LATE MIDDLE CAMBRIAN TRILOBITES FROM TRIAL RIDGE, SOUTHWESTERN TASMANIA

by J.B. Jago & A.V. Brown

(with one table, one text-figure and three plates)

INTRODUCTION

During the mapping of the HUNTLEY 1:50 000 Geological Atlas Map Sheet (Brown et al. 1982) new fossil faunas were found in two localities on Trial Ridge. The southern locality (no.1, fig.1) yielded a fauna with abundant agnostoid trilobites, numerous phosphatic brachiopods as well as polymeroids and trilobite tracks. The northern locality (no.2, fig.1) contains a similar but more restricted fauna. The trilobites described in this paper allow their horizon to be dated as late Middle Cambrian, the first of that age to be described from southwestern Tasmania.

Geological Setting

The term “Trial Ridge Beds” was introduced by Corbett (1970) for the succession of sedimentary rocks on Trial Ridge. In the course of mapping the Huntley Quadrangle the sequence on Trial Ridge was re-mapped in greater detail than previously, allowing the rocks within the area to be subdivided into three members. The lowest member (Cml, fig.1) comprises thickly bedded, siliceous, granule to cobble conglomerate and siliceous sandstone. The fossiliferous middle member (Cmm, fig.1) consists of thinly and monotonously interbedded light to dark-grey sandstone and siltstone. Some siltstone units contain abundant muscovite whereas, in other places, siltstone beds contain a sand-grade component. Most of the siltstone beds contain multiple truncated cross-bedding, with some of the interbedded sandstone units having silt-grade basal flame structures. The highest member (Cmh, fig.1) consists of an irregularly interbedded sequence of granule to cobble conglomerate, siliceous pebbly sandstone and siltstone. A detailed description of this succession is contained in Brown et al. (1989: 40–45).

Composition and Age of the Faunas

Locality 1 contains the following agnostoid trilobites: Goniagnostus nathorsti (Brøgger), Lejopyge laevigata (Dalman), Hypagnostus trali sp. nov., Liogoragnostus sp., Oidalagnostus changi Lu, Clavagnostus cf. repandus (Westergård), Glaberagnostus sp., Valenagnostus sp. and Agnostoid gen. sp. et indet. Polymeroid trilobites present are Amphoton sp. and Papyriaspididae gen. et sp. indet. Trace fossils, probably formed by polymeroid trilobites, are also present.

The following agnostoid trilobites are present at Locality 2: Lejopyge laevigata (Dalman), Hypagnostus trali sp. nov., H. brevifrons (Angelin), Ammagnostus laiwumensis (Lorenz), Oidalagnostus changi Lu and Agnostoid gen. et sp. indet. Polymeroid trilobites present are Fuchouia sp., Bathyrusicus(?) sp. and Proasaphisidae gen. et sp. indet.

The overlap in the faunal compositions suggests that the two faunas are of similar, if not identical, age. The combination of Lejopyge laevigata, Goniagnostus nathorsti, Hypagnostus brevifrons, Ammagnostus laiwumensis, Clavagnostus cf. repandus and Oidalagnostus changi suggests correlation with the L. laevigata Zone on the northern Australian biostratigraphic scale. Amphoton and Fuchouia are well-known late Middle Cambrian genera from China and Australia. The specimens described herein as Proasaphisidae gen. et sp. indet. belong in a genus known from several localities elsewhere in Tasmania. These include Native Track Tier and St Valentines Peak (see Laurie et al., 1995, for details of these localities), where the faunas are both of very late Middle Cambrian age (Bao 1995).

The combination of the above species suggests an age high in the L. laevigata Zone on the northern Australian biostratigraphic scale or near the boundary of the L. laevigata and Proagnostus bulbus Zones of the late Middle Cambrian of China (Peng & Robison 2000).

The composition of the agnostoid component of both localities (table 1) shows that, while there are similarities in the composition of the faunas from the two localities, there...
are also some differences. At Locality 1, 59.77% of the
known agnostoid cephala and pygidia are found in complete
specimens (table 1); Gonagnostus nathorsti makes up
67.82% of the agnostoid fauna and only three polymeroid
specimens are known.

