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1984/30. Some Ordovician and Silurian rocks and fossils from the Huskisson River area, western Tasmania

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Abstract

Specimens (C1130) from the base of the Gordon Subgroup in the Huskisson River area are biomicrites containing calcareous algae, corals, bryozoa, brachiopods, rostroconchs, gastropods, trilobites and conodonts. The conodonts are *Belodina compressa* (Branson & Mehl) of Middle-Late Ordovician age. An oolitic echinodermal microsparite (C1140) occurs slightly higher stratigraphically and contains *Tasmanognathus careyi* Burrett which indicates a correlation with the microfauna of the Lower Limestone Member of the Benjamin Limestone in the Florentine Valley.

A sandstone replete with external moulds of large diameter crinoid-columnals (?) demonstrates the presence of a correlate of the Crotty Quartzite. Despite the unusual shape of the columnals (?), no taxonomic assignment can be made.

A pale-grey biomicrite (C981) contains dasyclad algae, tabulate and rugose corals, bryozoa, brachiopods, bivalves, gastropods and echinoderms. The rugose corals may include *Tryplasma lonsdalei* Etheridge and *Stereoxylodes* sp. close to *S. multicarinatus* McLean. Tabulates include a favositid, probably *Pachypora*, and *Syringopora* sp. These corals are consistent with a Middle Silurian age.

Tentaculites cf. *ornatus* Sowerby occurs in siltstone correlated with the Amber Formation and is consistent with a Wenlockian age.

A specimen of ?*Cyrtograptus* may also be present. If correctly identified this would indicate a Wenlockian age for the limestone in the Amber Formation.

INTRODUCTION

Several specimens of limestone and one of sandstone from the Huskisson River area were made available by A.V. Brown, Tasmania Department of Mines, for determination of age and/or of the fossils present. M.J. Clarke made available siltstones with abundant *Tentaculites*.

The specimens bore the field numbers C631, C981, C1130-I, C1130-II and C1140. Details of these specimens are:

- C631: AMG reference CP64318672; limestone of Gordon Subgroup, 5 m below contact with overlying sandstone; Little Wilson River.
- C981: AMG reference CP70038335; limestone member within Amber Formation.
- C1130: AMG reference CP72597639; limestone of Gordon Subgroup;
 - Micro I - base of Subgroup.
 - Micro II - approximately 160 m above base of Subgroup.
 - Macro I - approximately 120 m above base of Subgroup.
 - Macro II - approximately 220 m above base of Subgroup.

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C1140: AMG reference CP72597639; limestone of Gordon Subgroup.

Crinoid specimen UTGD 122483: AMG reference CP696785; fossiliferous sandstone, Crotty Formation; former Department of Main Roads quarry at about 38.85 km mark on the Lower Pieman Dam Road.

Siltstone: AMG reference CP729792; correlate of Amber Formation.

The opportunity was also taken to determine the petrology of the limestones submitted.

PETROLOGY

Limestone

Specimen C981. This rock is a pale grey micrite with 'dolomitic' patches, poorly developed stylolites and many fossil fragments up to 34 mm long. The fossils include polyzoa, tabulate corals and echinoderm elements. In thin section (Plate 1a), the rock has fossil fragments forming 60% to 90% of the rock in a micritic matrix. The fossil fragments include those of dasyclad algae, tabulate and rugose corals, bryozoa, inarticulate brachiopods, bivalves, gastropods and echinoderms. These fragments are unsorted and show few signs of abrasion. Several of them do, however, show signs of boring. The rock also contains a small proportion (1-2%) of angular and subangular quartz grains of silt to coarse sand grade.

The clasts are in a micrite matrix which shows development of small calcite and dolomite rhombs and mosaic patches of calcite and siderite microspar. The matrix also has irregular, laminar, sharp-sided bodies of large carbonate grains, representing fillings of 'fenestrate' birdseyes. The carbonate grains lining these cavities and cavities in the fossils are calcite, then dolomite in places, ferroan dolomite and abundant siderite. Irregular poorly-defined zones of fine-grained calcitic and sideritic mosaic traverse the rock and probably represent incipient stylolites. At least one of these has been split by a fracture and the cavity filled with ferroan dolomite and siderite. Well-formed pyrite crystals form about one percent of the rocks and seem to be concentrated at the junction between the micrite matrix and later sideritic mosaic zones or in those zones, but are not restricted thereto.

The rock is a partially sideritised biomicrite clearly of marine origin, having accumulated in shallow, probably clear water on a surface which included very little extraneous detrital material. There was an abundant attached benthos but there was very little movement of bottom waters, although conditions were not reducing. It seems that some more-or-less laminar cavities as well as intra-skeletal cavities were present in the newly deposited rock. Subsequent to deposition recrystallisation of the matrix began and led to development of small calcite and dolomite rhombs in the micrite and to patches of mosaic of calcite and siderite microspar. Later fractures were filled with ferroan dolomite and/or siderite. At some stage the laminar cavities, and other cavities including the intra-skeletal, were lined with calcite, a thin layer of dolomite in places, then ferroan dolomite and predominant siderite. Stylolitisation began at a late stage in the history recorded in the rock, the stylolites being represented by zones with fine calcite and siderite mosaics and marginal pyrite. The pyrite probably represents a late introduction of sulphide or sulphate-bearing solutions with local reduction.

