TR16_50_65

## 10. Faunas from the Ferntree Group of south-eastern Tasmania

*M.J. Clarke*

In south-eastern Tasmania the Ferntree Group, which is the thickest and most persistent of all Tasmanian Permian rock units, comprises a characteristic sequence of medium-bedded, poorly-sorted mudstone and siltstone about 190 m in thickness. It overlies the richly fossiliferous Member E of the Malbina Formation with apparent conformity, and is in turn followed by the non-marine Cygnet Coal Measures, or massive- and cross-bedded, coarse-grained quartz sandstone of 'Triassic Ross Type'. The latter is apparently conformable in some sections, and disconformable in others (Hale, 1962). Everywhere in the Hobart area the base of the Ferntree Group is marked by a thin, but distinctive horizon of poorly-sorted and coarse-grained sandstone which is sometimes cross-bedded, pebbly and felspathic. This unit, the Risdon Sandstone, provides a convenient field datum which is readily apparent both lithologically and topographically. The remainder, and greater part of the Ferntree Group, comprises poorly-sorted mudstone and siltstone with occasional and impersistent pebbly horizons.

On Maria Island, the lithological correlate of the Ferntree Group is a little thinner and has a thickness of 162-165 m, but again comprises medium-bedded, poorly-sorted mudstone and siltstone. Three thin, but distinctive conglomeratic horizons occur at intervals of approximately 10 m, 50 m and 120 m above the base. The Risdon Sandstone correlate is absent and the Ferntree Group correlate rests directly on about 15 m of richly fossiliferous glauconitic and feldspathic sandstone; this is true of the Counsel Creek section at least. Further to the north, on the ridge above the quarries in the 'Crinoidal Zone' (Banks, 1958) about 1.3 km east of Darlington (fig. 10), the unit appears to be about 34 m thick). At its summit, the Ferntree Group correlate is succeeded with apparent conformity by massive-, and cross-bedded, quartz sandstone of 'Triassic Ross Type'.

Everywhere in south-eastern Tasmania, the Ferntree Group and its correlates are sparsely fossiliferous so that direct palaeontological proof of their age is lacking (Banks, 1962). Indirectly, and in a generalised sense, the rich faunas present in Malbina E indicate that the Ferntree Group is no older than Fauna IV (probably Fauna IVB or Fauna IVC) of the Queensland Bowen Basin (Dickins, 1964), and macrofloral and palynological assemblages from the Cygnet Coal Measures indicate that it is no younger than Permian (Banks and Naqvi, 1967). In detail, it seems doubtful whether the base of the Ferntree Group and its correlates is everywhere of the same age. For example, at Mt Nassau, Malbina E yields a rich fauna which includes:

*Fletcherithyris amygdala* (Dana); Campbell, 1965.
*Fletcherithyris parkesi* Campbell, 1965.
*Fusispirifer avicula* (G.B. Sowerby); Morris, 1845.
*Fusispirifer* sp. nov. (a very transverse form with degenerate ornament; = *F. malbinensis* Armstrong MS).
*Gilledia ulladullensis* Campbell, 1965.
*Maorielasma globosum* Campbell, 1965.
*Martiniopsis undulosa* (Campbell), 1961 and plicate var. nov.
*Martiniopsis magna* (Campbell), 1960, pl. 140, fig. 2.
*Notospirifer minutus* Campbell, 1960.
*Sulciplica phalaena* (Dana) (=*Spirifer vespertilio* G.B. Sowerby; Morris, 1845, pl. 17, fig. 3).
*Sulciplica transversa* Waterhouse, 1968.
*'Spirifer' duodecemcostatus* M'Coy; Armstrong, 1968.
Spiriferid gen. nov. (similar in external form and micro-ornament to *S. duodecemcostatus* M'Coy, but dental plates

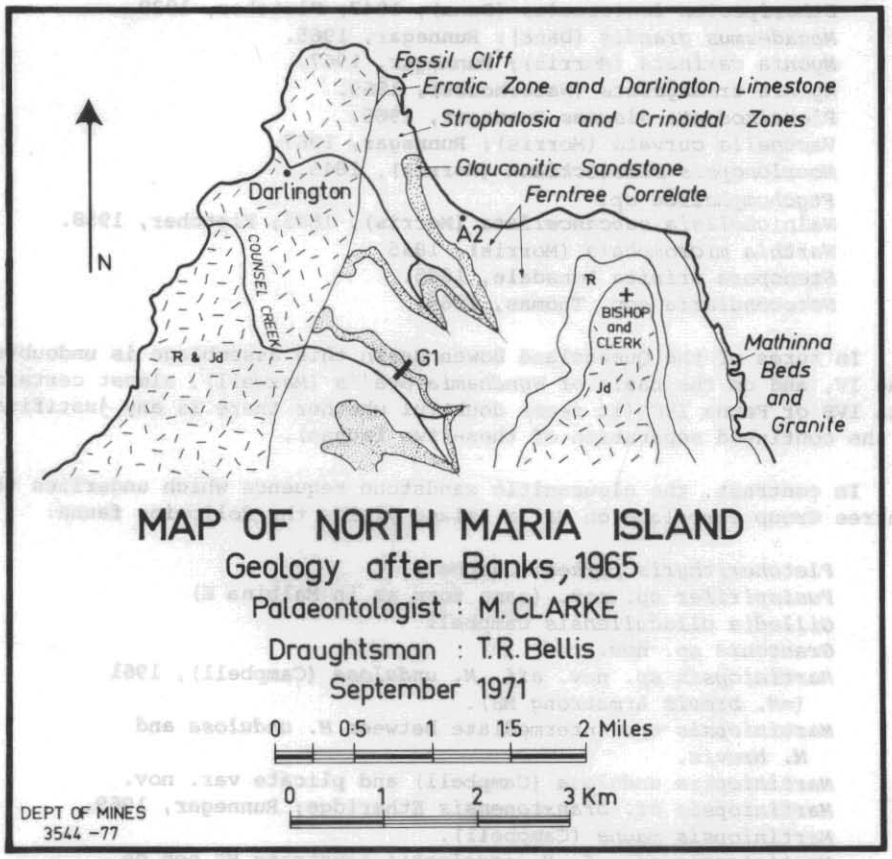



Figure 10.