In contrast to Locality 1, there are no known complete
agnostoids from Locality 2. G. nathorsti is not present, and
polymeroid trilobites make up about 50% of the trilobite
fauna. Of the polymeroids, Proasaphiscidae gen. et sp.
indet. is the most common trilobite at Locality 2. As noted
above, this species is also common in faunas of similar age
at Native Track Tier and St Valentines Peak in northern
Tasmania. The abundance of complete agnostoids,
particualrly G. nathorsti, at Locality 1 and the absence of G.
nathorsti and the presence of abundant Proasaphiscidae
gen. et sp. indet. at Locality 2 all suggest that the faunas of
Localities 1 and 2 respectively fit into Faunas 2 and 3 of
Jago (1973), with the Locality 1 fauna being a deeper water
fauna than that of Locality 2.

SYSTEMATIC PALAEONTOLOGY

All specimens described occur as internal and external
moulds in weathered siltstone. For description, silicone
rubber casts of the external moulds were prepared and then
photographed after whitening with magnesium oxide. The
terminology used for agnostoid trilobites is essentially that
of Shergold et al. (1990). Specimens are housed in the
collection of the School of Earth Sciences, University of
Tasmania.

DESCRIPTIONS

Order AGNOSTIDA Salter, 1864
Superfamily AGNOSTOIDEA M'Coy, 1849
Family PTYCHAGNOSTIDAE
Kobayashi, 1939
Genus Gonagnostus Howell, 1935b

Synonymy
See Lu & Lin 1989: 97. To this should be added Laurie
1989: 176; Shergold et al. 1990: 39; Peng & Robison 2000:
71.

Type species
Agnostus nathorsti Brøgger 1878: 68, pl. 5, fig. 1.

Remarks
The generic and subgeneric classification of Ptychagnostus,
Gonagnostus and related taxa has long been problematic
(e.g. Öpik 1961, 1979, Robison 1964, 1982, 1984, Laurie
We follow Peng & Robison in rejecting the subgeneric
subdivisions of the genus as proposed by Öpik (1979).
TABLE 1
Analysis of agnostoid trilobites from Trial Ridge*

<table>
<thead>
<tr>
<th>LOCALITY ONE</th>
<th>Complete specimens</th>
<th>Separate cephalon</th>
<th>Separate pygidia</th>
<th>Total no. of specimens</th>
<th>Total cephalon and pygidia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goniagnostus nathorsti</td>
<td>21</td>
<td>10</td>
<td>7</td>
<td>38</td>
<td>59</td>
</tr>
<tr>
<td>Lejopyge laevigata</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Hyperagnostus trali</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Limagnostus sp.</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Oidalagnostus changi</td>
<td>6</td>
<td>1</td>
<td>7</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Clavagnostus cf. repandus</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Glabernagnostus sp.</td>
<td>1</td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Valenagnostus sp.</td>
<td></td>
<td>2</td>
<td>2</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Agnostoid gen. et sp. indet.</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total number of cephalon and pygidia = 87. Number of cephalon and pygidia in complete specimens = 52. Percentage of cephalon and pygidia in complete specimens = 59.770/0.

<table>
<thead>
<tr>
<th>LOCALITY TWO</th>
<th>Complete specimens</th>
<th>Separate cephalon</th>
<th>Separate pygidia</th>
<th>Total no. of specimens</th>
<th>Total cephalon and pygidia</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lejopyge laevigata</td>
<td>3</td>
<td>2</td>
<td>5</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Hyperagnostus trali</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>H. brevifrons</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ammagnostus latiwnensis</td>
<td>3</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Oidalagnostus changi</td>
<td>3</td>
<td>3</td>
<td>6</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>Agnostoid gen. et sp. indet.</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Every available agnostoid cephalon and pygidium is shown on this table. Each individual cephalon and pygidium is counted as one unit; thus a complete agnostoid comprises two units.

