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1985/24. A diamond drill hole at Little Peppermint Bay, Woodbridge

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Abstract

A fully cored diamond drill hole at Little Peppermint Bay, Woodbridge [EN193226] has proved a thickness of 316 m for the Late Carboniferous Truro Tillite. The Truro Tillite is the basal formation within the Parmeener Supergroup and rests unconformably on a basement of lowest Palaeozoic(?) / relatively unmetamorphosed Precambrian(?) phyllite and quartzite. On the hill slopes above and west of the collar of the hole a further 130 m of tillite is exposed beneath the overlying glendonitic Woody Island Formation, so that the Truro Tillite has a total thickness of about 450 m in the Woodbridge area. This is the thickest known development anywhere in southeast Tasmania and is only exceeded by developments of the Wynyard Tillite in the Wynyard-Hellyer Gorge area, northwest Tasmania. It contrasts with the Hobart area where tillite is absent in the Glenorchy bore. The borehole also proved a substantial (320 m) layered body of Jurassic dolerite, and over thirty substantial sheet-like and dyke intrusions of Cretaceous alkaline rocks. The latter intrude both tillite and dolerite, and some of the thicker bodies are clearly composite; they occur with an ever increasing frequency and become noticeably more xenolithic down hole to the unconformity. The major layered dolerite body encountered at Little Peppermint Bay is similar to major layered dolerite bodies encountered close to the basal unconformity in boreholes at Margate, Glenorchy and Mt Nassau, and in the Mathinna Beds at the Quoin.

INTRODUCTION

Late Palaeozoic tillite has long been known at Little Peppermint Bay, Woodbridge (Hogg, 1902), and the locality was designated as the type section of the Woodbridge Glacial Formation (Hills and Carey, 1949). The Woodbridge Glacial Formation was stated to occupy a stratigraphical position between the Cascades Group and Ferntree Mudstone, and indicate a period of Late Permian glaciation quite distinct from the widespread Late Carboniferous glacial rocks (Wynyard Tillite and correlates) which occupy a basal position within the Parmeener Supergroup elsewhere in Tasmania. Nowhere in the Woodbridge-Cygnets-Hobart area is the basal unconformity exposed, but more recent detailed mapping in the Kingborough map sheet (Farmer, 1981) has demonstrated that the Little Peppermint Bay section is transected by a major fault which juxtaposes tillite against the Minnie Point Formation, Risdon Sandstone and Abels Bay Formation (= Ferntree Mudstone auctt.). Furthermore, age equivalents of the Cascades Group do not occur in the Woodbridge-Cygnets area, and on the hill slopes above and west of Little Peppermint Bay the tillite is overlain conformably by typical glendonitic Woody Island Formation. A similar stratigraphical relationship is demonstrable throughout the Cygnets area. The tillite therefore occupies a similar basal stratigraphic position as other Late Palaeozoic glacial rocks in Tasmania. Because of the confusion associated with the name Woodbridge Glacial Formation the basal glacial rocks in the Woodbridge-Cygnets area were re-named the Truro Tillite (Farmer, 1981). The detailed reasons are discussed in Farmer (1985).

The present borehole was therefore sited to determine the thickness of the tillite and associated glaciogene rocks, and to determine the nature of the pre-Parmeener Supergroup basement. It is the final borehole in a systematic drilling programme which has proved invaluable in elaborating the detailed stratigraphic relationships of Lower Parmeener Supergroup rocks throughout the Kingborough and Hobart map sheets.

All objectives were achieved, but not before overcoming serious drilling difficulties. Drilling of the original hole (BQ diameter) proved impossible below 696 m. The rods were recovered, however, and the hole was cemented back to 624 m, then cased. A wedge-off hole (AQ diameter) was then completed to a depth of 1023 m.

