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Eldon Group Fossils from the Lyell Highway, Western Tasmania

By

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In December, 1947, the writer was guided to an outcrop of fossiliferous rocks on the Lyell Highway by Professor S. Warren Carey of the University of Tasmania. In the collection of fossils he was assisted by Professor Carey and Mr. M. R. Banks. The author is indebted to these gentlemen for their able assistance.

Ecology

The area studied is that of the headwaters of the Nelson River. The Lyell Highway follows the upper reaches of this river for some miles, and more or less continuous outcrops are available along the road. Eldon Group (Silurian-Devonian) rocks occupy a good deal of the area; they consist of a suite of entirely siliceous sediments. There are quartzites of all kinds, from thin laminated types to very massive strata, grits and quartzitic sandstones. At the east end of the road-cutting on the Lyell Highway from which came the fossils described below, ripple marks are preserved. The long, low slope of the ripples is to the north and the shorter, steeper slope to the south. This indicates that the waves which formed the ripples came from north of this point. However, that is no proof that the main land mass was to the south.

The arenaceous type of sediments, the grits, cross-bedding and ripple marks present in these beds prove an inshore facies. This is further borne out by the nature of the fossil assemblage. Brachiopods, such as *Eatonia (Pareatonia) euplecta* sp. nov., are characteristic of the inshore facies, their weight and strong ribbing giving protection against displacement by current action (Lamont, 1934).

The locality on the Lyell Highway is the only one in which comparatively well-preserved fossils have been found, although fragmentary fossils were found in a number of places. For instance, if the northern tributary of the Nelson River, 14 miles from Queenstown, is followed to the first westerly branch, there is encountered not far from the tributary a waterfall, at the foot of which a fossiliferous band occurs. Here are present in the form of casts and moulds pieces of crinoid stems, pieces of branching bryozoans, and a few brachiopods of which only *Eospirifer* can be determined. The majority of the strata appear to be unfossiliferous, but even in those that are, the fossils are in most cases fragmentary. This fragmentation is further evidence of a region of wave, tide and other current action.

The trilobites are all very fragmentary. No complete cephalon was found of any species, and not even an uninjured cranidium. It is interesting to note the presence of the highly spinose *Odontopleura*, which is probably a planktonic form. No doubt the specimens were washed inshore, just as the graptolites were sometimes. Site of preservation is not necessarily place of death.

Palaeontology

Former work

At the end of last century, a number of studies were made of West Tasmanian Palaeozoic fossils by Etheridge, Salter, Johnston, and others. After 1897, no study on these faunas was published until the present decade, except for a paper on *Tetradium* by Chapman in 1919. There are numerous difficulties relative to the palaeontological work of the early period, viz.:—

1. Manuscript names were published, but as far as one can ascertain no descriptions ever reached the press, e.g., Salter's MSS names in Johnston (1886).

2. There appears to have been some inaccuracy in naming fossil localities and/or some confusing of collections, e.g., Etheridge (1896) records *Amphion*, *Asaphus* and *Illaenus* from the 'Despatch Limestone, Zeehan', but from the same locality records *Hausmannia meridianus*. He seems to have been perplexed himself. He writes, 'The species detailed in the foregoing pages present both a Lower (= present Ordovician) and an Upper (= present Silurian) Silurian facies, but with a preponderating tendency towards the latter'. Chapman (1919) was evidently puzzled in the same way. After visiting the area, it seems to me that the person or persons who collected the fossils put together in the one collection specimens from the Junee Group limestone and the Eldon Group rocks found in the middle of the Zeehan Basin.

3. Many of the place names are inadequate, so much so that even if the fossils could be found and were adequately described, they would still lack any stratigraphical significance, e.g., Johnston names fossils as coming from 'Tasmania West'. Other localities are given simply as 'Gordon River', 'Zeehan', or 'Heazlewood'.

4. There has been no careful housing of types apparently, and certainly no record in the papers of where they have been deposited. The names found in the old papers have been repeated in later works (although so out of date), often with mis-spellings. Most of the fossils described cannot now be found, and many figures are so poor that even generic determinations cannot be made from them.

The solution of these problems is to drop the MSS names (which are invalid), to disregard the registrations of fossils from localities which do not mean anything, and the descriptions of fossils which cannot be found and their figures adequately interpreted, and to make new collections with a careful record of localities. In the opinion of the author, the fossils so collected should be placed in recognised public institutions and registered numbers given them by which they can be traced, such numbers to appear with the descriptions of the fossils. By this method, it is possible for anyone who so desires to view the fossils, and so directly examine the evidence upon which stratigraphical and palaeontological conclusions have been based.

Locality

All the fossils described in this paper come from quartzitic sandstones outcropping in a road-cutting on the north side of the Lyell Highway 100 yards east of the 12-mile post (east from Queenstown). The locality is just east of where the road takes a right angle turn over a wooden bridge which spans a minor creek. The road roughly follows the strike of the beds. They bear N.62°W. at 33° on the west end of the cutting, which is about 80 yards on the Hobart side of H.145/Q.12 mile post, and N.41°W. at 34° at the east end of the cutting, which is at the next bend of the road.

Preservation of Fossils

The fossils are all preserved as casts (steinkerns) and moulds, all the calcareous matter having been leached away. Due to the coarseness of the enclosing sediments, fine structures (such as denticulations on hinge-margins and fine ornament) are not well preserved. The fragmentation of the fossils previously referred to has made it difficult to select adequate type materials. Indeed, a number of new species has been recognised but not described in the hope of finding better specimens later.

Systematic Descriptions of Eldon Fossils

The following is a preliminary description of the fauna from the Lyell Highway locality. All registered numbers (e.g., N.M.V. 14,545) are in the collection of the National Museum of Victoria, Melbourne:—

BRACHIOPODA

Genus EATONIA Hall, 1857

Sub-genus PAREATONIA McLearn, 1918

Eatonia (Pareatonia) euplecta, sp. nov.

