apsey R.S. on the road to the dredge, Wellington.
   Favosites richardsi Jones, Heliolites daintreei Nich. and Eth. (fourth group). The former is unknown outside the Upper Silurian and in fact this is the first
record outside the type area—Yass, N.S.W. The latter is known from the
Upper Silurian of Yass, the Lower Devonian of Molong, N.S.W., and the Devonian
of the Broken River, N. Queensland. The age may therefore be taken as Upper
Silurian.

SYSTEMATIC DESCRIPTIONS.

MADREPORARIA TABULATA.

Genus Favosites Lamarck.

Favosites goldfussi d'Orbigny.

Favosites goldfussi (partim) d'Orbigny, 1850, p. 107 (fig. 3b of Goldfuss,
1829 only).

For synonymy, description and figures, see Jones, 1936 and 1937.

Remarks: Favosites goldfussi as a member of the F. gothlandicus-F. goldfussi
group was discussed by Hill and Jones, 1940, pp. 191-3, where the similarity
between F. gothlandicus forma multipora and F. goldfussi was pointed out. The
specimen from Portion 82, Parish Mickey Mulga lies between F. gothlandica
forma multipora and F. gothlandica forma forbesi, but nearer to the former, and
might be called either F. goldfussi or F. gothlandica forma multipora. The
adult corallites are 1.75 to 2.5 mm. in diameter, slightly smaller than usual;
the walls are thick and the septal spines long and numerous, though somewhat
obscured by recrystallisation; the tabulae are complete, usually horizontal,
3 or 4 in a space of 3 mm.; the mural pores are in at least three rows.

A specimen from Willowtree Creek, Attunga, may be F. goldfussi. It is
however excessively recrystalline, so that identification is very doubtful. Septa
are numerous but apparently fairly short. The mural pores may be in two rows
and there are 6 or 7 complete tabulae in a space of 3 mm.

Range: Lower and Middle Devonian (Garra beds, and Nemingha and Moore
Creek limestone).

Localities: Portion 82, Parish Mickey Mulga, Wellington District, N.S.W.,
and ? Willowtree Creek, Attunga, Tamworth District, N.S.W. (Univ. of Sydney
Nos. 6252 and 5246.)

Favosites basalticus (Goldfuss) var. moonbiensis Etheridge.

Favosites basaltica (Goldfuss) var. moonbiensis Etheridge, 1899, pp. 164-5,
pl. xxiv, figs. 1, 2.

For synonymy and description, see Jones, 1937, p. 96.

Remarks: The one specimen is poorly preserved but is typical of the variety
moonbiensis in every way except that the spacing of the tabulae is rather more
variable than in the specimens from Tamworth—2 to 4 in 1 mm. The mural
pores are about 0.25 mm. in diameter in one row in the centre of the faces.

Range: Middle Devonian.

Locality: Portion 82, Parish Mickey Mulga, N.S.W. (University of
Sydney, 6250.)

Favosites bryani Jones.

Plate I, figures 1, 2.

Favosites bryani Jones, 1937, pp. 96-7, pl. xv, figs. 3-6.
Favosites bryani Hill and Jones, 1940, pp. 190-1, pl. v, fig. 2.

Remarks: A specimen from portion 206, Parish Mickey Mulga and one
from portion 50, Parish Curra, Wellington district, belong to this species. The
corallites are 1 to 1.25 mm. in diameter, the walls moderately thick, and the corallite angles rounded. Both are recrystalline but the septal spines appear to be of the form typical of this species—long, slender, sharply pointed, upwardly directed spines. The arrangement of the mural pores is not apparent. The tabulae are variable in number, 7 to 11 in a space of 3 mm.

Range: Lower Devonian to lower Middle Devonian.

Localities: Dubbo Road, 12 miles from Wellington, and Por. 50, Par. Curra, both in the Wellington district, N.S.W. (University of Sydney 6254 and 6253.)

Favosites sp. sp. nov.?

Plate I, figures 3, 4.

Remarks: A specimen from portion 119, Parish Veech (University of Sydney No. 5290) is probably a new species, but being poorly preserved and a single specimen, I refrain from creating a new name for it.