The basal beds of the Truro Tillite were proved to rest unconformably on a basement of black phyllite and minor quartzite of lowest Palaeozoic(?) / relatively unmetamorphosed Precambrian(?) type at a depth of 998 m. The unconformity surface is essentially planar and is inclined at an angle of about 15°, parallel to the prominent cleavage in the phyllite. The three lowermost intersections of the Truro Tillite are more properly described as mixtites. They contain a predominance of locally derived material from the underlying phyllite basement, and the alignment of the clasts within them suggests deposition from mass flow (see Appendix 1). The major intersections of glaciogene rocks consist of unsorted angular clasts of quartzwacke, quartzite, quartz-mica schist, phyllite, carbonate, feldspar porphyry and single grains of quartz, mica and chlorite, set in matrix of very fine-grained quartz, micaceous material and sparse iron oxides. These rocks can be reasonably interpreted as tillites. Metamorphism due to syenite and dolerite intrusions has affected most specimens. Metamorphic spots often occur in the matrix and are commonly centred on clasts. Thin sections of specimens from 756 m, 845 m, 852.30 m, 913.50 m, 929 m and 946 m exhibit a preferred orientation of recrystallised micaceous material within the spots in two directions, the bisectrix of which is parallel to the length of the core. This suggests that there was a superincumbent load control during metamorphism (see Appendix 1).

An interval of 3.5 m of dark grey to black, banded rhythmite siltstone with a few small clasts between 95.0 - 98.5 m possibly represents glaciolacustrine conditions.

The Truro Tillite is intruded by a major body of Jurassic dolerite, and both are intruded by over thirty bodies of Cretaceous alkaline rocks. The contacts of the dolerite are flat-lying and very fine-grained, but the grain size rapidly increases away from the contacts. The body is conspicuously layered with alternations of mottled coarse- to very coarse-grained dolerite in the upper third, and coarse- and medium-grained dolerite in the middle third. The lower third is more uniform fine- to medium-grained dolerite with rare banding.

Over thirty intersections of Cretaceous alkaline rocks were encountered. Thicknesses range from 400 mm to 37 m, but most fall within the range of 5 - 20 m. Both sheet-like bodies and dykes are present. The thicker bodies are sheet-like and some are composite with sub-parallel internal and external contacts. Chilled margins are very thin and abrupt. The alkaline rocks mostly consist of drab grey and buff-coloured, uniformly porphyritic banatite. Many of the thinner bodies have steeply inclined and irregular contacts and are clearly discordant. These dyke-like bodies are extraordinarily variable.

Normally they are coarsely and irregularly porphyritic, but some are more finely and uniformly porphyritic. Colours range from orange-red to red, pink, green, greenish yellow, khaki and grey. Within the bore the distribution of the alkaline rocks is uneven. Two substantial sheet-like bodies (12 m and 22 m thick respectively) occur within tillite above dolerite. Within the dolerite body, sheet-like alkaline intrusives 14 m, 18 m and 17 m thick respectively, occur near the top, middle and base of the dolerite. The two lower occurrences are associated with several thin, steeply inclined dyke intrusions. No significant interaction between the alkaline intrusives and the dolerite was observed in any instance. Below the dolerite alkaline intrusives occur with an ever increasing frequency towards the base of the Truro Tillite. Most are substantial sheet-like bodies, several are clearly composite, but some are thin and steeply inclined dykes. The alkaline rocks become markedly more xenolithic towards the base of the tillite. None were encountered in the basement intersection.

GEOLOGICAL LOG OF THE WOODBRIDGE DIAMOND DRILL HOLE

Collar height 11.3 m A.S.L. Located at Little Peppermint Bay, Woodbridge at EN519288-5222568, Kingborough Quadrangle. Hole drilled vertically and fully cored. Dips where observed are negligible. All thicknesses are down-hole depths in metres. Logged to 884 m by N. Farmer, the remainder by M.J. Clarke.

Truro Tillite (in part) 316 m

Depth (m)	Description
0 - 95	Tillite, medium to dark grey, clast-rich throughout. Clasts mainly 15 - 30 mm range.
95 - 98.5	Siltstone, banded, dark grey to black with a few dropped pebbles and one boulder. Glaciolacustrine?
98.5 - 180	Tillite, medium to dark grey, clast-rich. Many pebbles ranging from 25 - 50 mm in a background of smaller clasts (5 mm) and very fine matrix.
180 - 183.3	Baked tillite. Buff-coloured, clasts small (10 - 20 mm).
183.3 - 191.15	Pale grey to buff, baked tillite with numerous medium (40 mm) to small clasts. Some thin, near vertical veining.
[191.15- 203]	Syenite, pale grey, fairly even grained. Many small (5 mm) patchily distributed feldspar phenocrysts. Some irregular, steeply inclined veining towards middle.
203 - 235.5	Tillite, light to medium grey, pebbly; heavily baked towards the top; pebbles with haloes.
235.5 - 238.80	Siltstone, highly baked, with fine, dark irregular hair-like anastomosing structures, essentially horizontal in attitude. A few clasts, but small and rare.
[238.8 - 241]	Syenite, pale grey with many small phenocrysts; some veining.
241 - 263.4]	Syenite, dark grey with some conspicuous phenocrysts and more closely spaced and near vertical veining