Specimen C1130-I: In hand specimen, this rock is a 'crinoidal' biomicrite with small patches (?burrows) of dolomite. In some specimens shell fragments are very abundant and reach 13.5 mm long. Shells recognisable in hand specimen include algae, corals, bryozoa, brachiopods, trilobites and echinoderms. The dolomitic patches are up to 11.5 mm long and 2.5 mm wide. In thin section (Plate 1b), the rock is composed of fossil fragments, minor pellets and intraclasts, sparse oolites and rare, very angular quartz grains, both free and as nuclei of oolites. The fossil fragments have a marked parallel orientation leading in some places to a strong primary fabric. Some of the fossils are outlined by a thin corona of carbonaceous matter. The matrix is micrite in places, microspar in others and rarely sparite. There are patches of dolomitic (?) sparite, commonly with individual grains and the whole body outlined by 'limonitic' material. In places there are small oval or circular bodies filled with one to a few crystals of sparite with some micrite between the spar. These may be borings filled with micrite which has later undergone recrystallisation. The rock has numerous stylolites. Pyrite occurs as a rim around some fossil fragments, associated with the stylolites and possibly in places as a replacement.

The rock is an echinodermal biomicrite deposited in shallow, marine conditions with some agitation of the bottom waters but little introduction of extraneous detrital material. After deposition and, possibly boring, ?dolomitisation occurred, followed by stylolitisation and then introduction of pyrite.

Specimen C1130-II. This rock (Plate 1c) is very similar to 1130-I but the micrite is almost completely converted to microspar in places. There are fossil fragments up to 13.5 mm long. On weathered surfaces the (?)ferroan dolomite appears to occupy burrows up to 11.5 mm long and 2.5 mm wide. Fossils present include algae, corals, trepostome bryozoa, impunctate brachiopods, bivalves, trilobites and crinoids.

Depositional conditions and a post-depositional history similar to those inferred for 1130-I appear likely.

Specimen C1140. This rock is a medium to light-grey micrite, the weathered surface of which is marked by numerous, randomly distributed small projections (less than one millimetre high and round). On broken surfaces numerous, small cleavage surfaces of calcite can be seen, showing the presence of echinoderm elements. The rock is cut by calcite veins and later stylolites with amplitudes of more than 25 mm.

In thin section (Plate 1d) the rock is a well-sorted, oolitic, echinodermal microsparite with some angular quartz grains, both free and as nuclei for oolites. There are a few clasts of micrite with dolomite rhombs and also of mudstone. The rock is grain supported or almost so.

This rock was deposited on a sea floor swept by active currents or waves, probably a shallow sea floor. Fracturing took place, subsequent to deposition, the fractures subsequently being healed by calcite. Stylolitisation later occurred.

Specimen UTGD 122483. A quartz-rich sandstone with very abundant impressions of discoidal plates with large, central biconical depressions was also submitted. The discoidal plates vary up to 29 mm in diameter and have generally been referred to in Tasmanian geological literature (e.g. Gill, 1950) as crinoid columnals. The quartz grains are of medium sand grade and the rock is well-sorted. The rock is now somewhat porous and, in places, friable suggesting the initial presence of a carbonate cement.

In other places the grains are cemented by silica.

The lithological characters suggest a strongly wave-swept environment of deposition, possibly with crinoids growing on or close to a bed of coarse sand. The current strength was adequate to produce a well-sorted, grain supported sand with grains up to medium sand grade but not to sort the crinoid columnals.

The lithology and the presence of the crinoid columnals suggest correlation with the Crotty Quartzite.

COELENTERATA

RUGOSA

Five thin sections show obliquely transverse and obliquely longitudinal sections of a coral which is either solitary or fasciculate, and another section contains a transverse section of a smaller solitary coral.

Order CYSTIPHYLLIDA
 Family TRYPLASMATIDAE
 Genus *TRYPLASMA* Lonsdale, 1845
 ?*Tryplasma lonsdalei* Etheridge
 (Plate 2a)

The section is of an apparently simple coral with circular or slightly elliptical cross-section, 9 mm long diameter by 7.8 mm short diameter.

The corallum has numerous low, rounded interseptal external ridges. The wall is thick (0.4 mm) and septothecal. Two cycles of short, thick septa occur, the longer reaching one-third of the way to the axis, the shorter half or slightly more of the length of the longer. Both cycles may be spinose but in the absence of a longitudinal section this cannot be determined. There are about 25 septa in each cycle. Tabulae are present but probably sparse. Lack of a longitudinal section precludes comments on tabular spacing.

The specimen is assigned to *T. lonsdalei* on the basis of size, septal character and number but the assignment cannot be regarded as positive because of lack of material.