5 cm

are stout and not continuous with the floor of the valve; dorsal adminincula are absent; and ventral umbonal and lateral shoulders are very heavily thickened with callus).
*Terrakea brachythaera* (Morris); Waterhouse, 1964.
*Wyndhamia ovalis* (Maxwell), 1954.
*Astartila intrepida* (Dana); Runnegar, 1965.
*Atomodesma* (*Aphanaia*) sp. Hill and Woods, 1964, pl. 14, fig. 5.
*Etheripecten fittoni* (Morris), 1845.
*Etheripecten leniusculus* (Dana), 1847; Fletcher, 1929.
*Megadesmus grandis* (Dana); Runnegar, 1965.
*Myonia carinata* (Morris); Runnegar, 1967.
*Myonia triangulata* (Waterhouse), 1969.
*Pleurikodonta elegans* Runnegar, 1965.
*Vacunella curvata* (Morris); Runnegar, 1967.
*Mourlonopsis strzleckiana* (Morris), 1845.
*Ptychomphalina sp.*
*Walnichollsia subcancellata* (Morris), 1845; Fletcher, 1958.
*Warthia micromphala* (Morris), 1845.
*Stenopora crinita* Lonsdale, 1845.
*Notoconularia* spp. Thomas, 1969.

In terms of the Queensland Bowen Basin this assemblage is undoubtedly Fauna IV, and on the basis of *Wyndhamia ovalis* (Maxwell), almost certainly Fauna IVB or Fauna IVC (it seems doubtful whether there is any justification for the continued separation of these two faunas).

In contrast, the glauconitic sandstone sequence which underlies the Ferntree Group correlate on Maria Island yields the following fauna:

*Fletcherithyris parkesi* Campbell
*Fusispirifer* sp. nov. (same form as in Malbina E)
*Gilledia ulladullensis* Campbell
*Grantonia* sp. nov.
*Martiniopsis* sp. nov. aff. *M. undulosa* (Campbell), 1961 (=*M. brevis* Armstrong MS).
*Martiniopsis* sp. intermediate between *M. undulosa* and *M. brevis*.
*Martiniopsis undulosa* (Campbell) and plicate var. nov.
*Martiniopsis* cf. *branxtonensis* Etheridge; Runnegar, 1969.
*Martiniopsis magna* (Campbell).
*Martiniopsis* sp. cf. *M. strzleckii* Armstrong MS non de Koninck, 1876.
*Notospirifer extensus* Campbell, 1961.
*Notospirifer minutus* Campbell.
*Sulciplica tasmaniensis* (Morris), 1845; Armstrong, 1968.
*Sulciplica transversa* Waterhouse.
*Terrakea brachythaera* (Morris)
*Wyndhamia enorme* Clarke, 1970; Maxwell, 1954.
*Wyndhamia dalwoodensis* Booker, 1929.
*Astartila intrepida* (Dana).
*Atomodesma* (*Aphanaia*) sp.
*Etheripecten subquinquelineatus* (M'Coy), 1854.
*Myonia carinata* (Morris).
*Myonia corrugata* Fletcher.
*Pyramus myiformis* (Dana), 1847.
*Vacunella curvata* (Morris).
*Ptychomphalina* sp.
*Stenopora crinita* Lonsdale.

Coarse-grained crinoidal limestone and calcareous siltstone beneath the glauconitic sequence yield a straight-forward Fauna II with *Cancrinella farleyensis* (Etheridge and Dun), *Grantonia hobartensis* Brown, *G. cracovensis* Wass, *Martiniopsis ovata* (Campbell), *M. profunda* (Campbell), *Taeniothaerus subquadratus* (Morris), *Wyndhamia preovalis* (Maxwell), *W. jukesi* (Etheridge), *Eurydesma* spp., *Deltopecten* spp. together with many other forms.

The overall aspect of the fauna from the glauconitic sandstone sequence is quite clearly post Fauna II, and contains certain species usually characteristic of more than one stratigraphical horizon. Bearing in mind that glauconite often indicates slow and intermittent, shallow water deposition, it seems reasonable to postulate that the Maria Island glauconitic sandstone unit may represent a condensed sequence. Unfortunately, the best exposed, most accessible section of the glauconitic unit in the Counsel Creek area (fig. 10) is inadequate to allow bed by bed collecting. However, within the limits set by the available exposure, *Martiniopsis brevis* Armstrong MS, *M.* cf. *branxtonensis* Etheridge, cf. *M. strzleckii* Armstrong MS non de Koninck, *Notospirifer extensus* Campbell, *Sulciplica tasmaniensis* (Morris) and *Wyndhamia enorme* Clarke appear to be confined to the lower part of the unit, whereas *Martiniopsis undulosa* (Campbell), *M. magna* (Campbell) and *Notospirifer minutus* Campbell appear to be confined to the higher part of the unit. Most of the bivalves, particularly *Vacunella curvata* (Morris), are commonest in the upper part of the unit. The remainder of the fauna is cosmopolitan; in particular, *Wyndhamia dalwoodensis* Booker, is still present in abundance in the finer-grained glauconitic siltstone and mudstone immediately beneath the Ferntree Group correlate. The available evidence therefore suggests that the lower part of the glauconitic sequence is best correlated with Fauna IIIA or Fauna IIIB in the Queensland Bowen Basin, and the Ulladulla Fauna in the Sydney Basin; these are the equivalents of Malbina A in the Mt Nassau section (Clarke, 1971). The higher part of the unit appears to be significantly younger. If *Megadesmus grandis* (Dana) and *Wyndhamia ovalis* (Maxwell), neither of which occur in the Maria Island glauconitic sequence where *Wyndhamia dalwoodensis* Booker persists throughout, are taken as reliable indices for Fauna IVB (as seems to be true in Tasmania at least), then a Fauna IIIC or Fauna IVA age seems to be the most probable for the upper part of the glauconitic unit. The author agrees with Runnegar (1969) that there seems to be little justification for the continued separation of Fauna IIIC and Fauna IVA.

Thus if the incoming of *Wyndhamia ovalis* (Maxwell) is a reliable guide, the base of the Ferntree Group proper in the Hobart area is slightly, but significantly younger than the base of the Ferntree Group correlate on Maria Island. In addition, the evidence outlined above lends support to the tentative suggestion of Brill (1956) that in eastern and north-eastern Tasmania, glauconitic sandstone developments represent condensed equivalents (at least in part) of the Malbina Formation of the Hobart area, rather than the Risdon Sandstone (Banks, 1962).