- in places. Slight brown or orange tinge when wet. Contact with rocks below is slightly irregular but essentially flat-lying.
- 263.4 - 275.6 Siltstone and mudstone, highly baked, pebbly; pebbles small and haloed and indistinct. Hair-like veining throughout, both vertical and horizontal.
 - [275.6 - 287.5 Dolerite, very fine-grained; contact with sediments above sharp and flat-lying. Dolerite at contact very fine-grained, coarsening downwards.
 - 287.5 - 297 Medium-grained dolerite with bands of coarse-grained dolerite becoming more common downwards.
 - 297 - 333 Dolerite, coarse-grained and very coarse-grained, light grey in colour; mottled and banded.
 - 333 - 345.5 Syenite; contact with dolerite above is inclined but somewhat irregular with small apophyses of dolerite in syenite, probably due to inclination of dyke. Syenite irregularly porphyritic; feldspar phenocrysts common but not evenly distributed. Heavily veined towards base. Basal contact sharp and steeply inclined (65°+).
 - 345.5 - 370 Dolerite; very coarse-grained, banded and mottled, with varying coarseness of grain.
 - 370 - 392 Dolerite; coarse-grained with some very coarse, mottled patches, but coarse material diminishing downwards.
 - 392 - 470 Dolerite; medium- to coarse-grained, with some of the coarser material in bands; fining gradually downwards with disappearance of coarse material.
 - 470 - 483.6 Dolerite; medium- to fine-grained; fairly uniform in appearance.
 - 483.6 - 502.15 Syenite, core broken at contact, but appears to be inclined; dark grey and irregularly distributed small feldspar phenocrysts and some fine veining. Grey in colour at top, but lowest 2 m buff in colour and heavily veined.
 - 502.15- 504.53 Dolerite; fine-grained.
 - 504.53- 504.78 Thin, dark grey syenite; contacts flat but wavy and slightly irregular.
 - 504.78- 506.4 Syenite; fine-grained, greenish in colour; top and bottom contacts flat.
 - 506.4 - 537 Dolerite; medium- to fine-grained; some slight banding and slight veining. Flat-lying, banded vein material (50 mm) at 537 m.
 - 537 - 584 Dolerite; fine- to medium-grained, uniform.
 - 584 - 588 Dolerite; medium-grained, uniform; coarser than above.
 - 588 - 623.6 Dolerite; fine- to medium-grained; some slight development of banding.
 - 623.6 - 623.69 Syenite.
 - 623.69- 623.79 Dolerite; fine-grained.

- 623.79- 624.5 Syenite; dark grey, porphyritic.
- 624.5 - 626.2 Dolerite; dark, fine-grained.
- 626.2 - 633.28 Syenite; grey, fairly even grained; lower contact irregular and inclined; upper contact slightly irregular and gently inclined.
- 633.28- 635.12 Dolerite; dark, fine-grained.
- 635.12- 651.2 Syenite; dark grey with phenocrysts (5 mm) in a dark background. Top and bottom contacts wavy and gently inclined.
- 651.2 - 655.6] Dolerite; uniform, very fine-grained; contact flat.
- 655.6 - 662 Tillite; pebbly, highly baked; a few larger clasts, all haloed.
- [662 - 663 Syenite; upper contact inclined at 45°; coarse-grained and porphyritic; contact with syenite below is sharp and flat-lying. (Type A).
- 663 - 674.9 Syenite; finer and more even grained than above, phenocrysts less conspicuous. (Type B).
- 674.9 - 675.5 Syenite; type A, contact sharp and irregular, essentially flat-lying.
- 675.5 - 685.15 Syenite; type B.
- 685.15 - 688.5 Syenite; type A; contact a little diffuse, but flat-lying.
- 688.5 - 696 Tillite; pebbly; veined and highly baked; lowest 5 m badly broken.