Order STAURILIDA
 Suborder ARACHNOPHYLLINA
 Family ENTELOPHYLLIDAE
 Genus *STEREOXYLODES* Wang, 1944
Stereoxylodes sp.
 (Plate 2b-e)

Five sections thought to be conspecific are available of this coral. Unfortunately none could be properly oriented. The largest section (C981A) is probably obliquely transverse. Another section (C981B) is about half of a transverse section. Two sections (C981E and C981F) are partial longitudinal and partial transverse sections of a curved corallum. One section (C981C) is an oblique longitudinal section from the axial portion at a small diameter to the peripheral portion at a larger diameter.

The corallite is a curved or irregular, almost circular cone with some angulations suggesting a partial phaceloid habit. The largest section indicates a corallite at least 18 mm in diameter. The wall appears

externally smooth in some places or furnished with very low, rounded inter-septal ridges in others. It is about 0.2 mm thick and septothecal. Very marked rugosities are revealed by the longitudinal section.

Septa occur in two, or perhaps locally, in three cycles. The longer cycle shows a crude bilateral symmetry (not coincident with the long axis of the thin section) and some of the septa almost reach the centre but do not join there. One of the septa is much shorter than others adjacent to it and is presumably the cardinal septum, withdrawal of which produces a fossula. Several of the longer septa curve cardinally in the tabularium. The longer septa tend to be wavy in the dissepimentarium and those in the counter-cardinal quadrants to be dilated in the dissepimentarium producing fusiform septa. A few irregularly developed carinae occur on the longer septa, mainly in the dissepimentarium. A very few discontinuities occur in septa, especially peripherally, but may not be of biogenic origin. Because of the very oblique nature of the transverse section it is difficult to provide an accurate statement on the number of primary septa. Thirty-two can be counted but the spacing in the more distal part of the section suggests there may be as many as 66 major septa near the calyx. Minor septa are half to two-thirds of the length of the primary ones and tend to be thin, straight and without carinae. One or two, very short tertiary septa may be present.

In an ill-defined peripheral zone the dissepiments are small and inosculating between the major and minor septa. Adaxially the dissepiments form a single series concave to the axis with a few lateral dissepiments against major septa.

Lack of a suitable longitudinal section precludes positive statements about the tabulae but it seems likely from transverse sections that there is a zone of fairly highly convex tabellae and an axial series of flattish to gently concave tabulae.

Discussion

The coral is close to *S. multicarinatus* McLean in size, septal number and arrangement, carination and peripheral breakdown. However, the length of the minor septa is greater than in that species, carinae are much less abundant in the tabularium, the coral is probably phaceloid and details of the tabularium are unclear. For the present an assignment to *Stereoxylodes* is warranted but specific allocation is premature.

Subclass TABULATA
Order FAVOSITIDA
Superfamily PACHYPORICAE
Family PACHYPORIDAE
Genus ?PACHYPORA Lindstrom, 1873
(Plate 2e-1)

Thin sections of specimen 981 reveal the presence of a ramose (or frondescent) colonial coral with very thick corallite walls.

The cerioid colonies include cylindrical branches up to 6 mm across, up to at least 18 mm long, and probably of circular cross-section. Corallites are polygonal in cross-section in the axial part of the branch and vary from less than 0.2 mm to 0.4 mm in diameter. In this region the walls of the corallites are thin but increase gradually to fairly abruptly to become thick in the peripheral region. In this latter region the thickness of the wall may be a quarter of the corallite diameter, restricting the lumen to about half the total diameter. The corallites in the peripheral

region are variable in shape from polygonal to alveolitoid and open at an angle of 100° to 110° to the outer surface. In the axial region they are longitudinal. Near the periphery a few corallites contain one to, rarely, three or four short, wide-based wedge-like septa. Mural pores can be seen only in the peripheral zone and then only rarely. The pores are about 0.02 mm in diameter. In two colonies (one in 981B and one in 981G) the mural pores are arranged in rows parallel to the margin of the colony. Tabulae are absent or, at most, rare.

These specimens are clearly favositid (mural pores, cerioid) and pachyporicean (thick walls). The gradual divergence from longitudinal to oblique and the nature of the septa indicate that the specimens are pachyporids. They are assigned with some doubt to *Pachypora* on the basis of the presence of alveolitoid corallites and on the arrangement of mural pores. In colony form the specimens are closer to *Cladopora* but the corallite shape and arrangement of mural pores are against such an assignment.

Neither *Pachypora* nor *Cladopora* have been recorded in what are now understood to be Silurian rocks in Australia.

Order AULOPORIDA
 Superfamily SYRINGOPORICAE
 Family SYRINGOPORIDAE
 Genus *SYRINGOPORA* Goldfuss, 1826

There are numerous sections of a fasciculate phaceloid coral with parallel to subparallel corallites, generally thick-walled and joined by numerous, short, stout, hollow tubes. The colonies sectioned are up to 15 mm high and 20 mm wide. The corallites are circular in cross-section up to 0.9 mm in diameter but mostly about 0.6 mm, generally separated but in places in contact and open at between 60° and 90° to the exterior. The corallites, which are gently but slightly irregularly curved, are connected by short (0.3 to 0.7 mm), stout (0.4 to 0.5 mm), hollow to completely-filled tubes at irregular intervals (0.5 to 2.7 mm). The corallites are characteristically thick-walled (0.1 to 0.35 mm), such that the central lumen may be 0.4 or less of the total diameter but are thin-walled in places in the inner parts of the colonies. Where they are thin-walled there are signs of very short, stout septa (possibly about 12, C981-B7), of infundifulliform tabulae and a narrow syrxinx. In one place there is evidence of bipartite fission to form new corallites.