Although fragmentary and ill-preserved fossils have been periodically reported from the Ferntree Group (Lewis, 1946; Banks and Hale, 1957; Woolley, 1959; Gatehouse, 1967) few detailed identifications and no age assessments have been attempted. Recently, however, two small but apparently significant marine macrofaunas have been reported from the Ferntree Group of the Hobart area, and thus provide the first internal evidence of the age of the unit (Runnegar, 1967; Waterhouse, 1969; 1970; 1971). Although these two faunas were collected from separate localities, both appear to represent essentially the same stratigraphical horizon which occurs about 35-45 m below the summit of the Group. Runnegar (1967) recorded *Astartila intrepida* (Dana), *Megadesmus grandis* (Dana) and *Vacunella curvata* (Morris) from Flowerpot Point, Blackmans

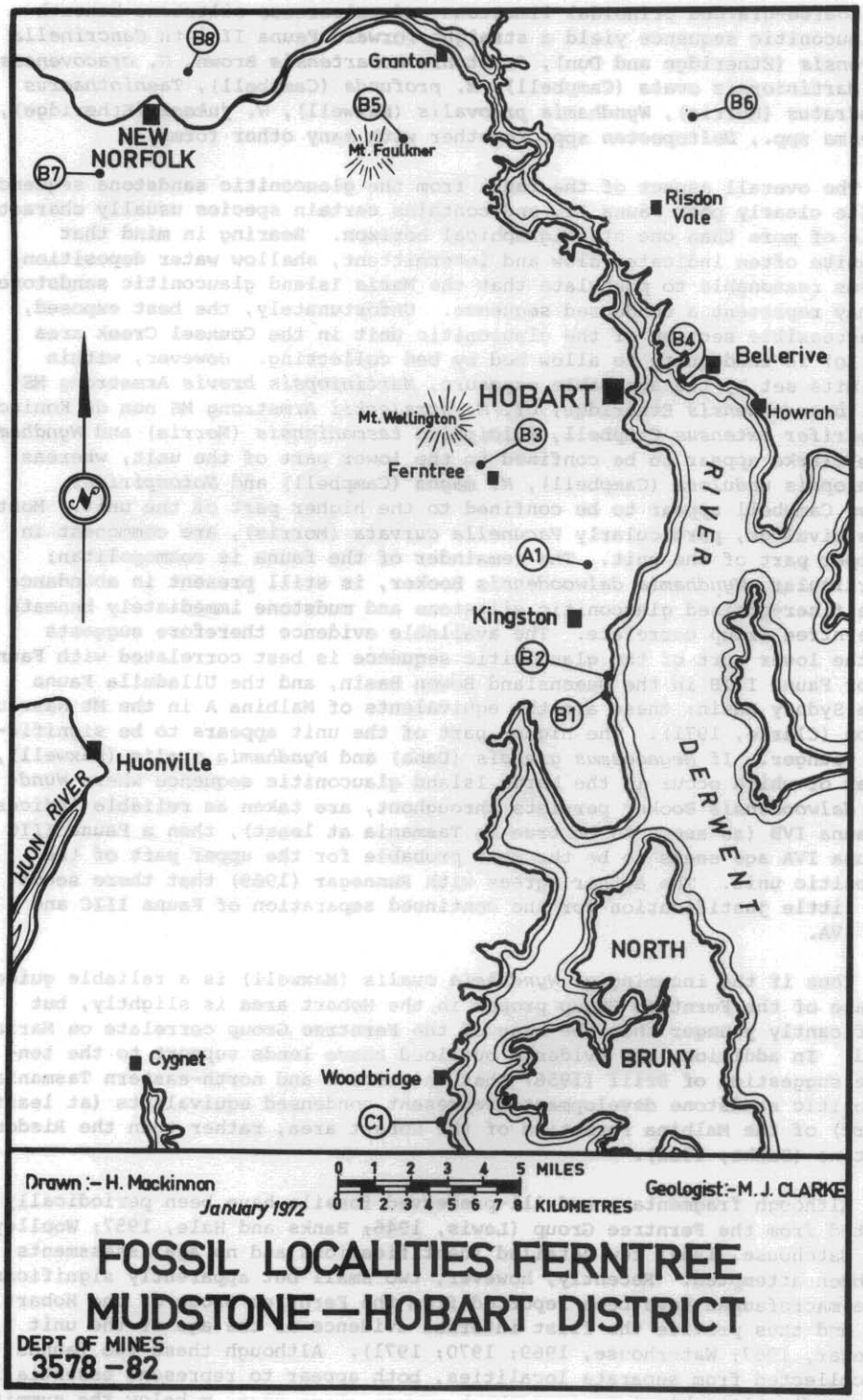



Figure 11.

5 cm

Bay, about 20 km south of Hobart (locality B2, fig. 11), and concluded that the Ferntree Group is not significantly younger than Malbina E or Fauna IVB of the Queensland Bowen Basin. Fauna IV is generally accepted as either Upper Kungurian or Lower Kazanian in terms of the world standard (Dickins, 1968; 1970). In contrast, Waterhouse (1969; 1970) reported *Martiniopsis antesulcata* (Waterhouse), [which is also named as *M. anteplicata* in Waterhouse (1967, p. 100),] *Eurydesma* and *Deltopecten* from 'tillite' within the Ferntree Group at Grasstree Hill, about 8 km north-east of Hobart (locality B6, fig. 11). Waterhouse proposed a correlation with the New Zealand Waiitian Stage which he equates with part of the uppermost Permian Tatarian Stage of the world standard (Waterhouse, 1969 *et seq.*).

These conflicting conclusions regarding the correlation of the Ferntree Group of south-eastern Tasmania with other Australasian sequences are of no small interest. Runnegar implies that no marine macrofaunas younger than Upper Kungurian or Lower Kazanian can be recognised in Tasmania, a situation closely paralleled throughout eastern Australia in both the Sydney and Bowen Basins (Runnegar, 1967 *et seq;* Dickins, 1964 *et seq.*). On the other hand, the proposed correlation of Waterhouse implies several more radical innovations viz:

(1) The characteristic Gondwanan bivalve genera *Eurydesma* and *Deltopecten* have much longer ranges in Tasmania than elsewhere in eastern Australia.

(2) A late Permian Tatarian period of cooling and glaciation can be recognised in Tasmania (as is also claimed for New Zealand and the Sydney Basin).

(3) Much younger and hitherto unknown Tatarian marine macrofaunas are present in Tasmania.

It is fortunate that recent regional mapping of the Hobart, Brighton and Kingborough Quadrangles by Dr D.E. Leaman and Dr N. Farmer, together with fieldwork by D.J. Jennings and the author on Maria Island, has not only increased the knowledge and understanding of the character and physical stratigraphy of the Ferntree Group, but has also revealed the presence of well-preserved and diverse faunas at nine additional localities. This new information is most pertinent to any attempt to resolve the conflicting conclusions proposed by Runnegar and Waterhouse.