Plate VIII, figs 15-22

Type Material: HOLOTYPE consisting of a steinkern of both valves together in brown sandstone. With the steinkern is a fragment of external mould to provide evidence of external 'ornament' (a poor name for this biologically significant structure of the exoskeleton). N.M.V. 14,545.

Description: Sub-circular in outline, costate, and uniplicate. Greatest width 1·6 cm., and greatest length 1·5 cm., both measurements being taken flat, i.e., in one plane and not following the curvature of the shell. Ventral valve shallower than dorsal, marginally deflected. Deep median sinus occupies quite a third of the width of the shell. One costa in centre of sinus, and three counted on each side of it. Muscular field flabellate to sub-circular, 8 mm. long and 8 mm. wide, deeply excavated and surrounded by a prominent ridge. Just anterior to the middle of the field is the adductor impression.

Dorsal valve with high fold surmounted by two costae, and three costae on each side of fold. The costae become progressively less well defined towards the cardinal angles. Short, very strong median septum, which truncates the two costae on the fold 4 mm. from the umbo, then narrows and runs down anteriorly between them for 4 mm. further as a rapidly narrowing and shallowing septum. Where the septum narrows, a ridge (not so elevated as the septum) occurs on each side, assisting in the truncation of the costae mentioned above. These ridges curve

anteriorly round the ends of the truncated costae and merge with the boundaries of the dorsal fold. Large, erect cardinal process. Myophore divided into two branches which protrude right into the cavity of the ventral valve (shown as two deep holes in the steinkern).

The fragment of external mould shows radiating striae at the margin. Owing to the coarse matrix, these structures are not well preserved.

Comment: McLearn (1918, 1924) has subdivided the genus *Eatonia* into the following sub-genera—

DEVONIAN

EATONIA s.s. Characterised by decline of fold and sinus, radially striate ornament, and elongate ventral muscle field.

PAREATONIA. Characterised by strong fold and sinus, radially striate ornament, and rounded ventral muscle field.

SILURIAN

EATONOIDES. Characterised by strong fold and sinus, concentrically lamellar ornament, and rounded ventral muscle field.

It is clear from this abstract that the Tasmanian shells are referable to the Devonian sub-genus *Pareatonia*. The trivial name for the new species is derived from the Greek *eu* = well and *plectos* = folded, a reference to the deep fold and sinus of the shell which mark it off readily from other rhynchonellids present in the same strata.

Pieces of sandstone very like that from which the holotype came were found in the bed of the north branch of the Nelson River where it crosses the Lyell Highway about 14 miles east of Queenstown. A search was made further upstream in an effort to locate this fossil horizon *in situ*, but without success. Although the fossils from the river bed are of no stratigraphical value, they are of palaeontological value in that they provide some further details about the species described. A steinkern from this source is figured (N.M.V. 14,546), but is given no typical standing because it was not found *in situ*. The specimen shows well the nature of the anterior border (Plate VIII, fig. 21). From Plate VIII, fig. 22, the adductor impression in the ventral valve is seen to be heart-shaped, with the point facing anteriorly. The field is deeply excavated and for a short distance anteriorly tunnels into the floor of the shell, i.e., in the steinkern there is a hollow under the posterior end of the adductor 'heart'. In all these structures the bilateral symmetry is preserved. The median septum runs right out on to the platform under which the muscle attachment is excavated. A fine longitudinal ridge divides the right and left halves of the adductor field. Traces of the radial ornament can be seen on the anterior part of the ventral diductor field in this specimen. *Pareatonia* has not been recorded from Australia before.

Genus CYRTIA Dalman, 1828

Cyrtia tasmaniensis, sp. nov.

Plate VIII, figs 23-26

Type Material: HOLOTYPE—Steinkern of a complete exoskeleton, viz., ventral and dorsal valves adjoined in whitish sandstone. N.M.V. 14,547. PARATYPES—Steinkern and external mould of a ventral valve in brown ferruginous sandstone. N.M.V. 14,548-9 respectively.

Description: HOLOTYPE—Ventral valve pyramidal, palintrope being about 1 cm. high in the centre, and 2·3 cm. wide along the hinge margin. The pseudodeltidium is 3·5 mm. wide at the hinge margin, and tapers towards the apex of the valve. There is what appears to be the foramen perforating the pseudodeltidium about 3 mm. from the hinge margin. There are striations (probably growth lines) on the interarea parallel to the hinge margin.

The dorsal valve is practically at right angles to the plane of the pseudodeltidium. There is a median fold in the shell such as is found in *Eospirifer*, but it is not strongly developed. The surface of the valve shows traces of an ornament of fine radiating lines as in *Eospirifer*.

PARATYPE—Steinkern of the ventral valve is without the pseudodeltidium, and so shows clearly the nature of the dental plates, which are strongly developed. The plates are 0·75-1 mm. thick where they border the delthyrium. In this specimen they are stouter at the apical end of the delthyrium than at the hinge margin end. When viewed from the ventral side of the valve, it is seen that the plates thin out slightly on their inside faces, but even so they end abruptly when about 0·5 mm. thick. The plates are spread at an angle of about 45°. The margin of the ventral muscle field is described by a line arching anteriorly from the anterior end of one dental plate to the anterior end of the other. A few growth irregularities in the form of very shallow concentric furrows are present on the shell. There is a shallow median sinus corresponding to the fold of the dorsal valve.

The external cast is of the apical end of the same ventral valve. It shows clearly the filiform external ornament; also that the pseudodeltidium was flat, tapering to a sharp point apically, and that it stood slightly outwards from the plane of the palintrope. The peduncular perforation in the pseudodeltidium is also evident.