Wedge-off hole

- [624 - 631 Syenite; phenocrysts up to 5 mm; lower contact sharp and flat-lying.
- 631 - 632.3 Dolerite; dark grey, fine-grained.
- 632.3 - 648.5 Syenite; porphyritic with phenocrysts up to 5 mm.
- 648.5 - 650 Dolerite; fine-grained with some pyrite.
- 650 - 650.15] Syenite; dark-grey; top contact inclined at 45°, bottom contact almost flat.
- 650.15- 659.9 Tillite; highly baked, mottled in appearance; some very thin stringers of syenite.
- [659.9 - 660.9 Syenite; pink to orange in colour; phenocrysts up to 5 mm; upper contact irregular and inclined at 45°, lower contact flat.
- 660.9 - 682.5 Syenite; buff coloured, finer-grained than above; base flat-lying.
- 682.5 - 686.5] Syenite; coarse-grained, porphyritic, pink; base flat-lying.
- 686.5 - 700 Tillite; highly baked.
- [700 - 732 Syenite; coarse, orange to grey with many xenoliths; upper contact flat-lying.

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- 732 - 732.1 Highly baked sediment (probable xenolith).
- 732.1 - 733.4 Syenite; grey, porphyritic.
- 733.4 - 734.25 Tillite; grey, highly baked (xenolith?)
- 734.25- 738.3] Syenite; grey, porphyritic.
- 738.3 - 761.25 Tillite, highly baked.
- [761.25- 769.50 Syenite; grey, porphyritic; upper contact slightly irregular, but flat-lying.
- 769.5 - 769.75 Highly baked, dark grey tillite (xenolith?)
- 769.75- 772] Syenite; grey, porphyritic with many small, dark xenoliths.
- 772 - 780.25 Tillite; pebbly, baked; brittle (775.6 - 775.8 diffuse syenite stringer).
- [780.25-797.7 Syenite; grey-buff-orange; top flat-lying, base irregular and near vertical.
- 797.7 - 798 Highly baked, dark grey ?tillite (xenolith?).
- 798 - 798.5 Dark grey, even grained, altered ?volcaniclastic rock (xenolith?).
- 798.5 - 833.3 Syenite; buff and orange; base flat-lying.
- 833.3 - 833.75 Hard, dark grey, highly baked rock - probably tillite xenolith.
- 833.75- 845.2] Syenite; dark grey, even grained, slightly mottled; composite body with upper and lower contacts and internal boundaries almost flat; abundant xenoliths of quartz, carbonate and other material up to 35 mm.
- 845.2 - 847 Tillite; grey, highly baked.
- [847 - 847.2] Syenite.
- 847.2 - 855.1 Tillite; dark grey, highly baked, even-grained with clasts up to 25 mm; smaller clasts common.
- [855.1 - 872] Syenite; grey, porphyritic; many small xenoliths.
- 872 - 873.7 Tillite; dark grey, baked, pebbly.
- [873.7 - 911] Syenite; massive, composite sheet-like body with upper, lower and internal contacts almost flat; red, orange, yellow and green; variably porphyritic.
- 911 - 915 Tillite; dark, pebbly, very highly baked.
- [915 - 922] Syenite; grey, evenly porphyritic.
- 922 - 926 Tillite; very highly baked.
- [926 - 928.4] Syenite; grey, evenly porphyritic.
- 928.4 - 930 Tillite; grey, very highly baked.
- [930 - 945] Syenite; massive orange-red, porphyritic; upper and lower contacts sharp and almost flat.
- 945 - 947.4 Tillite; dark grey with strong alignment of elongate phyllite and slate fragments; a few larger more equidimensional clasts of quartz and quartzite.
- [947.4 - 959] Syenite; grey-green, massive sheet-like with flat contacts; variably porphyritic; many xenoliths.

- 959 - 970 Tillite; massive with strong alignment of phyllite and slate clasts.
- [970 - 994.2] Syenite; massive, grey-green, red-orange variably porphyritic, composite sheet-like body with wavy but sharp and essentially flat contacts; xenoliths abundant.
- 994.2 - 998 Tillite; dark grey with marked alignment of elongate phyllite and slate clasts; larger, more equidimensional and angular clasts of quartz and quartzite.

Phyllite and minor quartzite 25 m

- 998 -1023 Black, strongly cleaved phyllite with thin bands of light-coloured quartzite; kink-bands well developed in places. Unconformity surface sharp, essentially planar and inclined at about 15°.