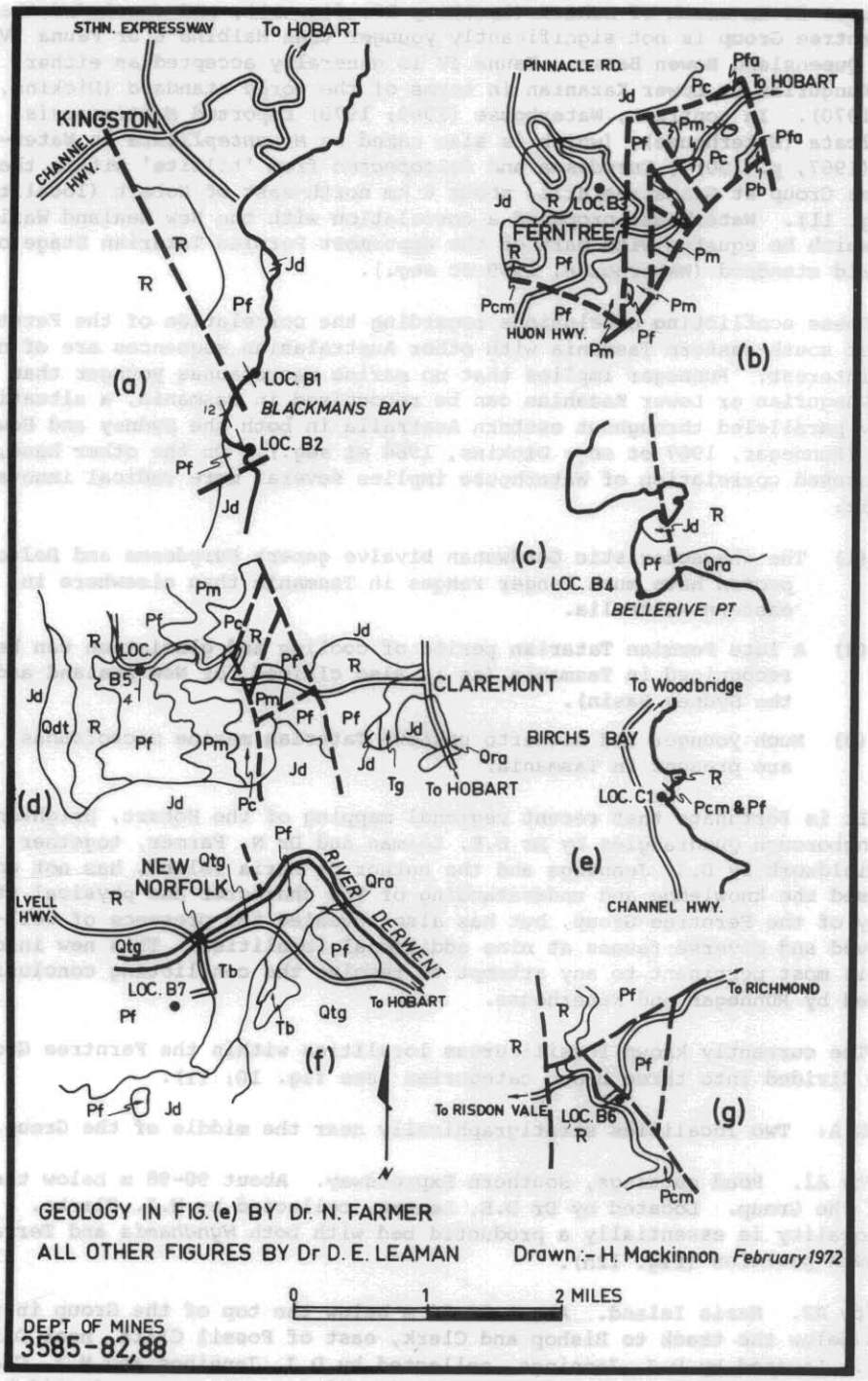
The currently known fossiliferous localities within the Ferntree Group can be divided into three broad categories (see fig. 10; 11).

HORIZON A: Two localities stratigraphically near the middle of the Group.

*Locality A1.* Road cuttings, Southern Expressway. About 90-98 m below the top of the Group. Located by Dr D.E. Leaman, collected by M.J. Clarke. This locality is essentially a productid bed with both *Wyndhamia* and *Terrakea* in growth position (fig. 12h).

*Locality A2.* Maria Island. About 82-84 m below the top of the Group in the cliffs below the track to Bishop and Clerk, east of Fossil Cliff, near Darlington. Located by D.J. Jennings, collected by D.J. Jennings and M.J. Clarke. This locality is similar to locality A1 and again comprises a productid bed with the material in growth position (fig. 10).

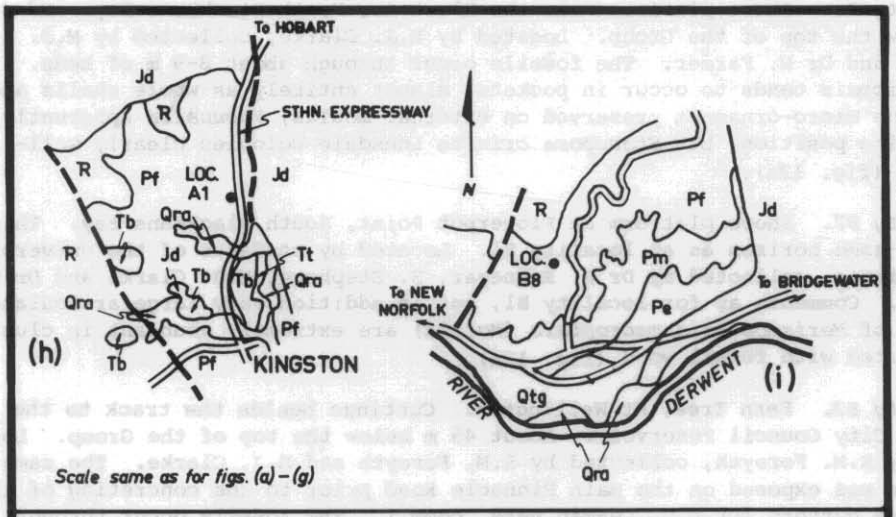
HORIZON B: Eight localities all stratigraphically within 37-46 m of the top of the Group.




Sketch maps of Ferntree Mudstone localities

5 cm

Figure 12a-g.




# LEGEND FOR FIGS. (a)—(i)

## SEDIMENTARY ROCKS

| | | |
|---|---|---|
| QUATERNARY | Qra | Alluvium |
| | Qtg | Gravel |
| | Qtd | Talus |
| TERTIARY | Tg | Gravel |
| TRIASSIC | R | Sandstone |
| PERMIAN | Pcm | Cygnet Coal Measures |
| | Pf | Ferntree Group |
| | Pm | Malbina Formation |
| | Pc | Cascades Group |
| | Pfa | Faulkner Group |
| | Pb | Bundella Mudstone |

## IGNEOUS ROCKS

| | | |
|---|---|---|
| TERTIARY | Tb | Basalt |
| | Tt | Sub-Basaltic Tuffs |
| JURASSIC | Jd | Dolerite |

DEPT OF MINES
3585—82,88

Sketch maps of Ferntree Mudstone localities

Figure 12h-i.

