

DESCRIPTIONS OF HELIOLITIDÆ FROM THE UPPER SILURIAN, YASS, NEW SOUTH WALES.

BASED ON NOTES BY THE LATE R. ETHERIDGE, JUNIOR.

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(Plates xviii-xxi.)

Prior to his death, Robert Etheridge, the late Director of the Australian Museum, made notes on numerous specimens and sections of specimens of the Heliolitidæ in the collections of the Australian Museum and the Mining and Geological Museum, Sydney. These notes, from a re-examination of the sections, have been amplified and, in part, form the subject of the present paper.

The interpretation of structures is based on Lindstrom's "Remarks on Heliolitidæ"<sup>1</sup> and as to affinities the principles adopted by Nicholson in his "Tabulate Corals"<sup>2</sup> have been followed.

HELIOLITES YASSENSIS, *sp. nov.*

(Pl. xviii, fig. 1.)

Corallum massive, attaining a size of about 20 cm. in diameter, height 12-15 cm. Autopores very large, circular, very even in size, 1.5-1.75 mm. in diameter, closely and very regularly spaced, outer margin plain or slightly indented, area of junction of siphonopores .5-1 mm. Pseudosepta twelve, irregularly developed and frequently absent; when present short, straight and spine-like. Tabulæ complete, both horizontal and concave, never vesicular, spacing variable but in periods of regular growth from .75 to 1 mm. apart; inter-tabular spaces regularly oblong. Siphonopores large and regular in form, polygonal—quadrangular to heptagonal, from .25-.5 mm. in diameter and 1-3 in each autoporal interspace (usually two). The circum-autoporal circlet is composed of from 16 to 20 siphonopores slightly larger than the general series. The transverse structures in the siphonoporal tubes are usually regularly spaced as regards adjoining tubes, and may be transverse, concave, or even amalgamating (sub-dissepimental).

Compared with Australian Silurian types *yassensis* is distinguished by the possession of constantly large autopores with well defined margins, equal in size, relatively closely spaced, with narrow siphonoporal areas. The large size of the autopores is very distinctive, and in this respect it

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<sup>1</sup>G. Lindstrom—K. Svenska Vet. Akad., Handlingar, 1899, xxxii.

<sup>2</sup>Nicholson—On the Structure and Affinities of the Tabulate Corals of the Palaeozoic Period, 1879.

compares with *H. jackii*, *H. distans*, and *H. wellingtonensis* (*vide postea*); all other types are small tubed.

The tabulæ as a rule are very regular and horizontal, though irregularity in rate of growth may lead to variations in direction, but any sign of anastomosis appears to be absent.

The siphonoporal tubes in this species is distinctive, but there is no tendency to the formation of a definite and regular autoporal circlet. The general form of the siphonoporal elements is less regular than in the species mentioned before; the transverse structures (tabulæ) are, as in the case of the autopores, very regularly horizontal. Fission in the siphonoporal tubes appears to be associated with those possessing more than the normal pentagonal outline.

In the size of the autopore *yassensis* resembles *distans*, but the structure of the tabulæ of the siphonopores at once separates the two species; in *H. jackii*, which has similarly large autopores, the siphonopores are much larger than in *yassensis* and have curved margins; in *H. wellingtonensis*, where the autopores are equally large, the great irregularity of the siphonoporal structures is very marked.

The description is based on specimens in the Australian and Mining Museums—A.M.F. 5176, Yass, Hatton's Corner (Section A.M. 62); Mining Museum, F. 794 (Section M. 173) Hatton's Corner, Yass, T. W. E. David and M. 685, Old Limekilns Ridge, Humewood, Yass (R. Etheridge).

HELIOLITES REGULARIS, *sp. nov.*

(Pl. xviii, figs. 2-3.)

Corallum discoid, irregularly ovate, forming more or less flattened masses, upper surface convex. Autopores regularly circular, with plain margins and equal in size, .75-1 mm. in diameter and equally spaced; the siphonopore area is from .5-.75 mm. in extent between adjoining autopores. Pseudosepta twelve, reduced to minute spikes. Tabulæ complete and generally horizontal, occasionally concave, rarely anastomosing; spacing irregular, averaging from 3 to 4 in 1 mm. Intertabular spaces transversely oblong. Siphonopores small, averaging .25 mm. in diameter, very regular, polygonal (mostly pentagonal), usually two in each autoporal interspace. Longitudinally the walls are usually markedly sinuous. The transverse structures (tabulæ) are usually complete and horizontal, rarely anastomosing, and occasionally highly concave.