Goniagnostus nathorsti (Brøgger, 1878)

Pl. 1A–K

Synonymy

Material
Twenty-one complete, or nearly complete, specimens, plus ten separate cephalon and seven separate pygidia. Specimens UTGD 125320a, b, 125321a, b, 125322–125324, 125325a, b, 125326a, b, 125328–125330.

Diagnosis
See Laurie (1989: 177).

Description
Cephalon slightly larger than pygidium, with weakly and finely pustulose surface; cephalon slightly wider than long. Well-developed radial scrobicules. Narrow border; narrow, shallow border furrow. Very short cephalic fulcral spines. Unconstricted acrolobe. Well-developed preglabellar median furrow. Well-defined axial furrows. Glabella length 0.75–0.8 that of cephalon; width about one-third of cephalon. Subtriangular anteroglabella has length about 0.4 that of glabella. F3 well developed; deflected slightly forwards centrally. F1, F2 well developed, extend about one-third of distance into glabella from either side; central part of posteroglabella raised well above lateral parts of glabella. Some specimens (e.g. pl. 1A) have shallow longitudinal furrows that separate the central and lateral parts of the glabella. Central part of glabella increases in height posteriorly. Small subtrapezoidal basal lobes.

Pygidium slightly wider than long. Low pustules on pleural areas coalesce to form a reticulate prosopon. Narrow, shallow border furrow; border widens posteriorly. Short posterolateral spines placed behind axial termination. Large shoulders and facets. Shallow postaxial median furrow shallows posteriorly to border furrow. Pygidial axis outlined by well-developed axial furrows. Axis about 0.7–0.8 length of pygidium; well-developed rosette with node. Axis constricted at M2 and at rosette. F1, F2 well developed. Central part of M1 and particularly M2 separated from lateral parts of axis by shallow longitudinal furrows that are more clearly developed on M2. Central part of M2 extends into a node that continues on to posteroaxis.

Discussion
These specimens fit into Goniagnostus nathorsti as discussed by Laurie (1989) and Peng & Robison (2000). G. nathorsti, as figured by Westergård (1946: pl. 12, figs 12–16), Opik (1979: pl. 47, fig. 6; pl. 60, figs 1–5; pl. 61, figs 1, 3–6), Xiang & Zhang (1985: pl. 20, figs 1–3, 6–10), Laurie (1989: fig. 1) and Peng & Robison (2000: fig. 56), shows considerable morphological variation. Variable features include the length of the glabella, the length and width of the pygidial axis and the position and length of the pygidial posterolateral spines. The Trial Ridge specimens show a similar variation, with some of the differences in appearance of the Tasmanian specimens, when compared to the specimens figured in the above papers, being due to the fact that the Trial Ridge
Genus Lejopyge Hawle & Corda, 1847

Type species

Remarks
The concept of Lejopyge has been discussed at some length by Daily & Jago (1975), Opik (1979), Robison (1984, 1994), Laurie (1989), Westrop et al. (1996) and Peng & Robison (2000). On the basis of cladistic analysis Robison (1994) placed Onymagnostus buckleyi and in synonymy with spiniger by Laurie (1989) were intermediate in size between those of spiniger illustrated by Laurie and those of nathorsti illustrated herein. It could be argued that spiniger from Queensland, buckleyi from northwestern Tasmania and nathorsti from Trial Ridge are simply geographic variants of a single species. However, the difference in the spines of spiniger and nathorsti is so marked that the writers feel the continued separation into two species is warranted.

Family SPINAGNOSTIDAE Howell, 1935a

Genus Hypagnostus Jaekel, 1909

Middle Cambrian trilobites from southwestern Tasmania

**Hypagnostus trali** sp. nov.

**PLATE 2**

(A,B,C) Hypagnostus trali sp. nov.: (A) UTGD125339 complete specimen, holotype, internal mould, ×10; (B) UTGD125340a pygidium with thorax attached, silicone rubber cast of external mould, ×12; (C) UTGD125341 pygidium and thoracic segments, silicone rubber cast of external mould, ×10.

