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GEOLOGY OF THE MAYDENA RANGE

by

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(with one plate and three figures)

ABSTRACT

The oldest rocks of the area are the (?)Precambrian pyritic quartzites with interbedded conglomerates. These are overlain by 60 m of pebbly siltstone, about 300 m of ferruginous sandstones and siltstones and 300 m of quartzite and siltstone which represent a stable tectonic environment of pre-Ordovician age. The pre-Ordovician rocks were folded before deposition of the Ordovician sediments.

The Arenigian Florentine Valley Mudstone is at least 140 m thick and is overlain by the lower 600 m of the Gordon Limestone, the upper parts of which are faulted out. The Lower-Upper Middle Devonian Tabberabberan Orogeny resulted in the formation of north-westerly plunging folds.

A complete flatly dipping Permian sequence begins with at least 220 m of Lower Sakmarian Wynyard Tillite, which was derived from a glacier with a north-westerly origin. This is overlain by 137 m of Woody Island Siltstone, 9.2 m of fossiliferous siltstones, 3.7 m of Darlington Limestone, and 32 m of Bundella Mudstone, all of which are marine. These are overlain by the freshwater sediments of the Mersey Group (with a maximum thickness of 52 m), followed by a marine sequence composed of 80 m of the Cascades Group, 64 m of the Malbina Siltstone and Sandstone and about 150 m of the Ferntree Group. The terrestrial Cygnet Coal Measures, 4.4 m thick, is the top Permian formation. The Permian rocks form a very shallow east plunging syncline.

Three hundred and twenty metres of freshwater Triassic sediments disconformably overly the Permian rocks and are intruded by a Middle Jurassic dolerite sill. Normal faults, with downthrow to the east-north-east and to the north-west and probably associated with the formation of the Tertiary Derwent Graben, cut the older rocks. Dolerite talus slopes developed as periglacial material during the Pleistocene.

INTRODUCTION

The mapped area (see fig. 1) lies close to Maydena. Almost the entire area is part of a forest concession granted to Australian Newsprint Mills Ltd, for logging purposes. Specimen numbers referred to in the text are those of the Geology Department collection, University of Tasmania.

Maydena is 55 miles from Hobart by sealed roads. Good exposures occur in cuttings of the roads which cover most of the mapped area. However, apart from Unit I of the Malbina Siltstone and Sandstone, the outcrop away from road cuttings and creek beds is poor. The climate of the Maydena area is discussed by Gilbert (1959). The average rainfall at the ANM depot is 50.9 inches.

PHYSIOGRAPHY

The mapped area includes part of the upper regions of the Tyenna Valley which narrows downstream. West of the ANM depot the Tyenna has a broad flat valley, due to the local base level formed by the quartzites of the Florentine Valley Mudstone which strike across the river between Maydena and the ANM depot and also cause the valley to narrow.

Near Maydena the stream is in the valley tract and meanders across a flood plain which narrows downstream toward Fitzgerald. This valley tract is due to the local base level caused by the Roberts Fault bringing into contact Permian strata and less resistant Gordon Limestone, on which the river flows. Further work downstream is needed before it can be shown that the Tyenna River is superimposed as suggested by Hughes and Everard (1953).

Risbys Basin is part of a karst in Gordon Limestone, with Pillingers Creek vanishing at its head. A large doline occurs at (4559E, 7343N). Underground caves also occur and are at least 129 m deep (Elliott, 1958).

The relatively flat floor of Risbys Basin is at an elevation of 300 to 370 m while about 2 km away, at the end of Roberts Road, the elevation is about 825 m and 3 km away Abbotts Lookout rises about 920 m above sea level. The close proximity of outcrops of Gordon Limestone and dolerite capped mountains leads to a rugged relief under existing climatic conditions.

The western end of the Maydena Range, east of Pillinger Fault is capped by some 150 m of dolerite. The highest parts of the range have a height of approximately 920 m along its entire length, a height corresponding to the *lower plateau surface* of Davies (1959). Davies tentatively suggested a Neogene age for this surface.

Anticlines, comprised mostly of quartzite of the Florentine Valley Mudstone, found between the Maydena-ANM depot road and the railway line stand out about 45 m above the surrounding countryside. The basal quartzite of the pre-Ordovician rocks stands out as a number of sharp hills, e.g., Pine Hill, on the north-western side of Risbys Basin.