This species falls into the *coronata* group by reason of the regularity of the structure of the circlet, in each case of 12 siphonoporal tubes, as a rule radially elongated and larger than the intermediate tubes; the autopores, however, are larger and much more widely separated in *coronata*.

The three forms *H. yassensis*, *jackii*, and *regularis* exhibit a very interesting gradation in the size of the autopores; *jackii* presents the

largest, *yassensis* is intermediate, and *regularis* possesses the smallest. The two last mentioned are usually associated, but are at once distinguishable from *jackii* by the remarkably curved sides of the siphonopores in the latter as compared with the angular outlines of the former two species.

The pseudosepta when present are short exsert structures and are seldom seen distinct from the exothecal thickenings, in the autoporal circle. Amongst the Australian forms, *H. regularis* is remarkable in this respect, and would indicate an approach to *Plasmopora*.

The siphonopores are many-sided, from 8 to 14, and in such cases the width is very markedly disproportionate. Fission is noticeable in the multi-sided tubes.

*Locality*.—Hatton's Corner, Yass. Specimen F. 975, section M. 174. Coll. T. W. E. David.

HELIOLITES REGULARIS var. HUMEWOODENSIS, *sp. nov.*

(Pl. xviii, figs. 4-5.)

A very well marked variety of *H. regularis*, occurs at Humewood and Limestone Creek. Although it possesses the same general characters as *H. regularis*, with autopores of the same size, there is a marked difference in the size of the siphonopores, which are much smaller and more numerous in the inter-autoporal spaces. The circle is still a distinct feature, but is not so prominent as in *regularis*, the elements being smaller and from 12-14 in number. The difference in size of the siphonopores is clearly shown in vertical sections. The pseudosepta are usually well preserved and long (about half the radius); extra-autoporal thickenings are not seen. The siphonopores occasionally become enlarged (Pl. xviii, fig. 5).

*Locality*.—Old Limekilns Ridge, Humewood, sections M. 585, 427, 3616. Mining and Geological Museum. Coll. R. Etheridge.

HELIOLITES JACKII, *sp. nov.*

(Pl. xviii, fig. 6 and Pl. xix, figs. 1-2.)

Corallum discoid, or irregularly ovate masses, upper surface strongly convex. Autopores circular, well defined, equally developed and widely spaced, 1.5-1.75 in diameter and 1-2 mm. apart. Pseudosepta 12, often inconspicuous and hardly developed. Tabulæ irregularly spaced, from one to three in the space of 1 mm., very directly transverse, occasionally deflected at edges, rarely incomplete. Inter-tabular spaces oblong. Siphonopores polygonal, 15-17 sided, comparatively large, variable in size. Autoporal circle composed of tubes which are radially elongated with particularly irregular outlines, walls slightly sinuous. Tabulæ usually opposite.

The edges of the autopores are usually uneven in consequence of the form of the siphonopores of the circle, but there is no markedly regular

pattern of successive invaginations as is evidenced in *H. porosa* Goldf.; they maintain the same dimensions and spacing very uniformly. The inter-autoporal spaces are occupied by 1-3 siphonoporal tubes. Pseudosepta are most irregular in their development, usually absent, the normal twelve being rarely shown; the thickening of the circling cell walls corresponding to the pseudosepta has not been seen.

The autoporal circling does not give the same uniform appearance as in the other species of this group, due to the irregularities of form and disposition of the individual calicles. It follows from this that the circling is *H. jackii* does not show the aureole appearance of *H. coronata* and similar species. When contiguous autopoieses are separated by a single rank of siphonoporal tubes the latter are generally relatively much elongated.

*Localities.*—Hatton's Corner, Yass. Australian Museum, F. 5174 (section 57 and E. 19); F. 4801 (section 60) coll. R. A. Barbour; Hume wood F. 4498 (section 55), coll. R. Etheridge; Yarralumla, Mining and Geological Museum, F. 440 (section M. 600), Old Limekilns Ridge, Hume-wood; F. 2536 (section M. 611) Quedong, coll. C. Cullen; F. 455 (section 615), Hatton's Corner, coll. C. Cullen; F. 446 (section 607), Hatton's Corner, Yass, coll. C. Jenkins.

#### HELIOLITES DISTANS, *sp. nov.*

(Pl. xix, figs. 3-6.)