(F,I,J) Otdalagnostus changi Lu 1964: (F) UTGD125344 cephalon internal mould, ×8; (I) UTGD125347 cephalon, internal mould, ×6; (J) UTGD125348 pygidium and thoracic segments, internal mould, ×7; (M) UTGD125351 pygidium, internal mould, ×5; (N) UTGD125352 cephalon, internal mould, ×10; (O) UTGD125353 cephalon, internal mould, ×8; (P) UTGD125354 cephalon, silicone rubber cast of external mould, ×10.

(G,K,L) Ammagnostus laiwensis (Lorenz 1906): (G) UTGD125345 cephalon, internal mould, ×5; (K) UTGD125349 pygidium, internal mould, ×6; (L) UTGD125350 cephalon, internal mould.

(H) Hypagnostus brevifrons (Angelin 1851) UTGD125346 cephalon and thoracic segments, internal mould, ×8.

(Q) Glaberagnostus sp. UTGD125355b complete specimen, internal mould, ×6.

(R) Valagnostus sp. UTGD125356 partial pygidium, internal mould, ×15.

(S) Agnostoid gen. et sp. indet. UTGD125357 cephalon, internal mould, ×15.

(T, U) Clavagnostus cf. repandus (Westergård in Holm & Westergård 1930): (T) UTGD125358 partial pygidium, internal mould, ×8; UTGD125359 pygidium, internal mould, ×10.

(V) Bathyriscus (?) sp. UTGD125360 partial cranidium, internal mould, ×10.


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**Type species**

*Agnostus parvifrons* Linnaeus 1869: 82, pl.2, figs 56, 57.

**Diagnosis**

See Shergold & Laurie (1997: 356), with the amendment that the F3 glabellar furrow may be effaced as may be the posterior parts of the axial furrows of the pygidium.

**Discussion**


The generally accepted concept of Cotalagnostus is that it is similar to *Hypagnostus* except that the F3 glabellar furrow is effaced, as may be the posterior parts of the pygidial axial furrows. Many of the pygidia of *Cotalagnostus sensu lato* and *C. lens claudicus* as illustrated by Westergård 1946 (pls 6, 7) and Hutchinson 1962 (pl. 6) are indistinguishable from those of *Hypagnostus*. Westergård (1946) and Robison (1964) considered *Cotalagnostus* evolved from *Hypagnostus* by effacement of furrows. Westrop et al. (1996) concluded that the difference between the two genera, i.e. the presence of a distinct F3 furrow on the cephalon of *Hypagnostus*, was arbitrary and regarded *Cotalagnostus* as a junior synonym of *Hypagnostus*. Shergold & Laurie (1997) maintained the separation of the two genera. Peng & Robison (2000) disputed the placement of *Cotalagnostus* in synonymy with *Hypagnostus*, on the grounds that *Cotalagnostus* is differentiated by the effacement of F3 and the greater effacement of its axial furrows on both the cephalon and pygidium. We accept *Cotalagnostus* as a junior synonym of *Hypagnostus* on the grounds given by Westrop et al. (1996) and because, as noted above, it is difficult to distinguish the pygidia of the two genera.

**Derivation of name**

Anagram of Trial.

**Material**

The holotype, a complete specimen (UTGD125339), a pygidium with thorax attached (UTGD125340) and two pygidia (UTGD125342–43) are assigned to this species.

**Holotype**

Complete specimen UTGD125339 (pl. 2A) is selected as holotype.

**Diagnosis**

Both cephalon and pygidium have unconstricted acrolobes, narrow borders and narrow, shallow border burrows. Posterior part of glabella outlined by shallow axial furrows. Narrow pygidial axis extends almost full length of acrolobe; F1 and F2 effaced. Terminal axial node present.