Upstream from the junction of the north and south branches of the Styx River, the north branch contains rapids and overlapping spurs indicating the mountain tract. Downstream from the Styx River bridge there is a small flood plain, and the river is in its valley tract. North of the Styx, the lateral streams are controlled to some extent by a bench developed just above Unit I of the Malbina Siltstone and Sandstone. The streams running off the spur flow along this bench (along strike) for short distances before flowing down the steep southern flanks of the Maydena Range. This is seen at both points 4560E, 7304N and 4580E, 7310N.

STRATIGRAPHY

Pre-Ordovician Rocks

Four rock units underlie the Lower Ordovician Florentine Valley Mudstone unconformably.

Quartzite

The oldest rock in the area is a quartzite at least 150 m thick, outcropping along the Risbys Basin road, on Pine Hill, and probably in the Styx River Valley. This last is the northernmost outcrop of the Precambrian quartzite which occurs to the south-west. It occurs as a massive cliff-like outcrop on the southern side of the north branch of the Styx River (4540E, 7287N). There is no visible bedding. Associated with the quartzite is a dark pebbly sandstone. Permian varved siltstone overlies the quartzite at this locality unconformably.

The best exposure of the quartzite is at 4553E, 7337N. Here it occurs in thick beds (up to 1 m) with intraformational conglomerates which make up about 10% of the rock. The quartzite is white to dark-grey and shows some recrystallisation. The conglomerate is white to dark-grey with cobbles up to 15 cm across and an average diameter of about 2.5 cm. It has an open framework. Almost all of the larger pebbles are pieces of angular quartzite with a few chert fragments. The matrix (thin section No. 33823) is composed of angular quartz pebbles and small pyritic crystals (up to 60% of matrix). Some of the pyrite penetrates the larger pebbles, suggesting an epigenetic origin. The rest of the matrix is composed of angular quartz fragments of low sphericity and roundness, averaging about 0.1 mm in diameter. A few of the quartz pebbles exhibit undulose extinction.

This unit may be exposed in road cuttings on the northern flanks of Pine Hill (4515E, 7350N), where it shows recumbent folding. The quartzite occurs as beds up to 15 cm thick, alternating with less competent and thinner phyllitic layers. On Pine Hill some of the quartzite contains a high proportion of haematite.

Pebbly Siltstone

In the Risbys Basin area the quartzite is overlain with apparent conformity by a pebbly siltstone, which appears to thin westward, because on the Burma Road and near Pine Hill the quartzite seems to be overlain by ferruginous sandstone. On the Risbys Basin Road the grey pebbly siltstone is about 60 m thick. The pebbles are not abundant and are almost all angular chert fragments with a few pieces of sandstone, schist and siltstone. They are up to 10 cm across with an average size of about 1 cm.

Ferruginous Sandstone and Siltstone

Overlying the pebbly siltstone with apparent conformity is about 300 m of ferruginous sandstone and siltstone. It weathers to a deep red soil.

The rock is a dark-brown, fine to medium grained, well-sorted sediment. In thin section (No. 33813) the sandstone consists of 50% iron oxides, 30% quartz, 5% rock fragments and 5% muscovite. The quartz particles have an average diameter of 0.20 mm ranging in size up to 3 mm across. They are poorly rounded and have a moderate sphericity. The muscovite flakes are up to 1 mm long.

The siltstone portions of this unit are almost invariably badly sheared and of a mottled chocolate colour. In thin section (No. 33814) much of the siltstone (up to 50%) is an irresolvable mass of fine clay. The siltstones contain no muscovite and a higher proportion of rock fragments than the sandstones. Iron oxides and quartz fragments make up the rest of the rock.

There is little or no sign of bedding and jointing is extremely irregular. The ferruginous sandstone and siltstone is overlain conformably by fine-grained quartzite and siltstone. A good contact is seen on Burma Road (4531E, 7347N).