Comment: The genus *Cyrtia* has not been recorded from Australia before, but Chapman's *Cyrtina sub-biplicata* (1913, p. 109) from the Yeringian (Lower Devonian) of Victoria, should be referred to it. Chapman's species has a deep sinus with sharp bounding edges (although in part this may be due to the slight crushing his specimen has suffered). The edges of the interarea contiguous with the pseudodeltidium are not overfolded as would appear from Chapman's drawing, and the foramen as figured by him is very doubtful. *C. sub-biplicata* is clearly related to *C. tasmaniensis*, but differs in the depth and definition of the ventral sinus, and in possessing a relatively wider pseudodeltidium.

'Spirifer' sp.

Plate VIII, fig. 31

Material for Description: Steinkern of a ventral valve in greyish sandstone. N.M.V. 14,550.

Description: Shell 11 mm. wide along hinge margin (greatest width), and 7 mm. long from beak to anterior margin. The longitudinal profile of the shell rises about 2·5 mm. above the plane connecting the anterior and posterior margins. Median fold of moderate depth. Four plications, or rather coarse costae, on each side of sinus, becoming progressively less defined from sinus to hinge margin. Fine dental plates, approximately 2·5 mm. long, on outer flanks of the costae bounding the median sinus. Beak fairly strong; interarea low. As far as can be ascertained, the surface is smooth.

Comment: This specimen cannot at present be fitted into the current definitions of any of the genera of the Spiriferacea, a group in great need of

revision as all agree. The present form is one of a series of early 'Spirifers' found plentifully in both Tasmania and the mainland. The genetic relationships of these forms, and their relation to genera already diagnosed, have not yet been determined.

In the Tasmanian material *Eospirifer* is present, but the specimens were not good enough to figure. Other spiriferids also occur.

Genus NUCLEOSPIRA Hall, 1857

Nucleospira megalorhyncha, sp. nov.

Plate VIII, figs 27, 28, 42, 43

Type Material: SYNTYPES—A. Steinkern of a ventral valve in sandstone. N.M.V. 15,557. B. Steinkern of a dorsal valve in sandstone. N.M.V. 14,552.

Descriptions: SYNTYPE A—Ventral valve oval, convex, moderately inflated, beak strong. Width 10·5 mm., length 7 mm. (both measurements in plane, i.e., not following curvature of shell). Median longitudinal profile rises about 3 mm. above the plane joining the anterior and posterior margins of the shell. Area low. Teeth strong. Muscle impressions flabellate, slightly excavated; traces of striations, but matrix inadequate for preservation of fine details. Traces of oval adductor impressions present. A median septum divides the muscle impression; anteriorly it reaches the border of the shell, but posteriorly it disappears on a flat platform at the umbo.

SYNTYPE B—Dorsal valve oval, convex, of about same convexity as ventral valve. Beak almost as strong as the ventral valve. Cardinal process tongue-like (represented by central depression under beak in umbonal view of steinkern, figured in Plate VIII, fig. 43). Crural bases well developed (see in same figure on each side of process). Adductor field elongate oval, and divided by a strong median septum which reaches from the cardinal process to the anterior margin. It is thus relatively longer than the ventral septum which is abbreviated at its posterior end. On the specimen described the septum is wider and higher posteriorly, but there is some variation in the species in this regard.

Comment: Our species is nearest the shells described as *Nucleospira* cf. *marginata* from the Lower Devonian of Victoria (Gill, 1942) and New Zealand (Shirley, 1938). The Tasmanian specimens examined are on the whole larger than the Victorian specimens and compare in this respect rather with the New Zealand specimens. Similarly, they compare with the New Zealand specimens in the strength of the teeth; they are not so strong in the Victorian form. The Tasmanian fossils, however, differ from both the Victorian and New Zealand forms in the strength of the beak, both in the ventral and dorsal valves (hence the trivial name—Greek *megas* = big and *rhynchos* = beak). The prominent ventral beak can also be seen on the specimen of this species named on the photograph of a slab of fossils (Plate VII). In the Tasmanian species the cardinal process is also stronger and, indeed, the cardinalia as a whole appear to be more strongly developed.

Genus STROPHONELLA Hall, 1879

Strophonella australiensis, sp. nov.

Plate VIII, figs 35-40, 44

Type Material: SYNTYPES—A. Steinkern of ventral valve in brown sandstone. N.M.V. 14,553. B. Steinkern of dorsal valve in grey sandstone. N.M.V. 14,554. C. External mould of Syntype B. N.M.V. 14,555. PARATYPES—A. Steinkern of

portion of a ventral valve cut away to show nature of hinge margin crenulation. N.M.V. 14,556. B. Steinkern of a ventral valve showing well-developed muscle field. N.M.V. 14,557.

Descriptions: SYNTYPE A—Shell concave, 34 mm. wide along hinge margin (which is greatest width of shell) and 30·5 mm. long from umbo to centre of anterior margin. Shell slightly distorted, but other specimens show cardinal angles to be right angles. Shell more or less flat over muscle field till about the middle of the valve, when it becomes resupinate. Although the valve is flat in the middle it is turned up round the edges, so that around the periphery it is only flat along the hinge margin. Palintrope strong and over 0·5 mm. thick, but it is thinner in the middle near the muscle field. Palintrope makes an angle of about 70° with the flat postero-central part of the shell. Interarea about 1·5 mm. high, tapering off a little towards the cardinal extremities. Interarea crenulate for about 6 m.m. on each side of the umbo, but only on the lower hinge margin part, i.e., the crenulations do not traverse the whole height of the interarea. Umbo very weakly developed.

Moderately excavated flabellate muscle field, about 11 mm. long and 15 mm. wide. Border of field well defined. Shallow linear median septum down length of muscle field, expanding at umbo. Fine papillae cover interior of valve and are especially marked on the areas between the muscle field and the cardinal angles. This specimen has a colony of *Pleurodictyum megastomum* attached to it. The exterior ornament consists of fine costellae with fine lines between them. At the anterior margin of the specimen described, only the costellae appear (i.e., on the inside of the shell), but in the middle of the valve near the attached coral the fine intercostellate lines can be distinctly seen.