5 cm

*Locality B1.* Shore platform near the Blowhole, North Blackmans Bay. 37-46 m below the top of the Group. Located by M.J. Clarke, collected by M.J. Clarke and Dr N. Farmer. The fossils occur through about 8-9 m of beds. *Martiniopsis* tends to occur in pockets, almost entirely as whole shells and with the micro-ornament preserved on external moulds; *Vacunella* apparently in living position, but *Stenopora crinita* Lonsdale colonies clearly well-rolled (fig. 12a).

*Locality B2.* Shore platform at Flowerpot Point, South Blackmans Bay. This is the same horizon as at locality B1. Located by students of the University of Tasmania, collected by Dr B. Runnegar, S. Stephens, M.J. Clarke and Dr N. Farmer. Comments as for locality B1, but in addition very large articulated valves of *Merismopteria macroptera* (Morris) are extremely abundant in clusters associated with fossil wood (fig. 12a).

*Locality B3.* Fern Tree, Mt Wellington. Cuttings beside the track to the Hobart City Council reservoir. About 45 m below the top of the Group. Located by S.M. Forsyth, collected by S.M. Forsyth and M.J. Clarke. The same horizon was exposed on the main Pinnacle Road prior to the concreting of the drainage gutters (Dr D.E. Leaman pers. comm.). The fossils occur through about 10 m of beds. Articulated *Merismopteria macroptera* (Morris) is very common in clusters, and *Martiniopsis* and the bivalves occur as whole shells (fig. 12b).

*Locality B4.* Shore platform, Bellerive Point. Exact horizon unknown but at least 37 m below the top of the Group. Located by Dr D.E. Leaman, collected by M.J. Clarke and Dr N. Farmer. The fossils occur through about 8 m of beds. The spiriferids and bivalves occur as whole shells, and *Vacunella* in apparent living position (fig. 12c).

*Locality B5.* Mt Faulkner. Road cuttings beside Sky Farm Road, Upper Claremont. About 37 m below the top of the Group. This section occurs on the eastern slope of Mt Faulkner and is about two miles south of the Mt Nassau section. Mt Nassau is a subsidiary prominence on the northern flank of Mt Faulkner. Located by Dr D.E. Leaman, collected by M.J. Clarke. The fossils occur in two bands about one metre apart. Articulated *Merismopteria* is very abundant (fig. 12d).

*Locality B6.* Grasstree Hill. Road cuttings beside the road from Risdon Vale to Richmond. About 37 m below the top of the Group. Located by Dr D.E. Leaman, collected by Dr J.B. Waterhouse and M.J. Clarke. The fossils occur both in clusters and scattered sparsely through about 6 m of beds. Those in clusters occur almost entirely as whole shells; those scattered individually mostly comprise well-rolled ventral umbonal fragments of *Martiniopsis*. *Stenopora crinita* Lonsdale is abundant as large, but clearly well-rolled masses (fig. 12g).

*Locality B7.* Peppermint Hill, New Norfolk. Excavations for council reservoir. Exact stratigraphical horizon unknown, but at least 107 m above the base, and at least 33m below the top of the Group. Located by D. Woolley, collected by M.J. Clarke. All the components of this fauna except *Fletcherithyris* and *Maorielasma* are disarticulated and fragmentary (fig. 12f).

*Locality B8.* Boyer, near New Norfolk. Natural outcrops in paddock west of track at [980349] (see Woolley, 1959). About 45 m below the summit of the Group. Located by D. Woolley, collected by M.J. Clarke. The fossils comprise mainly *Martiniopsis* both as well-rolled fragments scattered through at least 4.5 m of beds and as whole shells occurring in clusters or pockets (fig. 12i).

HORIZON C; A single locality stratigraphically 12-15 m below the top of the Group.

*Locality C1.* Shore platform near Birchs Bay, south of Woodbridge [EN1960 1875] (fig. 12e). Located by Dr N. Farmer, collected by M.J. Clarke and Dr N. Farmer. The fossils occur through at least 3 m of beds, but most are concentrated in a bed about 38 cm thick. An extremely rich and diverse fauna. Brachiopods and bivalves occur almost entirely as whole shells. Orientation random except for *Vacunella* which appears to be in living position. Very delicate spinose micro-ornaments of spiriferids and terebratulids beautifully preserved.

Faunas: (The asterisks indicate the more abundant species).

**Fletcherithyris amygdala* (Dana) B8, C1.
*Fletcherithyris parkesi* Campbell A2, B7.
*Fusispirifer avicula* (G.B. Sowerby); Morris A2, B7.
*Maorielasma globosum* Campbell ?B7, C1.
**Martiniopsis magna* (Campbell) B1, B2, B3, B4, B6, B7, B8.
*Martiniopsis* cf. *undulosa* (Campbell) B1, B3, B4, B8.
*Martiniopsis globosa* (Campbell) B8.
*Notospirifer minutus* Campbell C1.
*'Spirifer' duodecemcostatus* M'Coy B4.
*Subansiria* (or *Pseudosyrinx*) sp. C1.
*Sulciplica transversa* Waterhouse A1, A2, B7.
*Spiriferid gen. nov. (as in Malbina E) C1.
**Terrakea brachythaera* (Morris) A1, A2, B1, B4, B6, B7, B8, C1.
**Wyndhamia ovalis* (Maxwell) A1, A2, C1. Rare specimens at these localities are close to *W. planata* (Waterhouse) and *W. clarkei* (Etheridge).
**Astartila intrepida* (Dana) B1, B2, B3, B4, B5, B6, B7, B8, C1.
*Atomodesma* (*Aphanaia*) sp. A2.
*Etheripecten leniusculus* (Dana) A2, B6, B7, C1.
**Megadesmus grandis* (Dana) B1, B2, B3, B6, C1.
*Megadesmus gryphoides* (de Koninck) C1.
**Merismopteria macroptera* (Morris) B1, B2, B3, B4, B5, B6, B7, C1.
*Myonia carinata* (Morris) A2, B6, B7.
**Myonia triangulata* (Waterhouse) B2, C1.
*Nuculopsis* (*Nuculopsis*) sp. B6.
*Pleurikodonta elegans* Runnegar B7, C1.
*Schizodus* sp. C1.
*Stutchburia* cf. *compressa* (Morris) and spp. A1, B4, B6, B7, B8, C1.
**Vacunella curvata* (Morris) A2, B1, B2, B4, B5, B6, B7, B8, C1.
*Ptychomphalina* sp. A2, B5, B6, B7.
*Warthia micromphala* (Morris) B7, C1.
**Stenopora crinita* Lonsdale A2, B1, B2, B3, B4, B5, B6, C1.
*Euryphyllum* sp. A2.
Ostracods A2.
*Gangamopteris* sp. ?B8, C1.