Fine-grained Quartzite and Siltstone

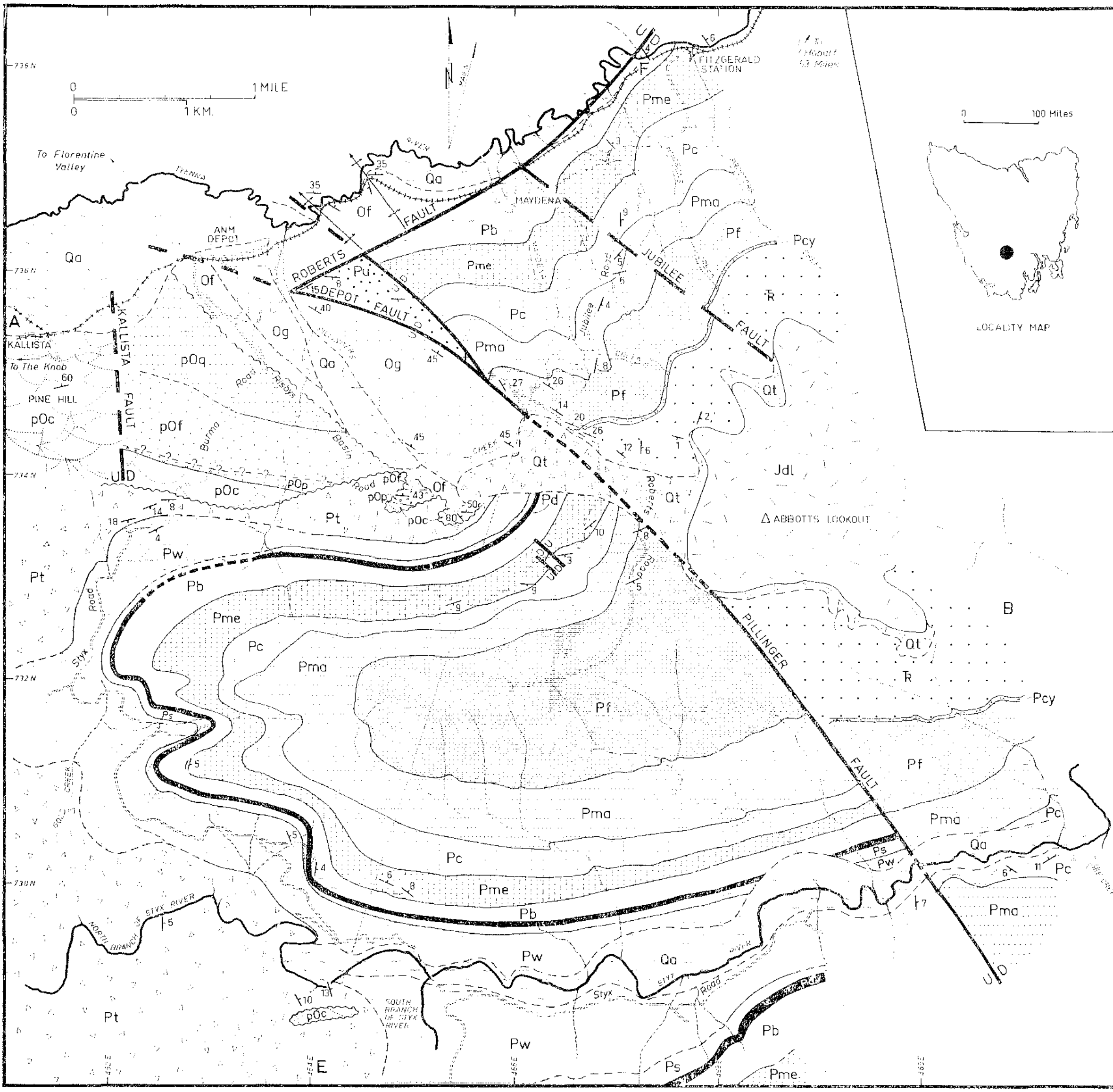
This unit is a massive, very fine-grained quartzite with subordinate siltstones. It is at least 300 m thick near the junction of the Burma and Risbys Basin Roads. In thin section (No. 33811) the quartzites are extremely fine-grained and consist almost entirely of quartz grains up to 0.75 mm across, averaging 0.02 mm in diameter. There are quartz veins of slightly coarser material through the fine-grained material. The rock is well sorted.

Siltstones are present at the base of this unit, as is seen at 4531E, 7347N on Burma Road. On the Risbys Basin Road (4539E, 7345N) the siltstone contains fairly well-rounded quartz pebbles up to 5 cm across. Here, there is poorly developed bedding 7 to 10 cm thick. On the eastern end of Pine Hill (4528E, 7349N) near the base of this unit is a dark-grey chert breccia. The fine-grained quartzite and siltstone are overlain unconformably by the Lower Ordovician Florentine Valley Mudstone.