SYNTYPE B—Dorsal valve convex. Postero-central area (approximately included by a semicircle described with the line from the umbo to the cardinal angle as radius) flat, and rest of the shell deflected. The median longitudinal profile makes an angle of about 145°. Strong bifid cardinal process with prongs about 1·5 mm. long. The prongs are about 1·5 mm. in their antero-posterior diameter, and about 0·5 mm. in diameter parallel to the hinge margin. They converge slightly posteriorly and have a short buttressing ridge (a hollow in the cast) on each side. There is a very fine ridge between the two prongs of the cardinal process.

As is usual in this genus, the adductor scars are well defined posteriorly by inverted U-shaped margins. The interior surface is covered with small papillae.

SYNTYPE C—Shows that the external ornament consists of fine costellae with 2-4 fine lines (as far as can be determined with the coarse matrix) between each pair of costellae.

PARATYPE A—Shows the crenulations along the hinge margin to be in a plane more or less parallel with the flat umbonal region of the shell. The crenulations extend approximately 7 mm. on each side of the umbo but apparently are interrupted at the umbo intself. The crenulations are not aligned to the median longitudinal axis of the shell but converge somewhat on that axis. This provides an efficient mechanism to prevent both side slip and antero-posterior slip of the valves. The part of the hinge margin bearing the crenulations stands out slightly from the plane of the interarea, thus ensuring complete engagement of the crenulations of the two valves.

PARATYPE B—Shows impression of interior of a mature shell, with consequently well-defined muscle scars resulting from well-developed ridges round the periphery of the muscle field. On this specimen the median septum is seen to expand slightly

at the anterior end and then sharpen again, so that the whole structure looks like a spearhead. At the posterior (umbonal) end, the septum expands and rises into a strong knob with a median furrow in it and a depression on each side. The two long prongs of the cardinal process would fit on each side of this knob, their ends being accommodated in the depressions. The fine ridge between the prongs would fit into the median furrow of the knob. This complicated mortice and tenon articulation of the valves is very efficient and a high specialization. A considerable gene complex must have been built up to control calcium carbonate deposition to give such nicely adjusted structures. On the grounds of this intimate fitting, the separate valves described are concluded to belong to the same species.

Eight millimetres from the anterior border of the muscle field is a line which may be the border of the adductor scar.

A further dorsal valve steinkern in brown sandstone is figured (N.M.V. 14,588); also a ventral valve steinkern to show the muscle field (N.M.V. 14,579).

Strophonella lyelli, sp. nov.

Plate VIII, figs 32-34, 41

Type Material: SYNTYPES—A. Steinkern of ventral valve in fawn sandstone. N.M.V. 14,559. B. Steinkern of dorsal valve in sandstone. N.M.V. 14,560.

Descriptions: SYNTYPE A—Ventral valve mildly concave. Fasciculate ornament of fine costellae with interstitial fine lines. Muscle field flabellate, but much narrower than in *Strophonella australiensis*. A high but very narrow ridge surrounds the muscle scars on both sides; it is low at the anterior end. The ridges are highest posteriorly; there they heel over and turn round so as to stand practically parallel to the narrow palintrope, with which they merge about 4 mm. from the midline. There are narrow slots between the palintrope and the deflected ridges. Interior of shell (especially on each side of the muscle field) finely papillate.

SYNTYPE B—Dorsal valve presumed to belong to this species. Muscle field very similar to that in *S. australiensis*. The median septum merges into the two-pronged cardinal process. On each side of the process are supporting ridges which curve fairly sharply anteriorly and join the ridges bounding the muscle scars. Interior finely papillate. Further steinkerns of a ventral valve (N.M.V. 14,561) and a dorsal valve (N.M.V. 14,562) are figured.

Comment: The trivial name is in honour of the English geologist Sir Charles Lyell, after whom was named the Lyell Highway where these fossils were collected.

This species is readily distinguished from *S. australiensis* by the shape of the ventral muscle field, and the nature of the dorsal cardinalia.

Genus **PROTOLEPTOSTROPHIA** Caster, 1939

Protoleptostrophia plateia, sp. nov.

Plate VIII, figs 29, 45

Type Material: HOLOTYPE—Steinkern of a ventral valve (impression of interior) in brownish sandstone. N.M.V. 14,563. PARATYPE—Steinkern of another ventral valve to show the crenulate hinge margin N.M.V. 14,564.

Descriptions: HOLOTYPE—Ventral valve plano-convex. Palintrope narrow. Cardinal angles obtuse. Ridges bounding muscle field well defined, thin and high (i.e., plate-like) in the middle and diminishing both anteriorly and posteriorly.

Long fine median septum which widens into a small platform posteriorly, then narrows and becomes elevated again to form a ridge between the two small but well-defined process cavities. The muscle field ridges are splayed apart so as to form an angle of about 60°. The ornament is costellate, but the coarseness of the enclosing sediment which took the impression precludes fine structures from being adequately preserved. Greatest width of shell (across middle) approximately 2·4 cm., and greatest length (along line of median septum) 2·4 cm.

PARATYPE—From this specimen it can be determined that the hinge margin is mostly crenulate. The crenulation extends for 6·5 mm. on each side of the umbo along a hinge margin calculated to be 20 mm. wide.

Comment: Chapman (1903) described *Stropheodonta (Leptostrophia) alata* from the Yeringian (Lower Devonian) of Victoria. Our species does not resemble at all closely Chapman's species, nor Mitchell's (1923) *Stropheodonta (Leptostrophia) quadrata,* a comparatively minute form only 13 mm. wide. These are the only two fossils so far referred to *Leptostrophia* from Australian strata. However, there is a number of other forms awaiting description.