Corallum massive, larger. Autopores circular, or slightly angulate, variable in size, 1-1.75 mm. in diameter, but constantly developed in the same individual, separated by a varying width of siphonoporal tissue, from 2-6 mm. apart, margin plain or slightly sinuous. Pseudosepta often absent, when present, in the form of small incomplete blunted ridges, or nodes, corresponding with the divisions of the circling, 12 in number. Tabulæ generally complete and horizontal, sometimes slightly oblique or concave, or slightly convex and bent downwards at outer margin; rarely incomplete and becoming vesicular; the vesicular structures, induced by anastomosis are subtriangular, three to 1 mm., four to 2 mm. or even at times 1 mm. apart. Inter-tabular spaces square or transversely oblong. Siphonopores small, about 3 mm. in diameter, very numerous, polygonal with straight sides, often becoming rounded at the angles, from two to ten between adjacent autopore tubes, average about five. Circling not conspicuous, elements pentagonal or hexagonal, 12-15 in number, usually twelve. Transverse structures (tabulæ) very variable in position and spacing, horizontal or very oblique, slightly concave, V-shaped, infundibuliform, vesicular with triangular vesicles, opposite or alternate, from three to four in 1 mm. Fission as a rule is sparse, but when present is common.

*Observations.*—This is the commonest and most widely distributed species of *Heliolites* in the New South Wales Silurian and is very variable. It is distinguished from the species already mentioned by the wider spacing of the autopoieses and the condition of the pseudosepta, the great abundance and small size of the siphonopores, and the variable nature

of their transverse structures. A casual inspection of sections shown on Plates xxix, figs. 3-6; xx; xxi, figs. 1-4 would, from the relative sizes of the autopoies and siphonopores, suggest three, or possibly four, distinct species, but the presence of intermediate forms forming gradations from one to the other and the general similarity of siphonoporal structures lead to the establishment of a series around forms of the type of Pl. xix, fig. 4, with large autopoies 1.75 and sometimes nearly 2 mm. in diameter and at the other extreme that figured in Pl. xxi, fig. 3 with autopoies never more than 1 mm. in diameter, yet in longitudinal section of the tabulæ practically the same, whilst in transverse section these structures present features not often seen in any of our species. Under these circumstances it would appear advisable to regard this set of forms as constituting a protean species that may be divided for convenience into fairly definite varieties by the proportions of various parts.

The autopoies are largest in specimens such as F. 56 (Pl. xxi, fig. 6) and F. 603 (Pl. xix, fig. 4), which may be taken to represent the species in chief; from 1.5-1.7 mm. in diameter. The first gradation in size is seen in F. 43 (Pl. xx, fig. 4) and F. 587 (Pl. xx, fig. 2) where they vary from 1.25-1.5 mm. and this will constitute variety (a) *shearsbyi humewoodensis*. The next is based on decrease in size of autopoies variety (b), *intermedia*, F. 76 (Pl. xx, fig. 6), 1-1.25 mm. in diameter; and the smallest is based on specimens F. 34 (Pl. xxi, fig. 3) and F. 34 (Pl. xxi, fig. 4) in which the diameter seldom exceeds 1 mm. This variety is named *minuta*. It will be seen that these differences in autopoies dimensions are associated with other minor characters.

The structure of the autopoies differs but little in the various forms, but in some the circular contour is somewhat modified by a slight angularity arising from the absence of curvature on the proximal edge of the circlet siphonopores. This is perhaps most accentuated in the species in chief (Pl. xix, fig. 6) and least so in var. *intermedia* (pl. xx, fig. 6) and var. *minuta* (Pl. xx, fig. 2); in this species the angularity of contour becomes slight flexuosity.

The siphonoporal area between the autopoies presents considerable variation. In *H. distans* F. 56 and 603 there are from two to eight siphonopores between adjoining autopoies, usually from five to six, covering a space of about 4 mm. In var. *humewoodensis* F. 43, 587 there are from five to ten siphonopores, occupying a space of 4-6 mm. In var. *intermedia* F. 76 there are 4-8 siphonopores covering 2-3 mm., and in var. *minuta* F. 34, 73 from five to eight siphonopores occupying from 2-3 mm. space.

Pseudosepta proper are not present in the varieties but are represented in var. *humewoodensis* occasionally, more frequently in *intermedia*, and abundantly in *minuta* by twelve inwardly directed thickenings of the autopoial wall, like small knobs, arising possibly from a thickening at the junction of the autopoial wall with the proximal ends of the circlet siphonopore walls, to which, most, if not all, the pseudoseptal structures are opposite. It is noticeable that when a thickening of autopoial wall is absent there is no trace of these structures.