Age of the Pre-Ordovician Rocks

Lewis (1940) and Hughes and Everard (1953) regard the quartzites on Pine Hill as equivalent to the Owen Conglomerate. This correlation is probably based on (*a*) the close proximity of the Pine Hill outcrops to the Florentine Valley Mudstone and Gordon Limestone, and (*b*) the

GEOLOGICAL MAP OF THE MAYDENA RANGE



QUATERNARY System

- Qa — ALLUVIUM AND RIVER GRAVELS
- Qt — DOLERITE TALUS

TRIASSIC System

- Ʀ — SANDSTONES AND SILTSTONES

PERMIAN System

- Pcy — CYGNET COAL MEASURES
- Pf — FERNTREE GROUP
- Pma — MALBINA SILTSTONE AND SANDSTONE
- Pc — CASCADES GROUP
- Pme — MERSEY GROUP
- Pb — BUNDELLA MUDSTONE
- Pd — DARLINGTON LIMESTONE
- Ps — FOSSILIFEROUS SILTSTONE
- Pw — WOODY ISLAND SILTSTONE
- Pt — WYNYARD TILLITE
- Pu — UNDIFFERENTIATED

ORDOVICIAN System

- Og — GORDON LIMESTONE
- Of — FLORENTINE VALLEY MUDSTONE

PRE-ORDOVICIAN ROCKS

- pOq — FINE GRAINED QUARTZITE
- pOf — FERRUGINOUS SANDSTONE AND SILTSTONE
- pOp — PEBBLY SILTSTONE
- pOc — QUARTZITE

IGNEOUS ROCKS

- Jdl — JURASSIC DOLERITE

- ROADS
- TRACKS
- RAILWAY LINE
- RAILWAY FORMATION
- GEOLOGICAL BOUNDARY—ACCURATE
- GEOLOGICAL BOUNDARY—APPROXIMATE
- STRIKE AND DIP
- VERTICAL BEDDING
- PLUNGING ANTICLINE
- FAULT
- FAULT INFERRED
- UNCONFORMITY
- INFERRED UNCONFORMITY

Compilation from Australian Newsprint Mills Ltd. 1 Mile to 4 inch maps which were compiled from 1957 Adastra aerial photographs. Origin of co-ordinates 400,000 yds. West and 1,800,000 yds. South of True Origin of Zone 7 of the International Grid.

MAPPED AND COMPILED BY J. B. JAGO 1965

Fig. 1.

presence within the quartzite of intraformational conglomerate beds which show marked similarities with the Owen Conglomerate and its correlates. However, many quartzite conglomerates would be lithologically similar and this is thus a suspect basis of correlation. The succession between the basal quartzite and the Florentine Valley Mudstone in the Maydena area also does not correspond with the Lower Ordovician succession reported by Corbett (1964) from the Florentine Valley. It is not surprising that the equivalent of the Owen Conglomerate from the Florentine Valley, i.e., the Tim Shea Conglomerate, does not extend to Maydena because elsewhere in Tasmania the basal Ordovician conglomerates are noted for their rapid lateral thickness variations (Banks, 1962*a*). Thus the rock units described above are considered pre-Ordovician.

The trends of the Ordovician and pre-Ordovician rocks are distinctly different and an unconformity is postulated between them. The quartzites in Risbys Basin and on Pine Hill are probably Precambrian. The age of the pre-Ordovician rocks above the basal quartzite is then either Precambrian or Cambrian. The ferruginous sandstones and siltstones are not unlike some of the supposedly Cambrian sediments found on the HEC road to the Gordon River. The pebbly siltstone, ferruginous sandstones and siltstones, and the fine-grained quartzite of the Maydena area described above may well be Cambrian.

Ordovician Rocks

Florentine Valley Mudstone

Etheridge (1904) used the term 'Florentine Valley Beds' in describing a trilobite fauna from the Florentine Valley. Banks (1962*a*) defines the Florentine Valley Mudstone from siltstones, calcareous siltstones and calcareous sandstones outcropping in road cuttings on the Florentine Road near Frodsham's Gap (44352, 7418), and states that it conformably overlies a sandstone correlated with the Caroline Creek Sandstone and underlies the Gordon Limestone. Corbett (1964) considered the Florentine Valley Mudstone to be about 670 m thick in the Florentine Valley.

In railway cuttings (4545E, 7368N and 4542E, 7366N) the Florentine Valley Mudstone outcrops as two anticlines. The rock is a well-bedded well-sorted quartzite with bedding planes between 0.3 and 1.3 m apart. Interbedded with the quartzite is a pale green siltstone often sheared to a phyllite. The siltstone beds are from 2 to 10 cm thick. About 30 m north of the Tyenna River (4540E, 7367N) sole markings are found in the siltstone. Ripple marks indicating currents from a northerly direction are present in the easternmost of the two rail cuttings.

Fossils occur in the siltstone of the western railway cutting. Kobayashi (1940) and Brown (1948) identified the brachiopods (?)*Tritoechia careyi* Brown and *Syntrophopsis karmbergi* Brown, the gastropods, *Sinuopea*(?) sp., *Roubidouxia*(?) sp., and *Lecanospira tasmanensis* Kobayashi, and the trilobites *Asaphopsis juneenis* Kobayashi, *A.*(?) *gracicostatus* Kobayashi, *Tasmanaspis lewisi* Kobayashi and *T. longus* Kobayashi, and considered the fauna to be Lower Ordovician.