END OF HOLE

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APPENDIX 1. THIN SECTION EXAMINATION OF ROCKS FROM THE WOODBRIDGE BORE

E. Williams

Samples from 224, 687, 691, 693, 738, 743, 743.50, 752, 756, 772, 776, 845, 852.30, 854.60, 913.50, 923.50 and 929.

TILLITE (UPPER PALAEOZOIC)

Angular clasts with re-entrant angled boundaries common, set in a very fine-grained matrix of quartz, micaceous material and sparse iron oxides.

The clasts are normally of quartzwacke (to 15 mm in 693), quartzite (to 12 mm in 693), quartz-mica schist, phyllite (to 8 mm in 693), carbonate (especially common in 691, and > 7 mm in 687), feldspar porphyry (743) and single grains (e.g. quartz, mica and chlorite which is as large as 2.5 mm in 693). A smaller average size of clasts was noted in 854.60, 913.50 and 929.

Metamorphism due to syenite intrusions has affected most specimens. Metamorphic spots often occur in the matrix and are commonly centred on clasts. Carbonate clasts sometimes show reaction rims (687). Within the spots (up to 1.2 mm in 687), which are of lighter colour than the unaltered matrix, recrystallisation results in larger quartzes and the growth of micaceous material in patches showing optical continuity. Specimens 756, 845, 852.30, 913.50 and 929 exhibit a preferred orientation of the recrystallised micaceous material within the spots in two directions, the bisectrix of which is parallel to the core length suggesting that there was a superincumbent load control during metamorphism. Irregular growths of iron sulphides occur, particularly in 691, 752, as a result of metamorphism, and veins of calcite (776, 923.50) and occasionally chlorite (738, 776, 854.60) have developed.

Samples from 702, 798.7, 839.80, 841.30

CRETACEOUS SYENITE

Feldspar, in varying stages of alteration, and chloritised ferromagnesian phenocrysts (particularly 798.7) are evenly distributed throughout an unfoliated altered matrix of predominantly quartz, feldspar, chlorite and iron oxides. The matrix is very fine-grained in specimen 841.30. Veins of calcite (particularly 702) result as a breakdown product.

Samples from 946, 968, 996, 998

MIXTITE (PROBABLY UPPER PALAEOZOIC)

Poorly sorted, with fragments of phyllite (to 9 mm in 968), some quartz-mica schist, occasionally quartzite (to 6 mm in 946), and rarely crack-seal quartz veins (996) set in a matrix of micaceous material and some quartz. The phyllitic fragments are invariably elongate parallel to their internal cleavage, and they may show marked alignment gently oblique to the core length (946), or they may be haphazardly arranged (996). Bedding within some phyllite clasts (996), which is indicated by thin, fine-grained siltstone laminae, may be at large angles to the internal cleavage and clast length. Fragments exhibiting kink bands also occur (996).

The matrix rich in micaceous material is usually recrystallised with the development of optical continuity in patches, and in 946 the mineral orientations possibly have a conjugate symmetry with the bisectrix parallel to core length indicating superincumbent load control during metamorphism. Some carbonate veins have developed (968) and iron oxide spotting occurs (.02 mm diameter in 968).

Fragments within the mixtite were derived in the main from a cleaved, kink banded, dominantly phyllitic sequence veined by crack-seal quartz seams. The alignment of fragments in some horizons within the mixtite suggests deposition from mass flow.

Samples from 1012.9, 1013, 1023

PHYLLITE/QUARTZITE SEQUENCE (BASEMENT - PALAEOZOIC(?)/RELATIVELY UNMETAMORPHOSED PRECAMBRIAN(?))

Dominantly a phyllite sequence with cleavage bounded lenticles (to .3 mm wide and to 70 mm in 1023) of very fine-grained siltstone (median size < 01 mm) within more micaceous cleavage seams. Kink bands are occasionally present (1023).

Layers of quartzite occur with an average grain size of .1 mm (1012.9, 1013). The quartz grains have sutured margins. A rough anastomosing cleavage has developed throughout and consists of disconnected micaceous ribbons (.001 mm thick and to .01 mm long). In 1013 the cleavage is axial to a fold outlined by a 1 mm thick micaceous layer in quartzite. The fold is truncated by a persistent cleavage seam of micaceous material. A widely spaced (.8 mm) later crenulation cleavage is sometimes present (1012.9). Crack-seal quartz veins occur (up to 3 mm thick in 1012.9).

The phyllite (and associated rock types) fragments which predominate in the overlying mixtite deposits were derived from this sequence.