**Description**

Complete specimen 3.5 mm long. Acrolobes unconnected. Cephalon about as wide as long. Narrow, shallow border furrow; narrow convex border. Small basal lobes. Broadly rounded glabellar posterior. Posterior part of glabella outlined by shallow axial furrows which extend almost 0.4 length of cephalon to a position just short of where F3 would be. Pygidium about as wide as long. Narrow, shallow border furrow; narrow, convex border widens posteriorly. Narrow pygidial axis extends almost full length of acrolobe; slight constriction at position of M2. F1, F2 effaced. Terminal axial node present.

**Discussion**

The pygidial axis of *trali* is narrower and extends further to the posterior than in *H. lens* or the subspecies *H. lens claudicus* (Westergård 1946). The pygidium of *H. confusus* is more effaced than that of *trali*, and where the outline of the axis of *confusus* can be seen (Westergård 1946: pl.7, figs 14, 16, 19), it is shorter than that of *trali*. *H. laevus* is...
much more effaced than *trali* (Robison 1964: pl.80, figs 17–28). The pygidial axis of *Catalagnostus* sp.1 of Egorova et al. (1982: pl.14, fig. 14) extends to the posterior of the acrolobe as in *trali* but is wider than that of *trali*. The pygidium of *trali* is similar to that of *H. hippalus* Opik 1961; however, the cephalon of *hippalus* is quite different.

**Hypagnostus brevifrons** (Angelin, 1851)

*PI. 2H*

**Synonymy**


**Material**

One cephalon with attached thoracic segments (UTGD 125346).

**Remarks**

As noted by Peng & Robison (2000) and other authors, cephalae of *H. brevifrons* and *H. parvifrons* are difficult to distinguish. However, when compared with previously illustrated material, this cephalon appears to fit better into *H. brevifrons*.

**Genus Lisogoragnostus** Rozova in Lisogor, Rozov & Rozova, 1988

**Synonymy**


**Type species**

*Lisogoragnostus kalisae* Rozova in Lisogor et al. (1988: 64, pl. 5, fig. 9).

**Diagnosis**

See Peng & Robison (2000: 64) with the amendment that the pygidium may have a narrow border.

**Remarks**

Peng & Robison (2000) discussed the genus comprehensively. The pygidium described by Jago (1976a: pl. 26, fig. 15) as Agnostid, gen. et sp. indet. no. 1 figured from St Valentines Peak, Tasmania, should be included in *Lisogoragnostus*. The explanation for plate 26, figure 15 in Jago (1976a) is incorrect in that it states that the specimen is Agnostid, gen. et sp. indet. no. 2.

**Lisogoragnostus sp.**

*PI. 1N, O*

**Material**

One almost complete specimen (UTGD 125333) and a partial pygidium (UTGD 125334). Neither specimen is well preserved.

**Description**

Both available specimens small. Complete specimen (pl. 1N) length of 1.5 mm. Acrolobes unconnected. Cephalon about as wide as long. Very narrow, shallow border furrow; very narrow border. Very small basal lobes. Shallow axial furrow effaced forwards of F3, F3 very shallow; concave anteriorly. Posteroablabella has length about 0.4–0.45 of glabella. Pygidium about as wide as long. Narrow, shallow border furrow; narrow, flat border. Narrow, shallow axial furrow. Axis has length about 0.6–0.65 and width about 0.5 of pygidium. Axis parallel-sided for about 0.75 of length from where it narrows to angulate posterior. F1, F2 effaced. Smooth pleural fields.

**Remarks**

These specimens differ from previously described species of *Lisogoragnostus* by the presence of a distinct pygidial border. However, the preservation is not good enough to justify the erection of a new species. The Trial Ridge specimens are probably closest to *L. hybus* Peng & Robison (2000: fig. 47). However, the cephalon of *L. hybus* is more elongated than the Trial Ridge specimens. The pygidial axis of the Trial Ridge species appears to be angulate in a manner similar to the pygidia described and figured by Rasetti (1967: 38, pl. 10, figs 22–26) as Agnostida, pygidium no. 1, which belong in *Lisogoragnostus* (Peng & Robison 2000). However, preservation of our specimens makes it difficult to be certain about this matter. The anteroaxis of the Trial Ridge specimens is more parallel-sided than in the specimen of *Lisogoragnostus* illustrated by Jago (1976a: pl. 26, fig. 15) as Agnostid gen. et sp. indet. no. 1.