This coral is placed in *Syringopora* on the basis of colony form and shape of tabulae. Of Australian species it is closest in size to *Syringopora* sp. (Strusz, 1961, plate 45, figs. 10-11) from the Middle Silurian of the Wellington District of New South Wales but differs from it in corallite spacing, wall thickness and type of septa.

Order TENTACULITIDA
 Family TENTACULITIDAE
 Genus *TENTACULITES* Schlotheim, 1820
Tentaculites cf. *ornatus* Sowerby
 (Table 1, fig. 1)

Diagnosis: *Tentaculites*, with an average angle of divergence of the sides of the cone of close to 5° , with bluntly triangular major annular rings numbering three per 0.4 mm proximally and 1.7 in a length equal to cone diameter near the aperture but with irregular spacing; apical portion and inter-ring areas with thin, annular minor rings, number about three in

0.2 mm; inter-ring areas (except for minor rings) rectilinear.

Material: Large number of specimens preserved as external moulds of uncompressed cones in siltstone from locality 1 [CP729792]; the moulds are commonly lined with a powdery coating of ferric hydroxide minerals; of the material available, 65 specimens were measured but not all parameters were measurable in all specimens; internal moulds very rare.

Method: The length of the cone and the width at the apertural end were measured using a micrometer ocular, at a magnification which rendered the smallest scale division equal to 0.1 mm. The spacing of rings and striae was determined at a magnification which rendered the smallest scale division equal to 0.02 mm. The number of rings proximally was measured as "rings/0.4 mm", and the number of inter-ring lamellae as "lamellae/0.2 mm". The spacing of rings distally was measured to the nearest 0.02 mm.

From the length and apertural diameter measurements an average angle of divergence of the sides was calculated ($= 2 \tan^{-1} \frac{AD}{2L}$). The ratio "number of rings/apertural diameter" was calculated by dividing the apertural diameter by the distal ring spacings of rings (up to three) closest to the aperture.

Some check measurements of the angle of divergence were made by measuring the angle on camera lucida drawings with a protractor. The calculated and measured angles were close especially in that part of the shells that was not subcylindrical.

Description: The fossils are sharply conical shells from 1.4 to 14.4 mm long and from 0.2 to 1.25 mm in apertural diameter. The angles of divergence of the sides of the cones were calculated to lie between 4° and 8° with the mode and the average close to 5°. The shells had a long conical portion but became subcylindrical close to the aperture. Most of the shells were straight but many had a gentle curve proximally. The apex itself seemed to be sharp (i.e. to have a very low radius of curvature) and no differentiation of an initial chamber was detected. A few specimens show evidence in the form of curved ferruginous septa convex to the apex of internal septation.

The outer surface of the shell has annular rings of two markedly different heights. The larger, major rings near the aperture rise about 0.15 mm above the general cone surface, are about 0.25 mm across the base and are bluntly triangular in longitudinal section. The smaller, minor rings are much lower (about 0.01 mm) and thinner (0.005 mm), being almost short, lamellar flanges.

The proximal portion of the shell shows only minor rings. At a diameter of 0.1 to 0.2 mm major rings appear and are spaced such that there are about three in 0.04 mm of length (see Table 1 for statistical details). The overall spacing of the major ridges increases distally to a maximum of one millimetre but is variable even on a single specimen and broadly between specimens. There is, however, a fairly narrow range in the ratio "rings/length equal to diameter" i.e. 0.58 to 4, with an average of 1.7 and the modal value of the ratio falling between 1.25 and 1.49. Although there is, on all specimens examined, a general increase in spacing of the higher rings distally this is not regular and in some specimens there is almost an alternation between narrowly and widely spaced rings proximally or distally.

The spaces between major rings are rectilinear except for the minor

rings. The inter-ring areas vary in length up to several times major ring length. The minor rings occupy the proximal part of the shell and the inter-ring areas with little impingement on to the major rings. The number varies from 1.14 to 8 per 0.2 mm, with the modal number 3 and the average 3.61. There is no sign of longitudinally oriented structures on the shell surface.

Comments: *Tentaculites* sp. was recorded by Gill and Banks (1950) from the Amber Slate near Zeehan. It was not described. It has subsequently been found in abundance in correlates of the Amber Slate at Trial Harbour, Queenstown, in the Princess River area on the Gordon River, and *Tentaculites* sp. has been noted in the Keel Quartzite, the Florence Quartzite and the transitional unit at the base of the Bell Shale.

Clarke and Brown (1980) correlated the *Tentaculites*-bearing siltstone from the Huskisson Basin with the Amber Formation at Zeehan and deduced a Wenlockian age for the siltstone from the Huskisson.