The tabulæ of the autopores are variably spaced, from 1 mm. apart down to four to 1 mm., usually complete and horizontal, occasionally concave. (F. 5187 Pl. xix, fig. 5), rarely convex (Pl. xx, fig. 3 and Pl. xxi, fig. 3), or vesicular (Pl. xx, fig. 5). The inter-tabular spaces usually transversely widened, sometimes square (Pl. xxi, fig. 3).

The structure of the siphonopores throughout this group is very characteristic and separates the members at once from the other Australian *Heliolites* examined. The siphonoporal tubes are very numerous and small, regularly angular, curved sides being rare, usually pentagonal or hexagonal, rarely quadrangular or heptagonal. The size is in proportion to that of the autopores; the largest are formed in *H. distans* (Pl. xix, figs. 4 and 6). In *humewoodensis* and *intermedia*, they are smaller, whilst in *minuta* the tubes are extremely small (Pl. xxi, figs. 3-4). The rounding of the angles of the polygonal siphonopores (Pl. xxi, fig. 1) and a less extent in Pl. xxi, fig. 4, is caused by a secondary thickening, which is seen in its most exaggerated form in some parts of the corallum of specimen F. 5556 (Pl. xx, fig. 6), giving to the tubes a rounded or oval section.

The circlet in this group is not a very prominent feature; the elements are usually pentagonal, sometimes hexagonal. In var. *minuta* the number of tubes in the circlet is most constantly twelve (Pl. xxi, figs. 3 and 4); in *humewoodensis* and *intermedia* the number is 12-15.

The transverse structures (tabulæ) of the siphonopores constitute a peculiar and important feature in the *distans* group. The structures may be kept opposite, sub-opposite, or alternate in contiguous tubes, and are very variable in their spacing, horizontal (Pl. xxi, fig. 3), very oblique (Pl. xxi, fig. 4, Pl. xix, fig. 6, Pl. xx, fig. 6), or slightly concave (Pl. xxi, fig. 4), at times almost sigmoidal, often V-shaped (Pl. xix, fig. 5), infundibuliform, and here and there vesicular (Pl. xxi, fig. 2). Usually there are three to four to 1 mm. In some instances tubes are seen in which the structures are constant for some distance of whatever condition it may be (Pl. xx, fig. 3, Pl. xix, fig. 5), or a tube may possess any two or three of the modifications giving a very remarkable appearance (Pl. xix, fig. 5, Pl. xx, figs. 1 and 3) which may almost be taken as a specific character. The absence of a constant horizontal growth leads to corresponding peculiarities in transverse sections; the cut edges of oblique tabulæ show as oblique lines across the siphonopore, the V-shaped showing as arches or portions of circlets, and so on (Pl. xxi, figs. 1 and 3).

*H. distans* is close to *H. murchisoni* Nich. and Eth. fl, which Lindstrom classes in the *interstinctus-deciptens* group,<sup>3</sup> but has greater autoporal interspaces and a greater number of siphonopores, *i.e.*, a lesser number of autopores in a given area. The same comparison may be made with *H. subtubulata* McCoy.<sup>4</sup> It is even nearer to *H. micropora* Eichw.<sup>5</sup> in comparison with the well marked character of the pseudosepta. It pre-

<sup>3</sup>Lindstrom—Op. cit., p. 51.

<sup>4</sup>McCoy—Brit. Pal. Fossils, 1851, t. 2, c., f. 2-2b.

<sup>5</sup>Eichwald—Lethaea Rossica, 1860, p. 454, t. 25, f. 7 a-e.

sents a close resemblance to Roemer's figure of *H. interstincta* from the United States.<sup>6</sup>

To sum up, the species in chief, *distans*, may be distinguished by its larger autopores, 1.5-1.75 mm. in diameter, and correspondingly large siphonopores; the absence of any trace of prominent pseudosepta; the constant and marked lack of horizontalities in the siphonoporal tabulæ and their frequently marked V-shape; cirlet elements from 12-16.

*Localities*.—Austr. Mus. F. 5173 (Sec. A.M. 56) Yass.

Austr. Mus. F. 4082 (Sec. A.M. 140) Old Limekilns Ridge.  
Coll. R. Barbour.

Mining and Geol. Mus. F. 1828 (Sec. 603) Yass. Coll.  
T. W. E. David.

„ „ „ F. 3616 (Sec. 588) Old Limekilns  
Ridge, Humewood. Coll. R. Etheridge.

Mining and Geol. Mus. F. 3616 (Sec. 586) Old Limekilns  
Ridge, Humewood. Coll. R. Etheridge.

HELIOLITES DISTANS, var. HUMEWOODENSIS, var. nov.

(Pl. xx, figs. 3-4.)