The Tasmanian leptostrophids occur in large numbers in a limited horizon. This same tendency has been noted in the Yeringian beds in Victoria and the Baton River Beds in New Zealand. It would appear that, given certain ecological conditions, they were very prolific. The trivial name is derived from the Greek word *platus* = flat.

Genus CHONETES Fischer, 1837

Chonetes sp.

A moderately inflated ventral valve of *Chonetes,* 1·0 cm. wide and 0·5 cm. long and with 35-40 costellae, is poorly preserved in brown sandstone. It has a shallow median sinus down the middle of the valve. The specimen is interesting in that it is clearly of the *Chonetes cresswelli* Chapman type (Gill, 1945).

Genus PARMORTHIS Schuchert and Cooper, 1931

Parmorthis vandiemeni, sp. nov.

Plate VIII, fig. 30

Type Material: HOLOTYPE—Steinkern of a dorsal valve in greyish sandstone. N.M.V. 14,543.

Description: Dorsal valve oval in outline, convex. Shell thickened in umbonal area. Cardinal process small, with trilobate myophore. Brachiophores well developed. They narrow on the inner side, forming an inverted V of about 60°. The brachiophores point in the direction of the boundaries on the muscle field. Muscle field faintly delineated, not by well-developed ridges as is commonly the case in *Parmorthis* but rather by the excavation of the muscle attachment area. The adductor impressions are rounded, and divided into four by a prominent, wide (but not high), longitudinal median ridge or septum, and a shallower and narrower transverse one. At the anterior end of the muscle field the median septum becomes much less conspicuous, but nevertheless continues almost to the anterior margin of the shell. Dental sockets small and ovoid in outline. Round the margin of the specimen the nature of the external 'ornament' is shown; it consists of fine costellae which average about 3 per mm.

Comment: This species differs from the typical *Parmorthis* shell in that, firstly, the dorsal valve is not 'concave to slightly convex' and secondly, there are no ridges bounding the muscle field.

Parmorthis vandiemeni is one of a group of numerous species in Australia previously placed under the form names '*Orthis elegantula*' and '*Dalmanella elegantula*'. No well-preserved ventral valve of the new species was found, and so instead of making a poor specimen a syntype it was decided to found the species on the dorsal valve.

Among the Lyell Highway fossils were found some poorly preserved specimens of a more typical *Parmorthis* with flatter dorsal valve and well-developed muscle ridges. Shirley (1938) has described such a form from the Lower Devonian of New Zealand as *Schizophoria allani.*

The trivial name of our species makes use of the first name for Tasmania—Van Diemen's Land—the appellation Abel Tasman gave the island.

MOLLUSCA

Only one pelecypod was found in the whole collection of fossils. It is a *Leiopteria* type of shell, but too poorly preserved for proper identification. Two kinds of gasteropods were noted—one a turbinate shell and the other a high-spired, many-whorled type—but the specimens could not be identified. These facts are mentioned because they give an idea of the ratio of the phyla in the fauna. The brachiopods dominate, followed by the trilobites. There are a few coelenterates and bryozoans, with gasteropods and pelecypods almost absent. A few crinoid stem joints were found, but they were comparatively rare.

COELENTERATA

Genus PLEURODICTYUM Goldfuss, 1829

Pleurodictyum megastomum Dun

Plate VIII, fig. 13

Synonymy as in Gill, 1942 (including that paper). Also Etheridge, R., 1897, pp. 31-32, Pl. I, fig. I; and Hill, Dorothy, 1942, pp. 7-8, Pl. II, fig. 5.

Material: An internal cast or steinkern of part of a corallum in whitish sandstone (N.M.V. 14,542) is figured as being a specimen characteristic of this species. The fossil is common and the usual variations in the number and size of the corallites have been observed. The species occurs in the present collection attached to '*Spirifer*', *Strophonella* and other shells. On the same slabs as specimens of *Pleurodictyum* were found *Eatonia, Cyrtia,* '*Spirifer*', *Nucleospira, Strophonella, Protoleptostrophia, Parmorthis,* and *Odontopleura,* but not *Encrinurus.*

Genus LINDSTROEMIA Nicholson and Thomson, 1876

'Lindstroemia' sp.

Plate VIII, fig. 14

In the fauna from the Lyell Highway there are casts of coralla of the type referred to *Lindstroemia* by Chapman (1925). Corals of this kind are common in the Melbournian (Upper Silurian) and Yeringian (Lower Devonian) in Victoria,

and in the beds at Yass, New South Wales. A series of specimens has been sent to Dr. Dorothy Hill for study, and pending results of this investigation, no closer determination of the Tasmanian fossils is attempted. Dun (1898) figures as *Petraia* sp. specimens which appear to be congeneric with those now illustrated. (N.M.V. 14,544.)

TRILOBITA

Genus CHEIRURUS Beyrich, 1845

Cheirurus sp.

Plate VIII, fig. 6

Material: A single specimen of *Cheirurus*, consisting of a steinkern of a glabella preserved in tough brown (ferruginous) sandstone is in the collection from the Lyell Highway. N.M.V. 14,565.

Description: Greatest length of glabella 16 mm. Frontal lobe at greatest width 14 mm. and at neck furrow 11 mm. The two anterior pairs of furrows are parallel, and curve posteriorwards; the inner ends of the pairs are about 2 mm. apart. The third pair of furrows is straight. The most posterior (fourth) lobes are wider than the two anterior to them (second and third). The coalescence of the third pair of furrows and the neck furrow results in the fourth lobes ending at about the same distance from the median longitudinal axis of the glabella as do the first and second pairs of furrows.