**Family AMMAGNOSTUS Opik, 1967**

**Genus Ammagnostus** Opik, 1967

**Synonymy**


**Type species**

*Ammagnostus psammius* Opik 1967: 139, pl. 55, fig. 3; pl. 66, figs 1–4; text fig. 40.

**Diagnosis**


**Remarks**

Peng & Robison (2000) discussed the genus comprehensively. These specimens fit *Peronopsis ekip* of Jago (1976a), which was placed in synonymy with *Ammagnostus laiwuensis* (Lorenz, 1906) by Peng & Robison (2000). This synonymy is accepted herein.
Family DIPLAGNOSTIDAE
Whitehouse, 1936
Subfamily OIDALAGNOSTINAE Öpik, 1967
Genus OIDALAGNOSTUS Westergård, 1946

Synonymy

Type species
OIDALAGNOSTUS TRISPINIFER Westergård (1946: 65, pl. 9, figs 4–7).

Diagnosis

Discussion
Robison (1988: 37) discussed Oidalagnostus and related genera in some detail and concluded that Ovalagnostus Lu 1974 (type species, O. changi Lu in Lu et al. 1974) and Tasagnostus Jago 1976 (type species, T. debori) are junior synonyms of Oidalagnostus Westergård 1946. Lu & Lin (1989: 81) placed Tasagnostus in synonymy with Ooidalagnostus, which they retained as a separate genus from Ooidalagnostus. Peng & Robison (2000) distinguished in the features of the pygidial axis. The anteroaxis of the pygidium comprises being included questionably in the Iniospheniscus depression on the anterior of the posterior pygidial lobe. Shergold et al. (1996: 134) suggested that O. trispinifer is found in the Glyptagnostus solidotus Zone of Tasmania. However, to the best of the authors’ knowledge, the youngest known Oidalagnostus from Tasmania is from the Brewery Junction Formation at Dundas, where it is in either the Erediaspis eretes or Acmarbachis quasivespa Zone (Jago 1972).

Oidalagnostus changi Lu, 1964
Pl. 2F, I, J, M–P

Synonymy

Material
Nine cranidia and four pygidia, three of which have attached thoracic segments. Illustrated specimens UTGD 125344, 125347–125348, 125351–125354.

Diagnosis

Remarks
These specimens are similar to Oidalagnostus changi as illustrated by Peng & Robison (2000: fig. 43). The cranidia show some variation. The anterior margin may be quite smooth (pl. 20) or have a slight angularity (pl. 2F, N). The depth of the transverse glabellar furrow is variable, as is the shape of the glabellar posterior. The pygidium the pleural fields are slightly pitted. The collar is separated from the axis by a shallow, narrow furrow; the knobs on the collar are well developed. There is a well-developed furrow between the collar and the pygidial border.

Family CLAVAGNOSTIDAE Howell, 1937
Subfamily CLAVAGNOSTINAE Howell, 1937
Genus CLAVAGNOSTUS Howell, 1937

Type species
AGNOSTUS REPANDUS Westergård in Holm & Westergård, (1930:13, pl.4, figs 11, 12 only).

Diagnosis

Clavignostus cf. Repandus (Westergård in Holm & Westergård 1930)
Pl. 2T, U

Material
Two small, poorly preserved pygidia, UTGD 125358–59.
PLATE 3

(A, G) Amphoton sp.: (A) UTGD125361a cranidium, silicone rubber cast of external mould, ×4; (G) UTGD125367 pygidium, internal mould, ×10.

(B) Fuchouia sp. UTGD125362 pygidium, silicone rubber cast of external mould, ×5.

(C–E, H–J) Proasaphiscidae gen. et sp. indet.: (C) UTGD125363 cranidium, internal mould, ×4; (D) UTGD125364 cranidium, internal mould, ×6; (E) UTGD125365 right librigena, silicone rubber cast of external mould, ×8; (H) UTGD125368 right librigena, internal mould, ×5; (I) UTGD125369 partial cranidium, internal mould, ×3; (J) UTGD125370 cranidium, internal mould, ×6.