The thickness exposed in the Maydena area is probably about 140 m. However, much of the outcrop is obscured and it is almost certain that the Florentine Valley Mudstone is substantially thicker than this figure.

Gordon Limestone

Corbett (1964) recognised five members in the Gordon Limestone of the Florentine Valley as follows:—

ELDON GROUP

Top

- An upper limestone member, 600 m thick.
- A siltstone member, 9 to 12 m thick.
- A lower limestone member, 500 m thick.
- A limestone member, containing *Maclurites* and *Girvanella* in profusion, 150 m thick.
- A cherty limestone member, 300 m thick.

Base

Florentine Valley Mudstone.

In the Maydena area about 610 m of the bottom part of the Gordon Limestone outcrop; the top part of this formation is faulted out by the Depot Fault. Although the Gordon Limestone was not studied in detail it appears that the lowest three members of Corbett's succession can be recognised. They are not differentiated in fig. 1. Here the cherty limestone is about 240 m thick. It is poorly bedded and in a quarry (4531E, 7360N) the percentage of chert is very high (about 75%). The proportion of chert decreases upward and this member grades into the overlying member. No fossils were seen in the cherty limestone member in this area.

The overlying unit is about 200 m thick in Risbys Basin, and is characterised by large numbers of *Girvanella*. In the upper half of the member the gastropod *Maclurites* is common. The best outcrop of this member is found in a doline leading to the entrance of Pillingers Creek Caves where *Girvanella, Maclurites,* other gastropods, trilobites, brachiopods and some cephalopods are known. The *Maclurites-Girvanella* beds are composed of a dark-grey dolomitic limestone which weathers to a pale grey colour. The beds are usually 0.6 to 1.0 m thick. Stylolites are rare. Banks and Johnson (1957) concluded that the age of this member in the Florentine Valley was probably Chazyan, and Corbett (1964, p. 54) supported this view.

The remaining 170 m of Gordon Limestone in Risbys Basin corresponds to the lower part of the lower limestone member of Corbett. Stylolites and dolomite stringers are common. No fossils were found. The rock is a well-bedded, usually fine-grained dark-grey limestone criss-crossed by numerous calcite veins. Corbett (1964, p. 57) stated that this unit is dominantly of Blackriveran age.

Permian Rocks

The generally flatly dipping Permian sediments rest unconformably on the older rocks or are faulted against them. There is a complete section through the Permian in this area, although parts of it are poorly exposed. The best sections are found on the higher parts of Roberts Road, and on a side road which turns off the main Styx Road at 4535E, 7304N.

Wynyard Tillite

The Wynyard Tillite in the Maydena area consists of two members, a lower tillite with associated siltstones, some of which are varved, and an overlying conglomerate with minor siltstones.

Tillite and Siltstone Member

This member is at least 175 m thick in the Styx Valley. The only contact between the tillite and the older rocks seen by the writer is that noted above between varved siltstones and the Precambrian quartzite in the Styx Valley. In fact at this locality (4540E, 7287N) the tillite seems to surround the quartzite outcrop, and the cliff-like nature of the outcrop is probably due to pre-Permian erosion, accentuated by Lower Permian glaciation. The nature of the outcrop certainly indicates that there was considerable pre-Permian relief (fig. 2).

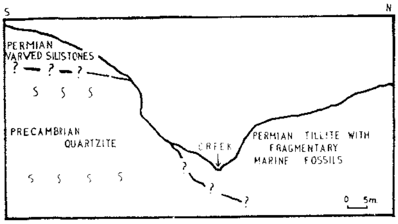


FIG. 2.—North-south section at western end of Styx Valley near (4540E, 7287N). Note the marked pre-Permian topography.

The tillite is generally a poorly sorted, pebbly, dark grey arenite associated with beds of varved siltstone and in the Styx Valley with beds of fine-grained dark-grey siltstone. Varved siltstones are best seen in a road cutting (4523E, 7337N) on the Burma Road and immediately overlying the Precambrian quartzite in the Styx Valley.

The pebbles, some well faceted, are usually well-rounded quartzite fragments up to 8 cm across, with some fragments of black slate, siltstone and chert. On Risbys Basin Road (4552E, 7337N) at the base of the tillite the erratics are larger and one boulder of richly fossiliferous sandstone is 0.6 m across. The fossils are *Cyrtia* sp. Crinoid plates are present in another boulder of sandstone. Both of these erratics are derived from the Siluro-Devonian Eldon Group, the nearest known outcrop of which is about 16 km to the north-west.