Comment: It seems worthwhile to describe and figure this fragment as it is the only specimen of *Cheirurus sensu stricto* which has been described from the Palaeozoic rocks of Australia. From Victoria, Chapman (1915) has claimed *Cheirurus sternbergi*. The glabellar furrows of this specimen (Plate 15, fig. 12; Plate 16, fig. 22) extend right across the glabella, and therefore the form belongs to the genus *Crotalocephalus* Salter. Etheridge and Mitchell (1917) have described species of *Crotalocephalus* from New South Wales.

Genus DALMANITES Barrande, 1852

Dalmanites aff. wandongensis Gill

Plate VIII, figs 1-3

Material: A. Steinkern of an imperfect cranidium in whitish sandstone. N.M.V. 14,566. B. External mould (N.M.V. 14,568) and steinkern (N.M.V. 14,567) of a pygidium preserved in whitish sandstone.

Descriptions: CRANIDIUM—Glabella 15 mm. wide at widest part (across large frontal lobe), narrowing to 9·5 mm. wide posteriorly; 22 mm. long as preserved. The glabella is mildly tumid, the surface of the frontal lobe (the most inflated part) rising but 3 mm. above a transverse line across the middle of the lobe. The first (most anterior) furrows are oblique and make an angle of about 55° with the median longitudinal axis of the trilobite. The second and third pairs of furrows are sub-parallel and transverse to the longitudinal axis; they are deeply incised, but neither fully reaches the axial furrows. However, there is a faint furrowing between the ends of the deep third furrows and the axial furrows.

The neck furrow is faint in the middle, but is deeply incised on the outer ends and reaches the axial furrows. Small sections of the fixed cheeks are preserved.

PYGIDIUM—Sub-triangular in outline. It is comparatively flat, a section line rising only about 2 mm. above a line joining the two lateral edges of the pygidium. The pygidium is 23 mm. long apart from the mucral spine, and 28 mm. wide (calculated from the complete left side). Pygorachis well defined, 6 mm. wide anteriorly, tapering gradually posteriorly. It merges into a short, sharply pointed mucral spine (shown in external mould) which is slightly turned upwards, i.e., dorsally. At its end the spine is of rounded cross-section. Thirteen pygorachial segments can be demonstrated in the specimen, but the indistinct terminus represents two, or perhaps three, more segments. In the anterior segments the ends are well rounded, and the posterior margin curves forward in the middle. The furrows between the segments are much more deeply incised at the ends than in the middle.

Eight pygopleural segments are well developed, with a ninth incipient one. The anterior segments are deflected posteriorly at an angle of ten to fifteen degrees. This deflection increases until the eighth and ninth (as shown by a wax squeeze of the external mould) are parallel with the longitudinal axis of the trilobite. The raised part of each pygopleural segment is traversed throughout its length by a shallow median furrow. Doublure narrow, being 1·5-1·75 mm. wide.

Comment: Dalmanites wandongensis was described from beds at Wandong in Victoria (Gill, 1948), and belongs to the '*Dalmanites meridianus*' gens. The Tasmanian specimens approximate to this species, but the carapace is very much flatter. More complete material is needed for a proper comparison. Etheridge (1897) figured '*Hausmannia meridianus*' from Zeehan. The full number of pygorachial segments is not present in his figure, but judging by analogy the number would exceed 16 and so put the form in the genus *Odontochile*.

Genus ENCRINURUS Emmrich, 1845

Encrinurus (Cryptonymus) aff. silverdalensis Etheridge and Mitchell

Plate VIII, figs 7-8

Encrinurus silverdalensis Etheridge and Mitchell, 1916, pp. 665-667, Pl. LIV, fig. 11; Pl. LV, figs 4, 9; Pl. LVI, figs 4-6, 14; Pl. LVII, figs 3, 10.

Material: CRANIDIUM—Steinkern in whitish sandstone. N.M.V. 14,569. PYGIDIUM—Steinkern in light brown ferruginous sandstone. N.M.V. 14,570.

Description: CRANIDIUM—7·5 mm. long from front of glabella to posterior margin of cephalon; 17 mm. wide in a straight line, i.e., not following the arching of the cephalon. Glabella moderately inflated, pyriform, devoid of lateral furrows, but with a row of prominent tubercles which simulate glabellar lobes but do not appear to be homologous with such. Surface covered with large tubercles of varying diameter. Axial furrows deep, well-developed; they join the furrows of the posterior border of the cephalon, and also the neck furrow.

Neck furrow at base of glabella shallow. Neck ring strongly arched—an arch superimposed on the wider arch of the whole posterior margin of the cephalon. Fixed cheeks moderately inflated, also bearing tubercles. Posterior border (outer extension of neck ring segment) narrow but strong. Furrow well developed, follows genal angle round to facial suture. Genal angles sharply rounded. Facial suture begins 1·5 mm. anterior to the posterior border of the cephalon and curves into the eye; this line is more or less parallel with the posterior border. The suture then moves directly forward, but only 1·5 mm. of this part of the suture can be traced in the specimen being described.

PYGIDIUM—This description is of the largest of the three pygidia shown in Plate VIII, fig. 8. Pygidium sub-triangular, 7 mm. wide and 7 mm. long, strongly inflated, the axis rising above the pleural areas. Axis 4 mm. wide anteriorly and tapering fairly evenly to 1·5 mm. wide posteriorly. Axial furrows clearly but not deeply incised. Axial segments about 16 in number, all continuous, but the anterior ones stronger. The majority are weaker in the middle of the axis, though not discontinuous. Row of tubercles down centre of axis; five or more are present, but the exact number cannot be determined.

The pleural lobes have a flat inner part and steep sides. The axis similarly has steep sides and is flatter dorsally. Pleural segments eight in number (with a minute ninth), and streamlined posteriorwards; this sweeping back of the segments increases antero-posteriorly until the eighth segment is only about 15° from the longitudinal axis of the trilobite, and the ninth is more or less parallel to it.