The closest species to the Huskisson *Tentaculites* recorded from other parts of Australia is *T. ornatus* Sowerby described by Sherrard (1967) from the Hume Limestone at Yass, N.S.W., subsequently placed as a member of the Silverdale Formation (Link, 1970) and assigned a Ludlovian age on conodont evidence.

The Tasmanian specimens are somewhat larger, have lower and narrower major rings, apparently a less regular ring spacing than the Yass specimens but about the same number of rings in a length equivalent to the diameter. Detailed comparisons cannot be made because of lack of relevant information concerning the Yass material.

Tentaculites ornatus Sowerby from its type area in the Wenlock Limestone at Dudley was redescribed and figured by Lardeux (1969, pp.42-44, plate 14, fig. 103; text figures 25-26). The Tasmanian specimens are close to those figured by Lardeux in major ring section shape, in the overall arrangement of minor and major rings, including the occasional appearance of paired major rings, but the spacing of major rings in the Tasmanian material is much more variable. Lardeux did not quote the ratio of ring spacing to diameter in the apertural region. From his figures, the ratio would appear to be between 1.1 and 1.7. Also from his figures there appear to be between 2 and 3 minor rings per 0.2 mm proximally. In view of the few, probably minor, differences between the Tasmanian material and *T. ornatus* from Dudley, it is probably best for the time being to assign the Tasmanian material as *T. cf. ornatus* Sowerby. The Tasmanian collection is closer to *T. ornatus* Sowerby than it is to the material from Yass and closer than the Yass material is to *T. ornatus* from Dudley.

Table 1. STATISTICS OF *Tentaculites cf. ornatus* SOWERBY

Parameter	Number	Average	Range	Mode	σ	σ^2
Angle of divergence	52	5.4	4-8	5	1.08	1.16
Major rings						
Proximal (no./0.4 mm)	53	3.5	1-10	3	1.68	2.81
Distal (no./shell diam.)	115	1.7	0.58-4	1.25-1.49	0.56	0.31
Minor rings						
Spacing (mm)	35	0.07	0.025-0.175	0.06	0.032	0.10
No./0.2 mm	37	3.61	1.14-8	3	1.73	3.01

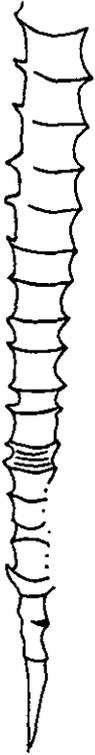


Figure 1. *Tentaculites* cf. *ornatus* Sowerby; camera lucida drawing of external mould, x10; showing irregular spacing and longitudinal section of major rings; also minor rings; TDM H1, (iii); correlate of Amber Formation, Huskisson Syncline.

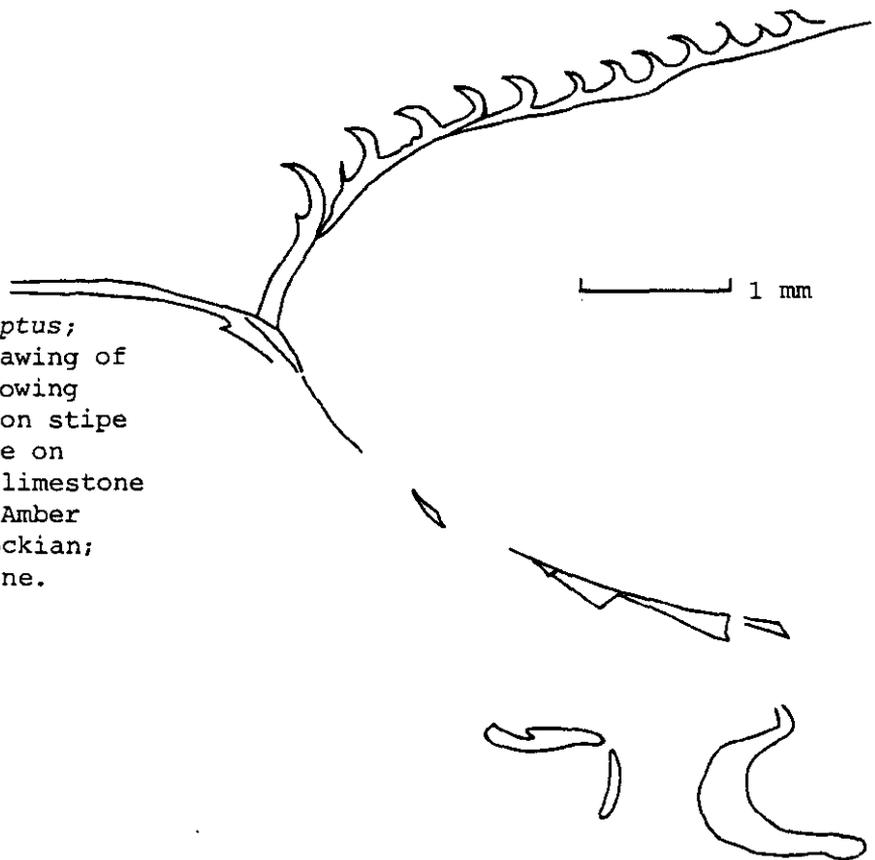
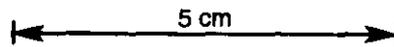


Figure 2. ?*Cyrtograptus*; camera lucida drawing of thin section; showing concical thecae on stipe and hooked thecae on cladia; C981 E; limestone in correlate of Amber Formation, Wenlockian; Huskisson Syncline.