(F, K) Papyriaspidae gen. et sp. indet.: (F) UTGD125366 partial thoracic segment, silicone rubber cast of external mould, ×10; (K) UTGD125371 right librigena, silicone rubber cast of external mould, ×5.

(L, M) Trace fossils: (L) UTGD125372 internal mould, ×2; (M) UTGD125373b internal mould, ×1. The arrow points to a small complete specimen of Goniagnostus nathorsti resting on the tracks.

Specimen figured in A, F, G, and K–M come from Locality 1; those figured in B–E and H–J come from Locality 2.
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Remarks
These pygidia are similar to C. repandus as described and illustrated by Westergard (1946), and in particular to the pygidium figured by Westergard (1946: pl.4, fig.22) and refigured by Jago & Daily (1974: 11, fig.4).

Family INCERTAE SEDIS
Genus Glaberagnostus
Romanenko, 1985

Type species

Diagnosis

Glaberagnostus sp.
Pl. 2Q

Material
One almost complete specimen, UTGD125355a, b.

Description
Specimen length, 7.0 mm. Cephalon almost completely effaced; only very posterior of glabella distinguished. Border appears absent. Position of any glabellar node indeterminate due to preservation. Pygidium with wide border and border furrow; low centrally placed node about 0.2 of distance from anterior to posterior of acrolobe.

Genus Valenagnostus Jago, 1976a

Type species
Agnostus nudus Beyrich var. marginata Brøgger 1878: 73, pl. 6, fig. 3.

Diagnosis
See Jago (1976a: 142).

Valenagnostus sp.
Pl. 2R

Material
Two small, poorly preserved pygidia. Illustrated specimen, UTGD 125356.

Remarks
The effaced acrolobe, wide pygidial border and suggestion of a terminal axial node suggest affiliation with Valenagnostus.

Agnostoid gen. et sp. indet.
Pl. 2S

Material
Five cephalia. Illustrated specimen, UTGD 125357.

Description
Narrow border; border furrow of moderate width. Glabella 0.6–0.7 length of cephalon. F1, F2 short, shallow; F3 shallow, straight. Posteroglabella length about 0.7 that of glabella. Glabellar posterior broadly rounded. Shallow preglabellar median furrow extends to anterior border. Small basal lobes confluent behind glabella. Smooth cheeks.

Remarks
These small cephalia are not assigned to any particular genus. They may belong in Agnostus or a related genus.

Family DOLICHOMETOPIDAE Walcott, 1916
Genus Amphoton Lorenz, 1906

Synonymy

Type species
Amphoton steinmanni Lorenz (1906: 89, pl. 4, figs 15–17).

Amphoton sp.
Pl. 3A,G

Material
One well-preserved cranidium is available both as the internal and external mould (UTGD 125361a, b); a small pygidium (UTGD 125367) may belong in the same species.

Description
Amphoton with shallow occipital furrow; base of what appears to have been a strong occipital spine preserved. Lateral glabellar furrows entirely effaced. Shallow axial furrows. Glabellar anterior almost straight. Anterior border of moderate width; shallow anterior border furrow. Palpebral areas of fixigenae gently convex. Shallow palpebral furrows. Narrow posterolateral limbs; well-developed posterior border furrow. Pygidial axis stops just short of posterior margin. Axis of four annulations plus terminus; four pairs of pleural furrows. No distinct border.

Remarks
The cranidium shows some similarities with Amphoton deois, although the anterior border of deois is a little wider, the palpebral areas of the fixed cheeks are a little narrower, and the anterior sections of the facial suture of deois do not diverge as much as those of the Trial Ridge form. The characters of the pygidium, including the absence of a distinct border, suggest affiliation with Fuchouia rather than Amphoton (e.g. Zhang & Jell 1987: 67). Although it is quite possible that the two specimens described here under Amphoton sp. belong in separate species or even separate, but related genera, they are placed together in open nomenclature until more material is obtained.