The corallum is massive, the corallites regularly 1.5 mm. in diameter, the walls slightly dilated but the angles little rounded. No septa show in the transverse section but it is much recrystallised and there are indications in the longitudinal section that septa may be present. The mural pores are round, large—0.3 mm. in diameter—in a single row in the faces of the corallites. The tabulae are complete, thin, regularly spaced, 7 or 8 in a space of 3 mm.

Locality: Portion 119, Parish Veech, Wellington, N.S.W. (University of Sydney 5290.)

Favosites richardi Jones.

Plate I, figures 5, 6.

Favosites richardi Jones, 1937, pp. 89-90, pl. xii, figs. 2, 3.

Remarks: The specimen (University of Sydney No. 7278) is completely typical of this species. The corallites are as usual of two orders of size, but this has been shown to be an environmental condition and not of specific value in F. forbesi (Jones, 1936) and unpublished work on F. richardi confirms this. The larger corallites have 8 to 11 sides, thus becoming nearly round, and are 3.5 to 4 mm. in diameter. The smaller corallites have 4 to 6 sides and are 2 to 2.5 mm. in diameter, but there are also many young, smaller corallites, triangular or four-sided. The corallite walls are thin or very slightly dilated. The septal spines are numerous, short, with a broad base but sharply pointed. The tabulae are complete, thin, 3 to 6 in 3 mm. The mural pores are in two rows on the faces of the smaller corallites but the arrangement has not been observed on the larger faces of this specimen.

Range: Upper Silurian.

Locality: A quarter of a mile north-east of Apsley R.S. on the road to the dredge, Wellington, N.S.W. (University of Sydney 7278.)

Genus Pleurodictyum Goldfuss.

Pleurodictyum Goldfuss, 1829, p. 113. Genoholotype: P. problematicum, ibid., p. 113, pl. xxxviii, figs. 18 a-g. Lower Devonian, Eifel district and Nassau, Germany.


Diagnosis: Cereoid Favositidae, walls dilated, septa spinose, the spines sometimes arising from the free axial edges of very short lamellae, sometimes
directly from the walls; tabulae present, sometimes spinose; mural pores numerous. Topotypes usually (?) always have a worm case in the base.

**Remarks:** The above diagnosis is based on four topotypes of the genotype (from Oberstaffeld, near Gerolstein, Eifel) which are all internal moulds, as is the case with all topotypes known. The deduction of the complete structure of the coral from these internal moulds is difficult but there is no doubt concerning the polygonal shape of the corallites, the thick walls and the presence of numerous small mural pores, which in *P. problematicum* are usually in two, sometimes three, rows. The septal spines show as numerous round pits which sometimes are situated in a single row in a longitudinal groove, representing a short lamella; many of the spines, however, arose directly from the walls, there being no trace of any groove; and the character varies from corallite to corallite and from specimen to specimen, some corallites having several grooves, most having only one groove in the centre, other pits to either side not being in grooves, one specimen I examined having as far as I could see only one groove on one corallite, none on the remainder.

In my opinion there were almost certainly tabulae for, firstly, on many of the moulds of the corallites there are transverse striations which can only represent ridges left when tabulae were broken away; it may be thought remarkable that all the tabulae were broken away before the corallites were filled and the other tissues dissolved, but the tabulae were thin delicate structures while the walls were thick and the spines short; perhaps the tabulae were thinner and more delicate than usual in the Favositidae; further, the corallites were short and the corallum low and spreading, almost discoidal; secondly, in the centre of each mould are a few corallites perpendicular to the bedding planes of the rock and in several instances the surface of these is covered with numerous small shallow pits which represent more or less vertical spines. The only structures on which these spines could have been based were tabulae.

Roemer (1883, p. 425), Hall (1876), C. L. and M. A. Fenton (1936, p. 23), Lang, Smith and Thomas (1940, pp. 84 and 102) and others consider that *Michelinia* de Koninck is a synonym of *Pleurodictyum*, although Roemer considered that tabulae were absent in the latter. This can only be finally decided by an examination of topotypes of *M. tenuisepta* (Phillips) de Koninck, the genotype of *Michelinia*. In the meantime, basing this opinion on published descriptions and figures, I agree that most species of *Michelinia* should be placed in *Pleurodictyum*. Nicholson (1879, p. 149) describes “intramural canals” in *P. stylophorum* (Eaton) but not in *P. problematicum*. I have not observed them in the latter species, nor so far as I know has any other writer. C. L. and M. A. Fenton do not mention them in *P. stylophorum*. Nicholson considers them to be of the same nature as similar structures which he described in *Columnopora*. Cox, 1936, refers the latter to *Calapoecia* Billings, and considers the “intramural canals” to be the result of some boring organism.