ECHINODERMATA

?CRINOIDEA

External moulds of a discoidal element have been reported to be present in the Crotty Quartzite by Gill (1950, p. 240; as "Crinoid Columnal 1") at Zeehan and are also known from the Calder Pass [DP108148] (Ward, 1909), Trial Harbour (Waterhouse, 1916) and The Sand Hill, Queenstown.

The specimens from the Huskisson River area vary from 12 to 29 mm in diameter (most common about 22 mm) and are up to 6 mm high. The elements vary from about four to about eight times as wide as they are high. One side of the circular elements is almost flat, the other gently convex. The moulds contain a central column which decreases regularly in diameter from both external surfaces to an approximately central position, i.e. it appears to be almost biconical. The central column at its narrowest point has a diameter about one-fifth of that of the element but in small specimens may be as much as one-third. The external surface and that of the columns is smooth, whether due to an original condition or to smoothing by abrasion is not clear. It must be recalled in this connection that the enclosing sediment is of medium sand grade so that a fine original ornament may not have been preserved.

The only previous description of this form is by Gill (1950, p. 24). His specimen was 16 mm in diameter, four millimetres thick, and had a central canal described as being "biconvex in outline" in longitudinal section, and 5.5 mm in diameter. The cross-section along a diameter was described as having a planate-oval outline.

These elements have been referred to as crinoid columnals (Gill, 1950) and this is still the preferred identification. However, it is not clear how they may have been stacked in a column, whether as a series of plates with flat surface up or a series with flat surface down, or a series with pairs of plates succeeding one another, each pair with plane surfaces apposed. Whatever the arrangement, there may have been regularly occurring points in the column with very small areas of apposition to one or both neighbours, a situation which would produce great flexibility but marked weakness. The biconical nature of the lumen in each element is also a puzzle.

Another possibility is that they are centro-dorsal plates of a stalked echinoderm but there is no evidence on either surface or around the margin as would be expected where the adjacent calical plates impinged. The great number of the one type of plate is also difficult to explain if they are centro-dorsals.

It has always been assumed that the impressions are those of calcitic elements. This is the most likely explanation, particularly as limestone with large echinoderm elements occurs at about the same stratigraphic level elsewhere in Tasmania, e.g. Mt Bobs (Correy, 1983) and on the Gordon River. However, no such calcitic bodies have been found in the Crotty Quartzite.

Phylum HEMICHORDATA
Class GRAPTOLITHINA
Family CYRTOGRAPTIDAE
?CYRTOGRAPTUS sp.

Material: In thin section 'E' cut from limestone C981, there are seven fragments of brown material embedded in the limestone within an area of

36 mm². Four of these are aligned in a way that suggests original continuity.

Description: The main fragment, and the three other fragments which may have been originally continuous with it, are curved in a gentle sigmoid from a convexity of which arises a long uniformly curved branch. The sigmoidally curved segment is about 0.075 mm thick where it is continuous. One of the isolated fragments of this segment has two wedge-shaped extensions on the convex side, the wedges being 0.5 and 0.75 mm long and about 0.15 mm thick at the larger end. Both wedges widen in the same direction. The uniformly curved branch is about 4.5 mm long, more-or-less smooth on its concave side and with thirteen projections on its convex side. Most of the projections curve out and back towards the origin of the branch and terminate sharply (*i.e.* they are hook-shaped). The hook closest to the origin is about 0.5 mm long and the other hooks become progressively shorter away from the branch origin.

The three 'isolated' fragments include a distinctly U-shaped one and two others in close proximity.

Interpretation: The brown, translucent nature of the fragments suggests that they are composed of carbonaceous matter and the regularity in spacing and shaping of the 'hooks' suggests a biological origin. If a biological origin is correct the fragments may be those of a hydroid, a ctenostome or a graptolite. Of these possibilities, the graptolite origin is most likely, especially as there is a faint suggestion of regularly spaced transverse bands (?fusellar half rings).

If the graptolite origin is accepted, the most likely possibility is *Cyrtograptus*, with a thecal spacing of about 11.5/10 mm on the main stipe and about 33 hooked thecae/10 mm on the cladia. Another possibility is *Diversograptus* and insufficient is preserved to rule this possibility out. *Cyrtograptus* has been reported from Australia. *C. aff. insectus* Boucek has been noted from New South Wales by Stevens and Packham (1953), and Sherrard (1954) and Thomas (1960, p. 43, and fig. 200) figured a *Cyrtograptus* from Tasmania. The present specimen, if a *Cyrtograptus*, is different in thecal spacing from the forms previously described from Australia.