*Varietal characters*.—Autopores 1.25-1.5 mm. in diameter, siphonoporal structures very similar to those of *distans*; the cirlet enlarged, 12-16 tubes.

*Localities*.—Austral. Mus. F. 4082 (Sec. A.M. 43) Old Limekilns  
Ridge, Humewood. Coll. R. A. Barbour.

„ F. 5548 (Sec. A.M. 72) Old Limekilns  
Ridge, Humewood. Coll. R. A. Barbour.

Mining Geol. Mus. F. 3616 (Sec. A.M. 601) Humewood,  
Old Limekilns Ridge, Yass. Coll. R. Etheridge.

Austr. Mus. F. 5547 (Sec. A.M. 71) Humewood, Old  
Limekilns Ridge, Yass. Coll. R. Etheridge.

Min. Geol. Mus. F. 3616 (Sec. 587) Humewood, Old Lime-  
kilns Ridge, Yass. Coll. R. Etheridge.

„ „ F. 3616 (Sec. 599) Humewood, Old  
Limekilns Ridge, Yass. Coll. R. Etheridge.

HELIOLITES DISTANS, var. INTERMEDIA, var. nov.

(Pl. xx, figs. 5-6.)

*Varietal characters*.—Autopores 1.1-1.25 mm. in diameter, siphonopores as in *distans*. In this variety the pseudoseptal projections are more freely developed and the cirlet is constantly composed of twelve elements, and siphonoporal tabulæ are very vesicular.

<sup>6</sup>Roemer—Sil. Fauna West Tennessee, 1860, t. 2, f. 5, 5 a.

- Localities*.—Austr. Mus. F. 5555 (Sec. A.M. 75) Old Limekilns Ridge  
Humewood. Coll. S. R. Mort.  
 „ F. 5556 (Sec. A.M. 76) Old Limekilns Ridge,  
Humewood. Coll. S. R. Mort.  
 „ F. 2433 (Sec. A.M. 52) Old Limekilns Ridge,  
Humewood. Coll. S. R. Mort.  
 Min. Geol. Mus. F. 3616 (Sec. M. 610) Old Limekilns  
Ridge, Humewood. Coll. R. Ether-  
idge.  
 „ „ F. 2397 (Sec. M. 602) Bowning. Coll.  
T. Ranft.

HELIOLITES DISTANS, var. MINUTA, var. nov.  
(Pl. xxi, figs. 1-4.)

*Varietal characters*.—Autopores small, never more than 1 mm. in diameter, siphonopores much reduced in size. Pseudoseptal structures nodose and highly developed, circlet constantly of twelve siphonopores.

- Localities*.—Austr. Mus. (Sec. E. 34) Yass District, Hatton's Corner.  
Coll. R. L. Jack.  
 „ F. 2461 (Sec. A.M. 53) Bowning. Coll.  
R. L. Jack.  
 „ F. 5554 (Sec. A.M. 74) Old Limekilns Ridge,  
Humewood.  
 „ F. 5553 (Sec. A.M. 73) Old Limekilns Ridge,  
Humewood.

Plasmopora, M. Edw. and Haime, 1849.

(*Compt. Rendus*, xxix, p. 262; Emend. Lindstrom, *K. Sv. Vet. Akad., Handl.*, 1899, xxxii, p. 74.)

PLASMOPORA SHEARSBYI, sp. nov.  
(Pl. xxi, figs. 5-6.)

Corallum massive, corallites long, slightly flexuous. Autopores oval to circular, closely spaced, 1.25-2.75 mm. in diameter, margins plain or very slightly flexuous, from .25-.5-1 mm. apart; the last spacing is unusual. Pseudosepta absent. Exothecal thickenings ("spines") short, inconspicuous, and irregular; when present the autopore margin is somewhat thickened. Tabulæ complete, close, very slightly concave, 3-5 in 1 mm. space. Siphonoporal area composed of very irregularly shaped vesicles, one to three series between autopores; the vesicles are lenticular and very irregular. Siphonoporal walls are absent. Exothecal spines sometimes coincide with cut edges of the siphonoporal vesicles but usually project into the spaces. The siphonopores are irregular both in shape and disposition. In section the cut edges are usually faint in comparison with the thickened autopore walls.

- Localities*.—Austr. Mus. (Sec. E. 21) Yass. Coll. R. L. Jack.  
 Min. Geol. Mus. F. 976 (Sec. 175) Hatton's Corner, Yass.  
 „ „ F. 3734 (Sec. M. 291) Bungonia. Coll.  
W. Guymer.  
 „ „ (Sec. M. 243), F. 3805, Hatton's Corner.