Fragmentary marine fossils occur sparsely in the tillite in the Burma Road section and commonly in some of the Styx Valley outcrops. They include stenoporids, fenestellids, spirifers and crinoid plates.

Conglomerate Member

The tillite is overlain by conglomerate. There is a complete section from tillite member to conglomerate member on the Burma Road (4522E, 7337N), where the conglomerate member is 40 m thick and the following succession was measured. The boundary between the tillite and the conglomerate is fairly sharp with a bed of conglomerate 120 cm thick taken as the basal unit of the conglomerate member. The boulders are up to 30 cm across and include Owen-type conglomerate, quartzite, quartz, schist and sandstone. One quartzite pebble shows glacial striations.

The basal conglomerate bed is overlain by a tillitic sandstone with a few boulders up to 15 cm across. This tillitic sandstone is about 4.6 m thick. It is overlain by 15 m of massive very poorly bedded conglomerate. The bedding becomes clearer up the sequence. Most of the clasts are from 2 to 15 cm across and moderately well-rounded. On the other hand the larger boulders (up to 30 cm in diameter) and the smaller clasts (less than 2 cm) tend to be angular. The matrix is a poorly sorted sandstone. The conglomerate itself is poorly sorted. The next unit is a 30 cm thick bed of coarse pebbly sandstone.

The overlying 3.65 m of sediment is a poorly bedded conglomerate. Boulders include quartz, quartzite, Gordon Limestone, Owen-type conglomerate, black slate, chert, adamellite, feldspar porphyry, quartz porphyry, chloritic schist and sandstone. The larger boulders are generally quartzite and igneous rocks up to 50 cm across. The Gordon Limestone fragments are up to 15 cm in diameter and include both stylolitic and dolomitic material. The schist fragments are invariably small.

The overlying 7.6 m consists of an alternation of conglomerate beds up to 60 cm thick and 15 cm beds of coarse sandstone with well-developed graded bedding. The pebble types are similar to those noted above. The largest pebbles in the sandstone are angular fragments of Gordon Limestone. All the larger fragments in this rock are angular with a low degree of sphericity. The boulders in the conglomerate beds show some tendency towards imbrication.

On the Burma Road the uppermost part of the conglomerate member is a fine-grained siltstone about 8 m thick. The boundary between the Wynyard Tillite and the overlying Quamby Group is not seen in the Burma Road section.

The succession within the Wynyard Tillite in the Styx Valley is basically the same as that on the Burma Road. Fossils are common in a road section near the Styx River (4540E, 7289N). The graded sandstone beds near the top of the conglomerate member on the Burma Road are absent in the Styx Valley outcrop, as is the uppermost siltstone. The uppermost 10 to 13 m of the conglomerate member in the Styx Valley is a moderately fossiliferous conglomerate. The boulders (up to 20 cm across) are not as large as those found in the Burma Road section. There are more quartzite and less Gordon Limestone boulders in the Styx Valley outcrops.

Fossils in this conglomerate include stenoporids, spirifers, strophomenids, pelecypods (including *Pyramus* and *Eurydesma*) and pectens (including *Deltopecten illawarensis*). The presence of *Eurydesma* and *Deltopecten illawarensis* indicates that the top of the Wynyard Tillite in the Styx

Valley is Lower Permian. In New South Wales *D. illawarensis* is not known below the Sakmarian (B. Runnegar, 1966 pers. comm.), and the lowest occurrence of *Eurydesma* is taken as one of the criteria for fixing the base of the Permian. The Darlington Limestone some 148 m above this horizon has an Upper Sakmarian age (Banks, 1962*b*, p. 194), and thus the top of the tillite is somewhat older.

Gulline (1967) reported the discovery of *Rhacopteris ovata* from varved mudstones about 185 m below the top and 290 m above the base of the Wynyard Tillite, in its type area near Oonah. He stated that this discovery indicated an Upper Carboniferous age for at least part of the Wynyard Tillite. However, Runnegar (1969*a*) has since shown that the *Eurydesma* fauna and the *Rhacopteris* flora overlap in at least two sequences in eastern Australia. Thus it is not certain that the flora noted by Gulline (*op. cit.*) is Carboniferous and at present it cannot be stated with certainty whether or not the Wynyard Tillite extends down into the Carboniferous.