Implications: If this specimen is a *Cyrtograptus*, it implies a Wenlockian age for the limestone.

OTHER FOSSILS

ORDOVICIAN

Bryozoa

The specimens (C1130 Micro II) from close to the base of the Gordon Subgroup contain abundant ramose trepostomes and rare fenestrate bryozoa (probably cryptostomes).

Brachiopoda

These specimens also contain abundant small brachiopods including dalmanellids, strophomenids and rhynchonellids.

Gastropoda

Several species of gastropods are present but not abundant.

Rostroconcha

Rare specimens of a rostroconch occur.

Trilobita

The most abundant trilobite present is a species of *Pliomerina* similar to that in the Lords Siltstone and its correlates. It is common. Also present is a small species of *Bumastoides* similar to one in the Lower Limestone Member of the Benjamin Limestone.

SILURIAN

Bryozoa

A ramose trepostome is very abundant in available thin-sections of C981.

Cephalopoda

Nautiloids, identified by Dr B.A. Stait as *Geisonoceras* sp., are present.

SUMMARY

Specimens from near the base of the Gordon Subgroup in the Huskisson River area contain *Belodina compressa* (Branson & Mehl) indicative of a Middle-Late Ordovician age. From an horizon 160 m further up in the section *Tasmanognathus careyi* Burrett has been obtained and indicates correlation with the Lower Limestone Member of the Benjamin Limestone. A specimen from 160 m above the base contains trepostome and fenestrate bryozoa, brachiopods, gastropods, rostroconchs, trilobites such as *Pliomerina* and *Bumastoides*. The trilobites suggest correlation with the Lower Limestone Member or Lords Siltstone Member of the Benjamin Limestone. A sandstone above the Gordon Subgroup contains abundant, large echinoderm, probably crinoidal columnals characteristic of the uppermost member in the Crotty Quartzite at Zeehan.

A limestone in the Amber Formation contains rugosan corals close to *Tryplasma lonsdalei* Etheridge, and *Stereoxylodes* sp., tabulates *Syringopora* sp. close to a species from the Middle Silurian of New South Wales and *?Pachypora*, as well as other fossils. The coral content is consistent with but not compulsive evidence for a Late Llandoveryan or Wenlockian age.

A siltstone correlated with the Amber Formation contains *Tentaculites* cf. *ornatus* Sowerby which is consistent with a Wenlockian age.

Cyrtograptus sp. may be present in the limestone in the correlate of the Amber Formation. If the identification is correct, the limestone is Wenlockian.

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[15 June 1984]

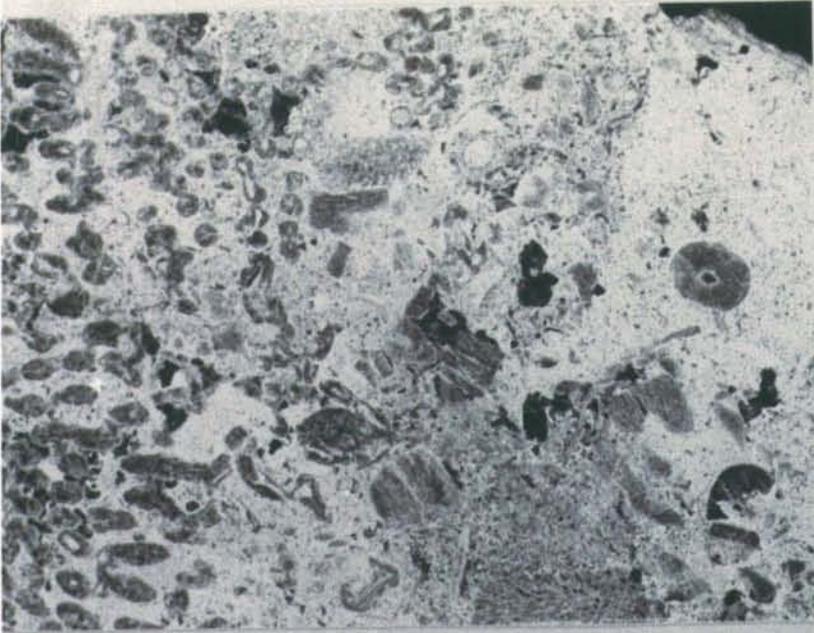
ADDENDUM

M.R. Banks

I should report for the record that the possible *Cyrtograptus* from the Huskisson Basin (see page 10) has been seen by Dr R.B. Rickards and others at the University of Cambridge, U.K. They do not regard it as *Cyrtograptus*, and they think it unlikely to be a graptolite but are unable to make any suggestions as to its biological affinities. I dissolved what little I had of the enclosing limestone and detected no remains of graptolites in the residue.

