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On the Occurrence of a Lituitean in the Upper Silurian Rocks of Bowning, New South Wales.

By R. Etheridge, Junr., Curator.

(Plate viii.)

Mr. John Mitchell, Resident Teacher of the Technical College, Newcastle, brought under my notice two specimens of a Cephalopod, from the Upper Silurian of Bowning, that appear to possess characters relegating them to the Lituitidæ. One of these is more or less wholly compressed, the other is partly so and partly still preserved in the round, the latter portion being about one half the youngest remaining whorl. The wholly compressed example Mr. Mitchell has been good enough to present to the Trustees of the Australian Museum.

The late Prof. A. Hyatt included[1] in the Lituitidæ the following genera :—*Cyclolituites*, Remelé; *Lituites*, Breynius; *Angelinoceras*, Hyatt; *Ancistroceras*, Boll; *Rhyncorthoceras*[2], Remelé; and *Holmiceras*, Hyatt.

As Hyatt's paper is not readily accessible, and with a view of showing how these genera differ from one another, the following abbreviated characters, taken from his descriptions, are appended :—

1. *Cyclolituites*, Remelé. — Whorls touching until a late ephebic stage; living chamber free only in part; section round or a compressed oval ellipse; hyponomic sinus deep and narrow; abdominal crests blunt; lateral sinuses present; dorsum occupied by a crest (?), and with an impressed zone.

2. *Lituites*, Breynius.—Whorls in contact for between three and four volutions; living chamber more or less straight; hyponomic sinus deep; lateral sinuses two, shallow; dorsum with a deep sinus; crests and sinuses well pronounced; coiled whorls costate.

3. *Angelinoceras*, Hyatt[3].—Whorls open and coiled for about three volutions, attenuated and compressed; outstretched free

[1] Hyatt—Proc. Amer. Phil. Soc., xxxii., 143, 3 L, 1894, p. 505.
[2] Hyatt spelt this name in two ways—*Rhyncorthoceras and Rhynchorthoceras*, (*loc. cit.*, p.p. 511 and 512.)
[3] Hyatt—Proc. Amer. Phil. Soc., xxxii., 143, 3 L., 1894, p. 508.

whorls present in the older stages; ventral sinuses deep more or less; lateral sinuses near the dorsum deep more or less; crests at the abdominal angles and on the dorsum.

4. *Ancistroceras*, Boll. (= *Strombolituites*, Remelé[4]).—Spiral closed for from one to one and a half, or two whorls; section compressed elliptical to more or less quadragonal; outstretched free whorl circular; a ventral and two lateral sinuses present; dorsum occupied by a broad low crest.

5. *Rhyncorthoceras*, Remelé (= *Rhyncoceras*, Remelé).—Completely uncoiled in the young stage, the apex simply curved, not coiled; ventral and dorsal crests and lateral lobes low and broad.

6. *Holmiceras*, Hyatt[5].—Whorls enrolled, open and discoidal. There are four major sinuses as in *Lituites*, but no median dorsal crest; ventral sinus shallow; ventro-lateral crests two, narrow; lateral sinuses shallow; dorsal sinus slight.

In referring the fossils now under description to *Cyclolituites*, I have been forced to rely on Prof. Hyatt's paper, the other memoirs dealing with the Lituitidæ being inaccessible to me, with the exception of two of Mr. Remelé's.

The Bowning petrifactions consist of coiled portions in one plane (Pl. viii., figs. 1 and 2) with the whorls in close contact, but without a gerontic free termination; one specimen displays four whorls, the other five. The former is entirely compressed, but there are still visible faint costæ on a portion of the last whorl preserved; these are obliquely concave forwards. On the latter of the two specimens the whorls are also compressed, with the exception of about half the last volution, and this is fortunately retained in the round. The cross section of this portion is reniform with a rather shallow contact furrow[6]; the venter and lateral portions are rounded, and the siphuncle is large and practically central.

On the venter the costæ describe deep, narrow and acute hyponomic angles, thence passing forwards laterally in gentle convex curves to the sub-acute edges of the contact furrow, but in the latter the course of the lines of growth are quite hidden by a crust of irremovable matrix. The intercostal spaces have a width of approximately three millimetres, and bear delicate striæ having the same direction of curvature.