Comment: Our form approaches closely *Encrinurus silverdalensis* Etheridge and Mitchell (1916). Those authors remarked that the *Encrinurus* figured by Etheridge (1897) from Heazlewood is similar to their *E. silverdalensis*. However, the specimen now described varies from the New South Wales species in details of the cephalon, and notably in the proportions of the pygidium and the number of axial and pleural segments in the pygidium. The material from the Lyell Highway probably represents a new species, but better specimens are needed for the full study of the form and for establishing adequate types.

Generic Position: Reed (1928) has claimed that it is doubtful whether *Cryptonymus* as defined by Vodges (1907) and Mitchell (1924) can stand as a genus. But the name *Cryptonymus* Eichwald 1840 actually has priority over the generic name *Encrinurus* Emmrich 1844. Palaeontologists seem loathe to surrender the long familiar name *Encrinurus*, but either the prior name should be accepted (as Vodges suggested in 1907), or the name *Encrinurus* should be established *de jure*. Even if the name *Encrinurus* is retained as used at present, the name *Cryptonymus* in our opinion should be used as a sub-generic name for Reed's Group 2 in *Encrinurus*. We agree with Reed's contention that the diagnosis of *Cryptonymus* on pygidial characters is unsatisfactory, but it could well be founded primarily on the cephalic features shown typically in *E. variolaris*. These include the complete obsolescence of glabellar furrows, and rounded genal angles.

The family Encrinuridae now stands in need of revision again, with definition of the relationships of the genera and sub-genera from a genetic point of view.

Genus GRAVICALYMENE Shirley, 1936

Gravicalymene australis (Etheridge and Mitchell)

Plate VIII, figs 9-12

Calymene australis Etheridge and Mitchell, 1917, pp. 481-486; Pl. 24, figs 1-7, 9; Pl. 27, fig. 1.

Material: CRANIDIUM A—Steinkern preserved in yellowish sandstone. N.M.V. 14,571. B—Steinkern (N.M.V. 14,572) and external mould (N.M.V. 14,573) to show clearly the nature of the pre-glabellar field.

PYGIDIUM C—Steinkern (N.M.V. 14,574) and external mould (N.M.V. 14,575) in whitish sandstone.

Descriptions: CRANIDIUM A—Narrow, sub-quadrilateral glabella with two large pairs of lateral lobes, one small pair, and one pair of incipient lobes (the most anterior). Glabella tumid, but not as much as in *G. angustior* (Chapman).

Pre-glabellar field with deep pre-glabellar furrow, then roll-like thickened anterior edge. In front of the glabella the furrow is narrower than the rolled edge. Longitudinal profile of glabella arched. Sub-quadrate posterior glabellar lobes. Next pair forward oval and directed forwards and outwards. Next pair poorly developed. The most anterior pair are but faint protuberances on the sides of the glabella. The glabella furrows meet behind the posterior two pairs of lobes, cutting them off from the main part of the glabella.

Neck furrow deep and neck ring strongly defined. The neck ring is slightly wider (antero-posteriorly) than the neck furrow.

CRANIDIUM B—The specimen shows a wide pre-glabellar field and strong frontal lip.

PYGIDIUM C—Anterior and posterior margins arched. Moderately tumid. Width 2 cm., length 1·1 cm. Prominent axis 7 mm. wide in front and 3 mm. wide behind before rounding off. Five axial segments and rounded terminal segment. Axial furrows well defined. Four well defined pleural segments and a fifth undeveloped segment more or less paralled to the axial furrow. First four pleural segments furrowed mesially throughout their length; furrows deeper at distal ends.

Comment: When the Calymenidae of Victoria were reviewed (Gill, 1945), the question of the relationship of *G. australis* (Etheridge and Mitchell) and *G. angustior* (Chapman) was left until the types of the former could be studied. When Etheridge and Mitchell established their species, they were doubtful whether it were different from Chapman's species or not. They said that if fourth glabellar lobes were present on the Victorian trilobites, as they are, then probably their species would fail. When describing the Baton River (N.Z.) fauna where a similar form occurs, Shirley (1938) questioned whether the two species were really different. The types have now been viewed and it is found that although the two forms are very similar, they can be separated objectively.

Etheridge and Mitchell did not name a holotype for their species, but the complete carapace figured by them (Plate 24, fig. 1) is the obvious choice and we hereby select this as lectoholotype.

The types of *G. australis* were examined in the Australian Museum through the courtesy of the Palaeontologist, Mr. H. O. Fletcher, and the following features noted:—

(a) *G. angustior* has a highly inflated glabella (see Gill, 1945, fig. 1C), but *G. australis* has only a moderately tumid glabella.

(b) On the whole, *G. australis* possesses a thicker rolled edge on the pre-glabellar field.

(c) *G. australis* has one axial segment less in the pygidium than *G. angustior*. The following table sets out the number of pygidial segments in these and other species of the gens—

Species	Pleural Segments	Axial Segments
G. australis (N.S.W.)	5	5
G. australis (Tas.)	5	5
G. cootamundrensis	5	6
G. angustior	5	6
G. duni	5	8

In describing *G. australis*, Etheridge and Mitchell wrote, 'Some pygidia of the species which exceed this length (carapace of 3") show seven or more annulations'. Our experience has been that the number of pygidial segments is constant for a species, and so probably the specimens to which Etheridge and Mitchell refer belong to another species.

The fossils from Tasmania clearly belong to the *angustior-australis* gens of *Gravicalymene*, but approach more closely *G. australis* in that the carapace is but moderately tumid, the lip of the pre-glabellar field is relatively thick, and there are only five pygorachial segments present. On the evidence of the parts available, there is no reason for not identifying the specimens with G. *australis*.