*Pleurodictyum* is not clearly distinct from the thick walled *Favositae*. Three features may be considered in this connection—lamellar septa, spinose tabulae and strong holotheca. If the first be taken as diagnostic a number of forms, including that to be described below, without lamellar septa but with the other two features, must be removed from *Pleurodictyum*; but the presence of spines on the tabulae, a character which varies much from species to species, and the presence of a stronger holotheca than is usual in *Favositae* are not enough on their own to justify separation of the two genera. The whole group of forms stands in need of revision.
Pleurodictyum bifidum sp. nov.

Plate I, figures 7, 8.

Holotype: The specimen 6251 in the collection of the University of Sydney from Por. 82, Par. Mickey Mulga, Wellington, N.S.W. Age: Middle Devonian.

Diagnosis: Pleurodictyum with numerous spinose septa, some of which are bifid, numerous irregular complete and incomplete tabulæ, mural pores large and rare.

Description: The corallites are polygonal but the angles are rounded by the dilatation of the walls which makes them as much as 1.25 mm. in thickness. The diameter of the corallites is 4 to 6 mm. The septa are spinose and very numerous, arranged in longitudinal rows which number seven or more on each corallite face. The spines are stout but usually sharply pointed and about 5 per cent. divide near their axial ends into two (? sometimes three) branches, an unusual and important character, upon which I have based the trivial name. This appears to be a type of rhabdacanthine septa (Hill, 1936) but on a larger scale than any yet described, and unfortunately the coral is not sufficiently well preserved to observe the trabeculae and confirm this suggestion. The tabulæ are thin, numerous, 10-13 in 5 mm., complete and incomplete in about equal numbers, horizontal or oblique, sometimes deeply invaginated. The mural pores are large, 0.25 mm. in diameter; their arrangement has not been definitely observed, but there is some evidence to suggest two rows, each row fairly close to the corallite angle.

Remarks: I know of no species with which this is closely comparable, the very large number of septa and their frequent bifid nature are very striking characters.

Localities: Por. 82 and Por. 206, Par. Mickey Mulga, Wellington, N.S.W. (6251 and 5287 University of Sydney collection). Middle Devonian.

MADREPORARIA HELIOLITIDA Jones and Hill.

Family Heliolitidae.

Genus Heliolites Dana.

Heliolites daintreei Nicholson and Etheridge.

Plate I, figures 9, 10.

Heliolites daintreei Nicholson and Etheridge, 1879, p. 224, pl. xiv, figs. 3, 3a.

Heliolites daintreei Jones and Hill, 1940, pp. 199-203, pl. vi, figs. 1-5; pl. vii, figs. 1-5; pl. viii, figs. 1-8; pl. ix, fig. 1.

For synonymy, diagnosis, etc., see Jones and Hill, 1940.

Remarks: This is a variable, long-ranged species, divided by Jones and Hill into four, ill-defined groups. The specimen under consideration falls into group four. The tabulæra are 1.75 to 2.5 mm. in diameter, rather larger than usual, with none to six rows of tubuli, and 0 to 4 mm. between the tabulæra. The tabulæra are in contact in only one place in the section and usually there are 2-3 rows of tubuli between. The walls of the tabulæra, the tabulæ and sola are typical of the group. The septa are largely obscured by recrystallisation but show in places in the transverse section, arising from the wall between the slight angles formed where two tubuli meet the wall. The walls are sometimes crenulate, and then the septa arise from the crenulations. That the septa are long spines upturned axially is shown in transverse section by their abrupt truncation and the occasional occurrence of apparently detached fragments towards the centre of the tabulæra.
Range: Group four ranges in Australia from Upper Silurian to Middle Devonian.

Locality: One quarter of a mile N.E. of Apsley on the road to dredge, Wellington, N.S.W. (University of Sydney 7272.)

Genus Propora Edwards and Haine.

Propora sp.

Plate I, figure 11.