The curvature of the costæ and lines of growth is so very regular and continuous that it is difficult to differentiate between sinuses and lobes, but there does appear to be a slight inflection of the curvature immediately before reaching the subacute edges of the impressed zone of the dorsum; on crossing these angles

[4] Remelé—Zeit. Deuts. Geol. Gesellsch., xxxii., 1881, p. 190; *ibid*, xxxiv., 1882, p. 116.
[5] Hyatt—Proc. Amer. Phil. Soc., xxxii., 143, 3 L, 1894, p. 512.
[6] Hyatt—*Loc. cit.*, diagram pl., f. B″.

they become lost as already explained. The wholly compressed specimen shows distinct traces of numerous regular septal sutures, one millimetre apart.

The acute angle formed by the costæ and lines of growth on the venter, representing the hyponomic sinus, except that the former are much stronger, closely resemble those on a shell termed by Mr. E. de Verneuil and Comte A. de Keyserling *Lituites cornuarietis*, J. Sby[7]., from the Lower Silurian limestones of the neighbourhood of Reval, Russia.

This hyponomic sinus is far more acute than that of Mr. F. Noetling's figure[8] of *L. lituus*, De Montfort. The inflections of the lines of growth certainly indicate a less number of crests and sinuses than that seen in *Ancistroceras*, Boll, irrespective of the different direction and angles of the latter[9].

Hyatt says[10] that the "crest and sinuses are very much more pronounced in Lituites[11], and the enrolled portion of the whorl is continued longer and is more closely coiled, the whorls being in contact for between three and four volutions." One sinus in the Bowning fossils, the hyponomic, is very pronounced, and the whorls numerous, at least five and in close contact; hence an approach to *Lituites*, but the free and straight portion of the living chamber is not preserved in either example.

Two of the, at first sight, more important characters of *Cyclolituites*, are the "whorls touching until a late ephebic stage," and no "genus of this family except Cyclolituites has an impressed zone[12]." Both of these conditions are fulfilled by our specimens. They are quite unlike the Rhyncorthoceran forms with uncoiled whorls.

The evident resemblance of Mr. Mitchell's fossils to *Cyclolituites*, particularly the two last characters referred to, and the absence of other features to the contrary emboldens me to refer them to that genus under the name of *C. bowningensis*. *Cyclolituites* is an Ordovician genus, but if my determination stands the test of further discoveries, we now find it occurring in the Upper Silurian, to which we have been in the habit of referring the Bowning beds.

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[7] De Verneuil & Keyserling—Murchison's Geol. Russia in Europe, ii., 1845, pl. xxv., f. 7b.
[8] Noetling—Zeit. Deuts. Geol. Gesellsch., xxxiv., 1882, pl. xi.
[9] Remelé—Zeit. Deuts. Geol. Gesellsch., xxxiv., 1882. pl. v, f. 1-5.
[10] Hyatt—Proc. Amer. Phil. Soc., xxxii., 143, 3 L., 1894, p. 507.
[11] Than in the other genera of the family.
[12] Hyatt—Proc. Amer. Phil. Soc., xxxii., 143, 3 L., 1894, p. 504.

EXPLANATION OF PLATE VIII.

CYCLOLITUITES BOWNINGENSIS, *Eth. fil.*

Fig. 1. Sub-compressed cast in mudstone showing the whorls in contact.

,, 2. Specimen partly compressed, partly in the round; the former portion exhibits the whorls in contact, the latter the original convexity, and the costæ.

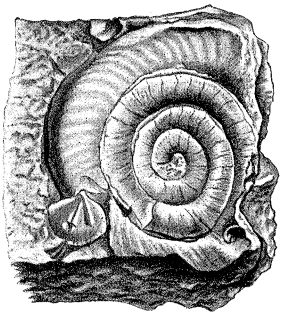
,, 3. The convex portion of Fig. 2 detached, exhibiting the dorsal contact furrow.

,, 4. Side view of Fig. 3.

,, 5. Ventral view of one portion of Figs. 3 and 4.

,, 6. Similar view of the other portion of Figs. 3 and 4. Both these figures (5 and 6) exhibit the strongly marked hyponomic sinus.

,, 7. Section of Figs. 3 and 4.



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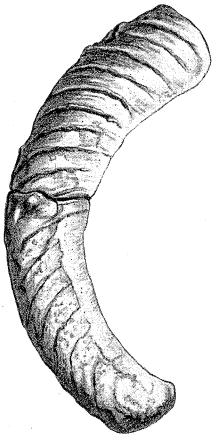

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