The vertical distributions of the various species within these faunas show some variation (fig.13 ). Thus of the thirteen species recorded from Horizon A, all occur in Malbina E, 10 occur at Horizon B and 6 occur at Horizon C. Similarly, of the 22 species recorded from Horizon B, only 12 occur at Horizon C yet 20 occur in Malbina E. The two exceptions are *Nuculopsis* (*Nuculopsis*) sp. and large ***Merismopteria macroptera*** (Morris). Horizon B is further distinguished from both Malbina E and Horizon A by the absence of *Wyndhamia ovalis* (Maxwell), *Euryphyllum* and *Atomodesma* (*Aphanaia*) sp. Of the 19 species recorded from Horizon C, 12 occur at Horizon B and only 6

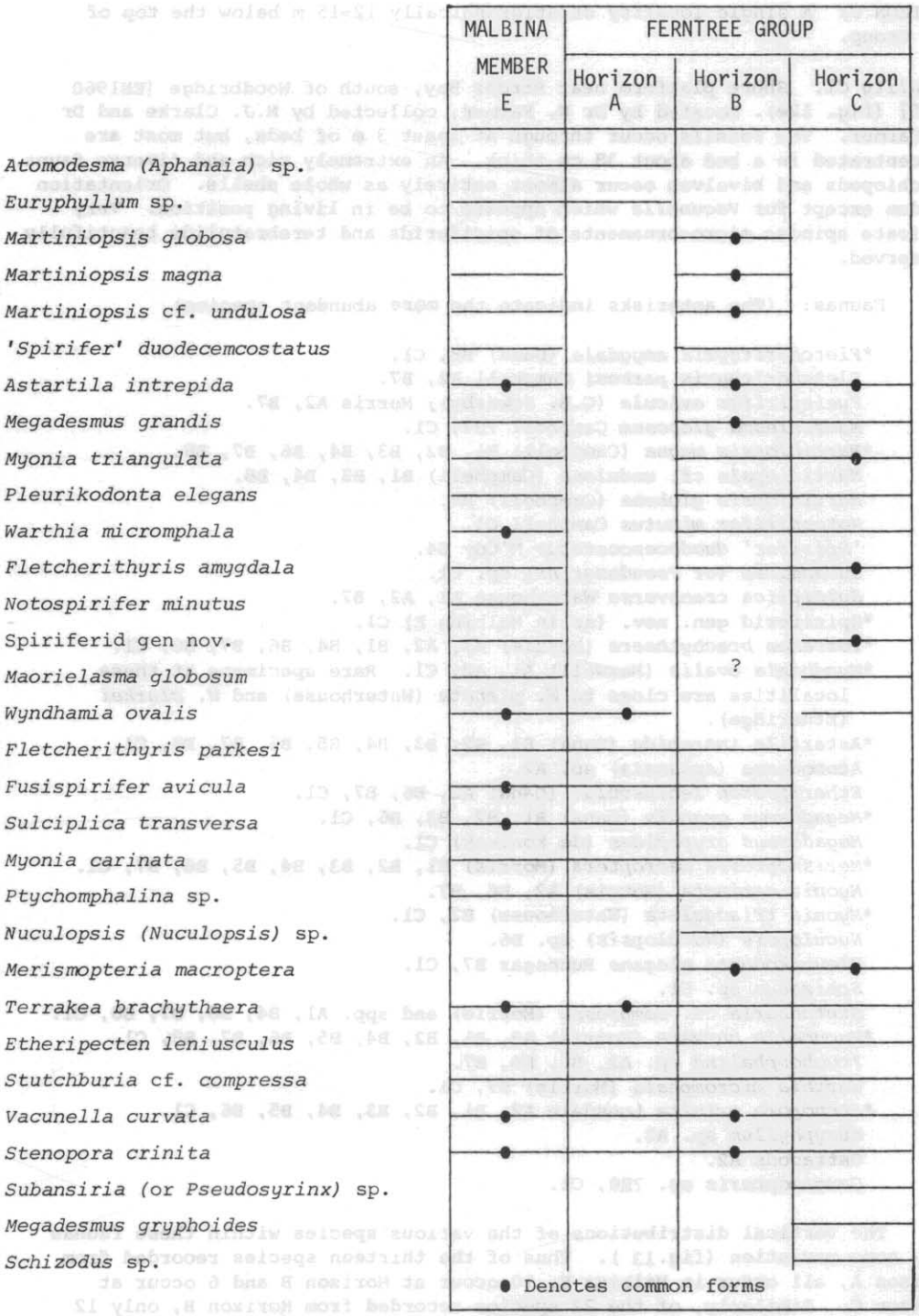



Figure 13. *Stratigraphic distributions of fossils in Malbina E and the Ferntree Group.*

at Horizon A, yet 15 occur in Malbina E. The four exceptions are rare specimens of *Megadesmus gryphoides* (de Koninck), *Schizodus* sp. and *Subansiria* (or *Pseudosyrinx*) sp. together with abundant large *Merismopteria macroptera* (Morris). Horizon C is additionally distinguished from Malbina E and Horizons A and B by the absence of the genera *Martiniopsis, Fusispirifer* and *Sulciplica*. Thus the three fossil horizons within the Ferntree Group are individually characteristic and may prove useful locally as an aid in stratigraphical and structural interpretation. However, despite the individuality of each of the fossil horizons within the Ferntree Group, none differs substantially from the fauna of Malbina E. In particular, Horizon A is indistinguishable on positive faunal grounds. Thus the original contention of Runnegar (1967) that palaeontologically the Ferntree Group is not significantly younger than Malbina E is herein supported. To recognise two further faunas (and Horizons B and C are more distinct from one another than either is from both Horizon A or Malbina E) is thought to be an unwarranted fragmentation, an approach that if taken to its logical conclusion, would ignore the important relationship between lithofacies and faunal phase. It would virtually necessitate the recognition of a unique fauna at each fossiliferous locality. Thus no significance is attached to the occurrence of rare specimens of *Nuculopsis* (*Nuculopsis*) sp. at locality B6, and *Subansiria* (or *Pseudosyrinx*) sp. *Schizodus* sp., and *Megadesmus gryphoides* at locality C1 since:

(1) Elsewhere in Tasmania, nuculanids are extremely rare except for *Phestia darwini* (de Koninck) which occurs locally very low in Sakmarian (Allandale Fauna) equivalents.

(2) Apart from *Neoschizodus australis* Runnegar which is abundant very low in northern Tasmanian Sakmarian faunas, schizodont bivalves are also very rare.

(3) *Pseudosyrinx allandalensis* Armstrong occurs in some abundance in Sakmarian faunas, and *Subansiria procera* Armstrong occurs sparingly in L. Artinskian (Fauna II) equivalents, but elsewhere in the Tasmanian succession syringothyrids are unknown.

(4) *Megadesmus gryphoides* (de Koninck) is otherwise known in Tasmania only at Latrobe in very low Sakmarian faunas (Johnston, 1888; Runnegar, 1965; Waterhouse, 1969). Whereas this species is known in Fauna I, Fauna II and Fauna III in the Queensland Bowen Basin, the present occurrence suggests that it may persist throughout the Tasmanian sequence.