Remarks: A single specimen is an undescribed species of Propora. The state of preservation is poor, but the transverse section shows the tabularia to be thick walled and crenulate with long septa, stout at the base but rapidly becoming thin, arising from the crenulations. The septa reach or nearly reach the centres of the tabularia and are prolonged in the other direction outside the tabularia into the reticulum. The longitudinal section is obscure so that the character of the septa cannot be determined. The reticulum consists of testae, but beyond this the characters cannot be seen. Of described species it may be close to Propora tubulata Lonsdale but further comparison must await better specimens. It is quite unlike P. conferta Ed. & H., the only other species recorded from Australia (see Jones and Hill, 1940, p. 209).

Locality: Por. 241, Par. Mickety Mulga, Wellington, N.S.W. (University of Sydney 7279.)

REFERENCES.

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Köninck, L. G. de, 1842. Description des Animaux fossiles... Leige, 1841-1844, 650 pp., pls. A-H and I-LV.
d’Orbigny, A., 1850. Prodomes de Palæontologie Stratigraphique... 1, pp. 294+ix, 8vo, Paris.
Explanation of Plate.
All figures x 2 approximately.

Figs. 1, 2. — Favosites bryani Jones. 1, transverse; 2, longitudinal section. Dubbo Road, 12 miles from Wellington. (S.U. 6254.)

Figs. 3, 4. — Favosites sp. nov. 3, transverse; 4, longitudinal section. Por. 119, Par. Veech, Wellington. (S.U. 5290.)

Figs. 5, 6. — Favosites richardsi Jones. 5, transverse; 6, longitudinal section. One-quarter mile N.E. Apsley R.S. on road to dredge, Wellington. (S.U. 7278.)

Figs. 7, 8. — Pleurodictyum bifidum sp. nov. Holotype. 7, transverse; 8, longitudinal section. Por. 82, Par. Mickety Mulga, Wellington. (S.U. 6251.)

Figs. 9, 10. — Heliolites daintreii Nich. & Eth. 9, transverse; 10, longitudinal section. One-quarter mile N.E. Apsley R.S. on road to dredge, Wellington. (S.U. 7272.)

Fig. 11. — Propora sp., transverse section. Por. 241, Par. Mickety Mulga, Wellington. (S.U. 7279.)
THE ETCH FIGURES OF BASAL SECTIONS OF QUARTZ. Their Use in the Orientation of Waterworn Crystals.


With Plates II-III and nine text-figures. (Presented by permission of the Under-Secretary for Mines.)

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Introduction.

This paper sets out the results obtained by etching sections of quartz cut perpendicular to the optic axis. It also examines the possibility of orientating sections, cut in this plane, in which the positions of the prism faces are unknown.

The main use of quartz is for the manufacture of quartz plate resonators. For this purpose the plates have to be cut in a definite relationship to the crystal axis, in order to obtain the optimum temperature-frequency coefficient and eliminate secondary resonances. The margin of error permitted in this operation is very small and in order that the cutting can be carried out with the required degree of accuracy, the positions occupied by the prism faces must be known fairly accurately.

A certain quantity of waterworn quartz crystals of high quality is available, which cannot be used for piezo-electric purposes unless the positions of the prism faces are known reasonably accurately. The position of the optic axis can be obtained with an accuracy of ±10 minutes by means of a polariscope (Booth and Sayers, 1939). The position of a plane perpendicular to all prism faces thus being known, it still remains, before the orientation is completely determined, to fix the positions these faces occupy in this plane. The order of accuracy required for this operation is not so great as that for the determination of the position of the optic axis.

The work, the results of which are set out in this paper, was originally undertaken in order to see whether a way of solving this problem could be found, without recourse to X-ray methods.

A summary of some of the properties of quartz has been included in order to make the results detailed easier to follow.

Properties of Quartz.

Quartz crystallizes in the hexagonal system and occurs as two varieties, α-quartz and β-quartz (Bragg and Gibbs, 1925; Gibbs, 1926). α-quartz, which forms at temperatures below 575° C, has only trigonal symmetry and possesses the property of piezo-electricity. Quartz is enantiomorphous, the form assumed depending on whether the spiral atomic structure is right- or left-handed. This variation in internal structure is reflected in a variation of the outward form by the disposition of the subsidiary x and s faces, as shown in Figure 1.

The Bulletin of the Imperial Institute (1938) has given the following notation for piezo-electric quartz decided upon by the Department of Scientific and Industrial Research: The principal crystallographic axis, which is an axis of threefold...

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