Conditions of Deposition of the Wynyard Tillite

The Eldon Group erratics suggest on present knowledge that the glacier came from the north-west at least in the early part of the glacial epoch. Banks (1962*b*, p. 191) considered that the erratics found in the tillite near Maydena suggest a source near Elliott Bay or Mt Darwin. The source of the adamellite found in the conglomerate member on Burma Road is unknown, but is presumably from western Tasmania. It is unlike the specimens of Elliott Bay adamellite available in the Geology Department collection, University of Tasmania. Another possible source of the adamellite is the Port Davey area. The higher proportion of Gordon Limestone in the tillite of the Burma Road compared with the Styx Valley outcrops, may indicate that the source of some of the glacial material was to the north-west throughout the glacial epoch. The fragmentary marine fossils found in the tillite member suggest that it was deposited below sea-level from a wet-base glacier as proposed by Carey and Ahmad (1961) and supported by Banks (1962*b*, p. 194).

The coarse sandstones, exhibiting graded bedding and a marked imbrication of the pebbles, are probably outwash gravels. At the same stratigraphic horizon in the Styx Valley there are fossiliferous conglomerates. Palaeogeographically this indicates the presence of a shoreline between Burma Road and Styx Valley in Lower Sakmarian times. The fact that fragmentary marine fossils are found in the tillite member, in both the above localities indicates that the sea-level fell between the deposition of the tillite member and the upper parts of the conglomerate member.

Large thicknesses of conglomerate as described above are unusual in the Tasmanian Permian tillites. It seems likely that this material was deposited directly from the glacier possibly as kame or esker deposits. Banks (1962*b*, p. 214) and Gee and Burns (1968) have showed that there was considerable sub-Permian relief in different parts of Tasmania. This is confirmed in the Maydena area where in the Styx Valley (Fig. 2) there was marked local relief. The cliff-like nature of the Precambrian quartzite at this locality may mean that the Styx Valley in this region was glacially eroded in early Permian times.

The overall aspect of the late Palaeozoic glaciation in Australia has recently been discussed by Crowell and Frakes (1971).

Quamby and Golden Valley Groups

(And general notes on the nomenclature of the Permian System)

The Permian rocks in Tasmania which occur between the Wynyard Tillite and the Mersey Group are included in the Quamby and Golden Valley Groups by Banks (1962*b*). Banks (1962*b*, p. 194) states 'The Quamby Group includes all formations between the basal tillite or conglomerate and the Darlington Limestone and its correlates' and on page 197 states 'The Golden Valley Group includes all formations between the top of the Quamby Group and the base of the Mersey Group'.

In south-eastern Tasmania the Golden Valley Group includes the Darlington Limestone and the Bundella Mudstone. The name, Quamby Group, was first used by McKellar (1957). The term 'Golden Valley Group' is taken from the Golden Valley Formation (Wells, 1957). In the Hobart area and on the East Coast the Darlington Limestone and Bundella Mudstone belong lithologically to the same group. However, in the Maydena area the Darlington Limestone belongs lithologically to the underlying rocks. Thus in the following descriptions, the rock units are not assigned to either group but are considered as individual formations. No new local names are applied and, where possible, nomenclature previously applied to Tasmanian Permian rocks is used.

It is appropriate at this point to discuss the term 'Roberts Sandstone' as used by Lewis (1940, p. 31). Lewis did not give a precise definition but Smith (1957, p. 118), by taking appropriate sentences from Lewis, defined the Roberts Sandstone. Part of Roberts Sandstone appears to correspond to parts of the Mersey, Cascades and Malbina Groups, however, the sediments found in the section along Roberts Road between 4538E, 7358N and 4552E, 7353N cannot be fitted with certainty into any Permian formation seen elsewhere in the area. This section is unfortunately surrounded on all sides by faults.

Woody Island Siltstone

The Woody Island Siltstone conformably overlies the Wynyard Tillite. On the northern slopes of the Styx Valley 137 m of this unit outcrop. The best sections are seen on the main Styx Road and particularly on the road leading to the east from the main Styx Road at 4535E, 7305N.

The chief rock type is a fine-grained, well-sorted, buff to dark grey siltstone. It weathers characteristically, developing ellipsoidal bodies, 1.2 to 1.8 m long, as some form of spheroidal weathering. An outstanding characteristic of the Woody

Island Siltstone, especially in the lower parts is the presence of very prominent joint planes in two or more directions. Bedding is poorly developed, particularly in the lower two-thirds of the formation.