The presence of large *Merismopteria macroptera* (Morris) at Horizons B and C, the absence of the genera *Martiniopsis, Sulciplica* and *Fusispirifer* at Horizon C, the absence of *Euryphyllum* and *Atomodesma* (*Aphanaia*) sp., and the rarity of *Wyndhamia ovalis* (Maxwell) and *Terrakea brachythaera* (Morris) above Horizon A, are in all probability the consequence of facies control.

The record of *Martiniopsis antesulcata* (Waterhouse), *Eurydesma* and *Deltopecten* from 'tillite' within the Ferntree Group at Grasstree Hill (locality B6) by Waterhouse (1969, 1970) is therefore strongly at variance with the results of the present investigation. The writer has not seen the material collected by Waterhouse so that no conclusive comments are in order. However, his results may be questioned on several grounds:

(1) It should be emphasised that in Tasmania, tillite has not been recognised above the basal Wynyard Tillite or its correlates such as the Woodbridge Tillite or Woodbridge Glacial Formation (see Smith, 1957; Banks and Read, 1962; Bravo and Pike, 1969 for explanations of the confusion which surrounds this term). Faunal

and floral evidence from these tillites is scanty but the record of *Rhacopteris ovata* (Banks, *in* Gulline, 1967) from the Hellyer Gorge suggests that they may be, in part, of Carboniferous age. Elsewhere, such as at Maydena (Runnegar, 1969) and Frankford, sparse *Eurydesma* faunas indicate a Permian age. At many localities, especially Latrobe, rich faunas almost immediately above tillite prove that it is not younger than Sakmarian (Allandale Fauna). The Ferntree Group at Grasstree Hill contains a few small, scattered pebbles but is otherwise less pebbly than many other localities both in the Ferntree Group and at very many other horizons throughout the Tasmanian sequence.

(2) The material of *Martiniopsis antesulcata* (Waterhouse), the critical species on which the New Zealand Waiitian Stage is based, is most unsatisfactory. Until such time that adequate topotype material becomes available and allows a strict morphological definition of the species, no sensible or meaningful comparisons can be made. All the martiniopsids that the writer has seen from the Ferntree Group are close to either *M. magna* (Campbell), 1960, pl. 140, fig. 2, or *M. undulosa* (Campbell) 1961, or *M. globosa* (Campbell) 1960. *M. magna* is generally regarded as a reliable indication of Fauna IIIC-IV, that is, a pre-Tartarian horizon at least (Waterhouse, 1971).

(3) *Eurydesma* and *Deltopecten* are two well-known and characteristic Gondwanan bivalves. In Tasmania and eastern Australia both genera are enormously abundant in Sakmarian (Allandale) faunas. Both persist in some abundance in Lower Artinskian (Fauna II) assemblages, but thereafter suffer a rapid decline; *Eurydesma* the more so. The youngest known occurrence of both genera in Tasmania is at Arcadian Siding, near Maydena in rocks which yield a fauna which is impressively similar to that of Malbina A in the Mt Nassau section (Clarke, 1971). [*Deltopecten* has now been found, but *Eurydesma* still remains unknown from Malbina A in its type section.] Malbina A is no younger than U. Artinskian (Baigendzhinian) or Fauna IIIA-IIIB in Queensland or the Ulladulla Fauna in the Sydney Basin. Thus the Tasmanian distribution of *Deltopecten* and *Eurydesma* is in close agreement with those elsewhere in eastern Australia (Dickins, 1968). No valid comparison with New Zealand seems justified since *Eurydesma* is there unknown, and *Deltopecten* is rare. The record of both genera from Grasstree Hill by Waterhouse must therefore be treated with caution. Without his material no definite conclusion can be drawn. It is possible, however, that *Astartila intrepida* (Dana) may have been misidentified as *Eurydesma* since internal moulds of this species from several localities within the Ferntree Group show a superficial resemblance to small specimens of *Eurydesma*, the more so when the umbonal cavities are incompletely filled with sediment. *Etheripecten leniusculus* (Dana) has a rather long and triangular resilifer pit, but is quite distinct from biconvex, coarsely-costate forms with the ligamental structure of *Deltopecten*.

(4) Scientific hypotheses must be based on observations and experiments, the results of which must be reproducible. The exact experiment of Waterhouse has been repeated and similar experiments have been conducted at ten other localities within the Ferntree Group. The broadly consistent results are strongly at variance with his conclusions.

The fauna obtained from Grasstree Hill (locality B6) in this study is listed below. The possible equations with the species recorded by Waterhouse are indicated.

*Martiniopsis* cf. *magna* (Campbell), 1960, pl. 140, fig. 2
(?= *Ambikella antesulcata* Waterhouse).
*Terrakea brachythaera* (Morris).
*Astartila intrepida* (Dana) (?= *Eurydesma* Waterhouse).
*Etheripecten leniusculus* (Dana) (?= *Deltopecten* Waterhouse).
*Megadesmus grandis* (Dana)
*Merismopteria macroptera* (Morris)
*Myonia carinata* (Morris)
*Nuculopsis* (*Nuculopsis*) sp.
*Stutchburia* sp.
*Vacunella curvata* (Morris)
*Ptychomphalina* sp.
*Stenopora crinita* Lonsdale

The fauna obtained from locality B2 (Runnegar, 1967) and the equivalent horizon at the Blowhole, Blackmans Bay (locality B1) in this study is also listed for comparison.

*Martiniopsis magna* (Campbell), 1960, pl. 140, fig. 2.
*Martiniopsis* cf. *undulosa* (Campbell)
*Terrakea brachythaera* (Morris)
*Astartila intrepida* (Dana)
*Megadesmus grandis* (Dana)
*Merismopteria macroptera* (Morris)
*Myonia triangulata* (Waterhouse)
*Stutchburia* sp.
*Vacunella curvata* (Morris)
*Stenopora crinita* Lonsdale

## CONCLUSIONS

There is no tillite or other obvious evidence for an increase in glacial intensity within the Ferntree Group of south-eastern Tasmania.

Faunas from eleven localities indicate that three separate and individually characteristic fossil horizons occur within the Ferntree Group. Although these horizons may prove useful locally as an aid to stratigraphical and structural interpretation, they are considered not to differ significantly in age from Malbina E or Fauna IVB-C in the Queensland Bowen Basin (=Upper Kungurian or Lower Kazanian).

In Tasmania, *Eurydesma* and *Deltopecten* are not known with certainty above horizons correlative with the Ulladulla Fauna in the Sydney Basin or Fauna IIIA-IIIB in the Bowen Basin (=Upper Artinskian or Baigendzhinian).

The base of the Ferntree Group and its correlates is diachronous being younger in the Hobart area than on Maria Island.