[1 August 1984]

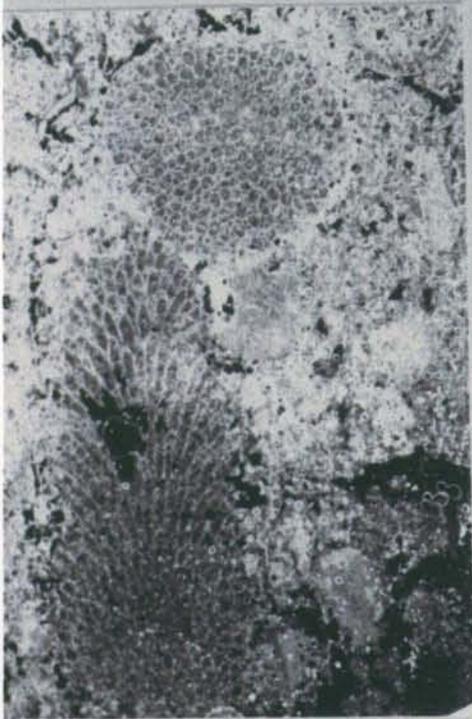
- Plate 1. (a) biomicrite - mainly syringoporid, pachyporid and echinoderm fragments in a micritic matrix; TDM C981-B7; x5.
- (b) echinodermal biomicrite - algal, echinoderm and arthropod fragments in a micritic matrix; TDM C1130-I; x4.
- (c) echinodermal biomicrite - bryozoal and echinodermal fragments in a sparse micritic matrix; TDM C1130-II; x5.
- (d) oolitic echinodermal microsparite - oolites, echinoderm fragments and quartz grains in a microspar matrix; TDM C1140; x20.



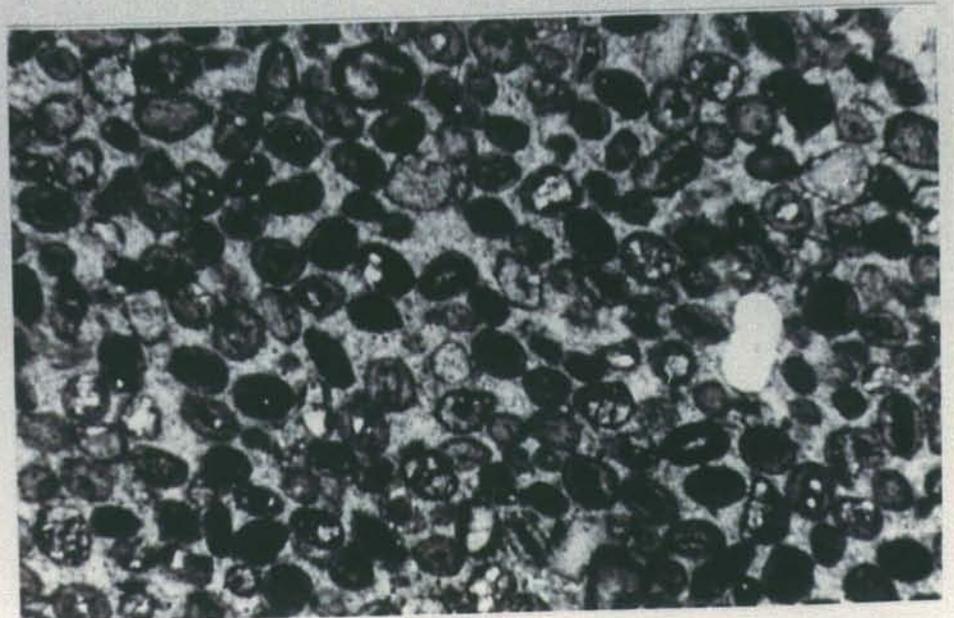
A



B



C



D

- Plate 2. (a) ?*Tryplasma lonsdalei* Etheridge; transverse section, x4; C981 D.
- (b) *Stereoxylodes* sp.; section close to transverse, x5; C981 A.
- (c) *Stereoxylodes* sp.; longitudinal section within dissepimentarium, x4; C981 C.
- (d) *Stereoxylodes* sp.; transverse section, x5; C981 B.
- (e) *Stereoxylodes* sp.; transverse and longitudinal section; and ?*Pachypora*, transverse section; x5; C981 E.
- (f) ?*Pachypora* sp.; longitudinal section showing thin-walls in axial region and branching; x5; C981 B8.
- (g) ?*Pachypora* sp.; longitudinal section showing branching, alveolitoid corallites and a few mural pores; x5; C981 D.
- (h) ?*Pachypora* sp.; oblique section showing thick walls and alveolitoid and polygonal corallites; x10; C981 B.
- (i) ?*Pachypora* sp.; oblique section showing polygonal corallites, sparse mural pores, a septum and a boring; x10; C981 D.
- (j) ?*Pachypora* sp.; longitudinal section showing thickening of walls in peripheral region; x12; C981 C.
- (k) ?*Pachypora* sp.; oblique section showing thick walls and mural pores; x10; C981 G.
- (l) ?*Pachypora* sp.; slightly oblique transverse section, showing thick walls in peripheral region and sparse wedge-like septa; x10; C981 B.
- (m) *Syringopora* sp.; partly longitudinal, partly transverse section showing thick walls and short connecting tubules; x10; C981 B.
- (n) *Syringopora* sp.; section cutting some corallites transversely, others longitudinally, showing thick walls, short connecting tubules; x5; C981 B7.