Genus **ODONTOPLEURA** Emmrich, 1839

Odontopleura aff. rattei Etheridge and Mitchell

Plate VIII, figs 4-5

Odontopleura rattei Etheridge and Mitchell, 1896, pp. 699-703, Pl. 50, fig. 7; Pl. 51, figs 8-9; Pl. 52, figs 1-4; Pl. 53, figs 1-3.

Material: A—Steinkern of a cranidium in whitish sandstone. N.M.V. 14,576. B—External mould in part and steinkern in part of a free cheek in a similar matrix. N.M.V. 14,577. C—Steinkern of a pygidium in whitish sandstone. N.M.V. 14,578.

Descriptions: A—Glabella expanded in front (homologous with a pair of glabellar lobes in some other species), and with two pairs of lateral lobes which are completely circumscribed with furrows. The lobes are elongate oval, and are directed forwards and a little outwards. The nuchal ring and furrow are well developed. The steinkern shows no evidence of a central tubercle or spine on the nuchal ring. The anterior margin of the glabella is straight and finely dentate.

The cranidium is 8 mm. long and 9 mm. wide as preserved. The glabella is 5·5 mm. long, the nuchal ring furrow 0·5 mm. and the nuchal ring about 1·5 mm. The glabella is 5 mm. wide across the anterior pair of lobes. The cranidium is moderately tumid, the glabella rising above the fixed cheeks. The nuchal ring is arched.

B.—Free cheek from left side of cephalon very tumid, granulated. Outer edge of cheek and cephalon end of genal spine with a number of spines. Six are present on the specimen described but there were originally many more than that. Nine were counted on another incomplete specimen. Genal spine 8·5 mm. long, acicular, strong (1 mm. wide at base), bearing last two or three cheek spines. The outer margin of the spine is a continuation of the line of the free cheek, and in this is different from many odontopleurid genal spines which take a different course from the lateral border of the cheek.

Facial suture forwards from the eye inclines outwards from the longitudinal axis of the trilobite. Backwards from the eye, it is also inclined away from the longitudinal axis. Neck furrow 1 mm. in from posterior margin of cephalon. Eye prominent, elevated on raised part of cheek.

C—Pygidium not sufficiently well preserved to figure. Length 2 mm. and width 5 mm., apart from spines. Two short axial spines 1·5-2 mm. long, on each side of which is a longer spine of 4 mm. Outside of those again are two or three short spines on each side.

Comment: The species with which our specimens can best be compared is *O. rattei*, described from the Middle and Upper Trilobite Beds of the Yass District, New South Wales.

Stratigraphical Inferences

Age of Strata: Because fossils capable of adequate identification were found in strata of the Eldon Group only at one locality in the area under study, the age determination applies only to one horizon.

Encrinurus is usually a Silurian genus, but it is on record as occurring with a fauna otherwise Devonian (Cooper *et al.*, 1942, p. 1769). This is, of course, an exception and not the rule, but it may be that *Encrinurus* is not an absolute index of Silurian age. Two trilobites in the fauna from the Lyell Highway are compared with (viz., *Encrinurus* aff. *silverdalensis* and *Odontopleura* aff. *rattei*) and one identified as *(Gravicalymene australis)* forms found in the uppermost beds of the Hume Series in the Yass-Bowning District in New South Wales. *Dalmanites* is present in the fauna under review, but Delo has shown that this genus *sensu stricto* is found on both sides of the Silurian-Devonian boundary.

Many of the brachiopods are indecisive, but the genus *Protoleptostrophia* (Caster, 1939, Shimer and Shrock, 1944) and the sub-genus *Pareatonia* (McLearn, 1918, 1924) are limited to the Devonian. Schuchert and Le Vene (1929) erroneously referred *Pareatonia* to the Silurian.

Thus in the fauna from the Lyell Highway we have the Silurian genus *Encrinurus*, but on the other hand the Devonian forms *Protoleptostrophia*, *Pareatonia* and *Pleurodictyum*. It is probably significant that *Encrinurus* was in no case found on the same slab as any of the Devonian forms. This suggests that in the few stratigraphical feet of cutting, the Silurian-Devonian boundary may be spanned. However, the matter is left open until the locality can be zone collected and field relationships carefully checked. There is no doubt that this is a very significant locality for studying the Silurian-Devonian boundary in Tasmania.

It may be noted here that the Eldon Group rocks definitely include strata of Devonian age. On the right bank of the Little Henty River 1 mile S.E. from Zeehan, quartzites and fine sandy shales which contain fossils of Devonian age outcrop near peg K153. This fauna is at present being worked out and includes numerous specimens of the chonetid brachiopod *Anoplia*, so characteristic of the Yeringian (Lower Devonian) beds of Victoria (Gill, 1942, 1945*b*).

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PLATES

PLATE VII

Slab of fossils from 100 yards east of 12-mile post on Lyell Highway, West Tasmania, x2. (N.M.V. 14,559)

PLATE VIII

Fossils from 100 yards east of 12-mile post on Lyell Highway, West Tasmania. All natural size except four figures of bottom row which are x2 to show special features. Registered numbers of the specimens in the National Museum of Victoria are given in brackets.

Fig. 1.—*Dalmanites* aff. *wandongensis* Gill. External mould of pygidium. (14,568)

Fig. 2.—*Dalmanites* aff. *wandongensis* Gill. Steinkern of pygidium, counterpart of Fig. 1. (14,567)

Fig. 3.—*Dalmanites* aff. *wandongensis* Gill. Steinkern of cranidium. (14,566)

Fig. 4.—*Odontopleura* aff. *rattei* Etheridge and Mitchell. Steinkern of cranidium. (14,576)

Fig. 5.—*Odontopleura* aff. *rattei* Etheridge and Mitchell. Free cheek. (14,577)

Fig. 6.—*Cheirurus* sp. *sensu stricto*. Steinkern of cranidium. (14,565)