Glauconitic sandstones below the Ferntree Group correlate on Maria Island are the condensed equivalents of the Malbina Formation of the Hobart area (at least in part), rather than the Risdon Sandstone.

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## REFERENCES


ARMSTRONG, J.D. 1968. Synonomy of the Australian spiriferid genera *Trigonotreta* Koenig, 1825 and *Grantonia* Brown, 1953. *J.geol.Soc.Aust.* 15:79-86.

ARMSTRONG, J.D. 1970. *Eastern Australian Permian spiriferid brachiopods.* Ph.D. thesis. University of Queensland.

BANKS, M.R. 1958. Recent additions to the knowledge of the Permian System in Tasmania. *20th Int.geol.Congr.* Comision para la Correlacion del Sistema Karroo: 151-177.

BANKS, M.R. 1962. Permian *in* SPRY, A.; BANKS, M.R. (ed.). The geology of Tasmania. *J.geol.Soc.Aust.* 9:189-215.

BANKS, M.R. 1965. Maria Island *in* SMITH, E.M.; WILLIAMS, E. *Geological excursions for the Australian and New Zealand Association for the Advancement of Science 38th Congress. 16-20th August 1965*:34-36. Department of Mines : Hobart.

BANKS, M.R. 1967. *in* GULLINE, A.B. The first proved Carboniferous deposits in Tasmania. *Aust.J.Sci.* 29(9):332-333.

BANKS, M.R.; HALE, G.E.A. 1957. A type section of the Permian System in the Hobart area. *Pap.Proc.R.Soc.Tasm.* 91:41-64.

BANKS, M.R.; NAQVI, I.H. 1967. Formations close to the Permo-Triassic boundary in Tasmania. *Pap.Proc.R.Soc.Tasm.* 101:17-30.

BOOKER, F.W. 1929. Preliminary note on new subgenera of *Productus* and *Strophalosia* from the Branxton district. *J.Proc.R.Soc.N.S.W.* 63:24-32.

BRAVO, A.P.; PIKE, G.P. 1970. Amended and renamed groups of the Upper Permian Rocks of the Western Tiers area, Tasmania. *Tech.Rep.Dep.Mines Tasm.* 13:83-85.

BRILL, K.G. 1956. Cyclic sedimentation in the Permian System of Tasmania. *Pap.Proc.R.Soc.Tasm.* 90:131-140.

CAMPBELL, K.S.W. 1960. The brachiopod genera *Ingelarella* and *Notospirifer* in the Permian of Queensland. *J.Paleont.* 34:1106-1123.

CAMPBELL, K.S.W. 1961. New Species of the Permian spiriferoids *Ingelarella* and *Notospirifer* from Queensland and their stratigraphical implications. *Palaeontographica* A 117:159-192.

CAMPBELL, K.S.W. 1965. Australian Permian terebratuloids. *Bull.Bur.miner. Resour.Geol.Geophys.Aust.* 68.

CLARKE, M.J. 1970. Tasmanian Strophalosiidae. *Rec.geol.Surv.Tasm.* 10.

CLARKE, M.J. 1971. The fauna and age of Malbina A. *Tech.Rep.Dep.Mines Tasm.* 14:151-157.

DICKINS, J.M.; MALONE, E.J.; JENSEN, A.R. 1964. Subdivision and correlation of the Permian Middle Bowen Beds, Bowen Basin, Queensland. *Rep.Bur. miner.Resour.Geol.Geophys.Aust.* 70.

DICKINS, J.M. 1968. Correlation of the Permian of the Hunter Valley, New South Wales, and the Bowen Basin, Queensland. *Bull.Bur.miner.Resour. Geol.Geophys.Aust.* 80:29-44.

DICKINS, J.M. 1970. Correlation and subdivision of the Permian of western and eastern Australia. *Bull.Bur.miner.Resour.Geol.Geophys.Aust.* 116: 17-27.

GATEHOUSE, C.G. 1967. Geology of the Richmond-Sorell Area. *Pap.Proc.R. Soc.Tasm.* 101:1-7.

HALE, G.E.A. 1962. Triassic System *in* BANKS, M.R.; SPRY, A. (ed.). The Geology of Tasmania. *J.geol.Soc.Aust.* 9(2):217-224.

JOHNSTON, R.M. 1888. *Systematic account of the geology of Tasmania.* Government Printer : Hobart.

LEWIS, A.N. 1946. *Geology of the Hobart District.* Mercury Press : Hobart.

MAXWELL, W.G.H. 1954. *Strophalosia* in the Permian of Queensland. *J.Paleont.* 28:533-559.

MORRIS, J. 1845. Descriptions of fossils. Mollusca *in* STRZLECKI, P.E. *Physical descriptions of New South Wales and Van Diemans Land:* 270-291. Longman, Brown & Longman : London.

RUNNEGAR, B.N. 1965. The bivalves *Megadesmus* Sowerby and *Astartila* Dana from the Permian of eastern Australia. *J.geol.Soc.Aust.* 12:227-252.

RUNNEGAR, B.N. 1967. Desmodont bivalves from the Permian of eastern Australia. *Bull.Bur.miner.Resour.Geol.Geophys.Aust.* 96.

RUNNEGAR, B.N. 1969. The Permian faunal succession in eastern Australia. *Spec.Publ.geol.Soc.Aust.* 2:73-98.

SMITH, E.M. 1957. *Lexicon of the Stratigraphy of Tasmania.* Bureau of Mineral Resources, Geology and Geophysics : Canberra.

THOMAS, G.A. 1969. *Notoconularia*, a new conularid genus from the Permian of eastern Australia. *J.Paleont.* 43:1283-1290.

WATERHOUSE, J.B. 1966. Lower Carboniferous and Upper Permian Brachiopods from Nepal. *Jb.geol.Bundesanst. Wien, Sonderbd.* 12:5-99.

WATERHOUSE, J.B. 1967. Upper Permian (Tatarian) brachiopods from New Zealand. *N.Z.Geol.Geophys.* 10:74-118.

WATERHOUSE, J.B. 1968. The classification and descriptions of Permian Spiriferida (Brachiopoda) from New Zealand. *Palaeontographica* A. 129:1-94.

WATERHOUSE, J.B. 1969. World Correlations of New Zealand Permian stages. *N.Z.J.Geol.Geophys.* 12:713-737.

WATERHOUSE, J.B. 1970. Correlation of marine Permian faunas for Gondwana. *Proc.Pap.2nd Gondwana Symp:* 381-387.

WATERHOUSE, J.B. 1971. The Permian brachiopod genus *Terrakea* Booker, 1930. *Smithsonian Contrib.Paleobiol.* 3:347-361.

WOOLLEY, D.R. 1959. The geology of the New Norfolk-Black Hills district. *Pap.Proc.R.Soc.Tasm.* 93:97-109.