Genus Fuchouia Resser & Endo
in Kobayashi 1935

Synonymy

Type species
Bathyuriscus manchuriensis Walcott (1911: 97, pl. 16, fig. 4).
**Fuchouia** sp.

**Pl. 3B**

Material
One pygidium, UTGD 125362

Description
Although posterior of axis is poorly preserved there appear to be four axial annulations plus a terminus. Four pairs of pleural furrows, plus at least two pairs of faintly developed interpleural furrows. Very narrow border.

Remarks
The presence of the interpleural furrows and a very narrow border indicates that this pygidium belongs in *Fuchouia* rather than *Amphoton* (Zhang & Jell 1987: 67).

**Genus Bathyuriscus** Meek, 1873

Type species
*Bathyurus(?) haydeni* Meek (1873: 484).

Diagnosis
See Robison (1964: 534).

*Bathyuriscus (?) sp.*

**Pl. 2V**

Material
One partial cranidium, UTGD125360.

Remarks
This specimen is questionably assigned to *Bathyuriscus* as defined by Robison (1964: 534). In *Bathyuriscus* the glabella expands anteriorly, but this feature is not clear on the available specimen. Robison’s diagnosis stated that the palpebral lobes have a length one-third that of the cranidium. However, although a complete cranidium is not available, it is probable that the palpebral lobes of the Tasmanian specimens are considerably longer. When compared with *Bathyuriscus fimbratus* Robison 1964, *Bathyuriscus (?) sp.* has wider fixigenae.

Family PROASAPHISCIDAE Chang, 1963

**Proasaphiscidae**, gen. et sp. indet.

**Pl. 3C–E, H–J**

Material
Six partial cranidia and several librigenae. Illustrated specimens, UTGD 125363–125365; 125368–125370.

Description
Large, convex subrectangular glabella about 0.75–0.8 cephalic length and about 0.43 cranidial length. Glabella tapers slightly forwards to a truncated front at anterior border furrow. Deep axial furrows. Lateral glabellar furrows very poorly defined. Shallow occipital furrow; occipital ring narrow abaxially. Long, crescentic palpebral lobes extend from just forwards of occipital furrow to about three-quarters length of glabella. Anterior ends of palpebral lobes close to axial furrows. Wide palpebral furrows. Palpebral areas of fixigenae gently convex. Gently convex anterior border furrow. Anterior sections of facial suture diverge slightly; posterior sections diverge markedly. Wide posterior border furrow. Gently convex librigena with shallow border furrow. Moderately wide border widens posteriorly and extends into long genal spine.

Remarks
These specimens belong to a new genus of the Proasaphiscidae that is also found in other late Middle Cambrian faunas from Tasmania, at Riana, Native Track Tier and St Valentin's Peak (Laurie et al. 1995). Much better preserved, and more complete specimens, are known from these localities (Bao 1995).

**Family PAPYRIASPIDIDAE** Whitehouse, 1939

**Papyriaspididae**, gen. et sp. indet.

**Pl. 3F, K**

Remarks
A single well-preserved partial librigena (UTGD 125371) and a partial thoracic segment (UTGD 125366) may belong in a single genus of the Papyriaspididae. It has a narrow border and part of a well-developed genal spine. A very well-developed and prominent caecal pattern radiates out from the shallow palpebral furrow. The librigena is similar to that figured by Opik (1961: pl.15, fig. 6) for *Pianaspis sors* (Opik).

**Trace Fossils**

**Pl. 3L, M**

Remarks
Two sets of what appear to be trilobite resting places occur at Locality 1. The larger one (Pl. 3M) has a length of almost 100 mm, while the smaller one (Pl. 3L) has a length of almost 30 mm. Both are incomplete. Given that only two specimens are available, it is difficult to assign these specimens to any particular ichnogenus, but they appear to be related to *Rusophycus*. One of the specimens (Pl. 3M) has a small specimen of *Goniagnostus nathorsti* resting on it.

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