Glendonites and pyrite nodules are quite common in the lower half of the formation. Calcareous concretions up to 15 cm across are occasionally found. There are a few pebbles in the lower half of the formation and these are usually well-rounded quartzite pebbles up to 5 cm across. Between 10 and 13 m from the top of the formation pebble bands are common; such bands are up to 8 cm thick. Fenestellids and spirifers are associated with some of these pebble bands.

Fossils are rare in most of the Woody Island Siltstone. Rare spirifers and pelecypods (probably *Eurydesma*) are the only fossils observed in the bottom 100 m. The upper 37 m contains some quite richly fossiliferous beds. Fossils include *Stenopora*, fenestellids, *Ambikella* cf. *konincki, Strophalosia subcircularis, Grantonia, Pseudosyringothyris* and other spiriferids, *Peruvispira* and other gastropods, *Deltopecten illawarensis* and other pectens, *Eurydesma* and some crinoid columns. It should be noted that the writer is following Runnegar (1969*b*, p. 293) and is using the generic designation *Ambikella*, rather than the possible alternatives *Ingelarella, Martiniopsis* or *Tomiopsis*.

Fossiliferous Siltstone

Overlying the Woody Island Siltstone is 9.2 m of richly fossiliferous siltstone. Lithologically and faunally it is similar to the Satellite Siltstone described by Banks, Hale and Yaxley (1955) from Woody Island. However, on Woody Island there is 45.7 m of sediment between the Satellite Siltstone and the Darlington Limestone. Thus the siltstone described here probably should not be termed the Satellite Siltstone.

The siltstone has thick bedding, good sorting and rare pebbles. At the base it is buff-coloured becoming dark grey upwards. Fossils form up to 30% of the rock. This formation also displays prominent jointing. Fossils include *Stenopora tasmaniensis, S. johnstoni,* fenestellids, at least two species of *Strophalosia, Grantonia hobartensis* and other spiriferids, *Deltopecten illawarensis, Eurydesma cordatum* and other pelecypods, and the gastropods *Peruvispira* and *Keeneia*. The fauna is dominated by the stenoporids and *Strophalosia*. In the upper parts of this formation, a limy siltstone, strophomenids comprise about 50% of the fauna, stenoporids 30%, fenestellids 10% and other fossils 10%.

The top metre of this formation is composed almost entirely of *Strophalosia* shells, and the rock is almost a limestone. A few well-rounded quartzite pebbles up to 2 cm across are present. This formation and the Woody Island Siltstone are Sakmarian in age. The fossiliferous siltstone grades into the Darlington Limeston.

Darlington Limestone

A richly fossiliferous pebbly limestone, 3.7 m thick, overlies the siltstone. The rock is a dark-grey calcirudite. The basal 1.5 m is a richly fossiliferous calcareous siltstone which exhibits 'fenestellid' bedding. Fenestellids and spirifers are the principal fossils. Pebbles are common and about 1.2 m above the base of the Darlington Limestone there is a 15 cm layer of pebbles. The overlying metre is very rich in *Eurydesma cordatum*, and near the top is a prominent pebble band. The pebbles are mostly angular quartzite fragments up to 30 cm across. Some of these fragments, shown in Plate 1, fig. 1, are distinctly faceted, indicating a glacial origin. Other rock fragments include schist, Gordon Limestone, siltstone and sandstone.

There is 1.2 m of hard dark grey, less pebbly limestone above the *Eurydesma*-rich beds. The pebbles are quite large at the base of this 1.2 m but become smaller toward the top of the Darlington Limestone. This upper part of the Darlington Limestone is highly fossiliferous, with stenoporids making up 20% of the fossils present, strophomenids (15%), spirifers (40%), deltopectens (15%), *Eurydesma cordatum* (5%), and other fossils, including rare crinoids (5%). Among the fossils found in this formation at 4540E, 7303N is *Streptorhynchus*, which in Tasmania has so far only been found high in the Quamby Group or low in the Golden Valley Group and their equivalents. The following genera and species are known from the same locality, *Stenopora tasmaniensis, Schuchertella, Peruvispira, Deltopecten illawarensis,* and *D. squamuliferus*. The Darlington Limestone has an Upper Sakmarian age (Banks, 1962*b*, p. 194).

Bundella Mudstone

The Bundella Mudstone is 32 m thick. The basal 3 m is a pebbly, sparsely fossiliferous sandstone. In thin section (No. 33781) the rock is composed of 35% angular quartz fragments up to 0.5 mm across, with an average diameter of 0.2 mm. Angular feldspar fragments (15%) are up to 0.5 mm in diameter, and rock fragments (15%) include schist, chert and quartzite. There are 5% dark minerals. The matrix (30%) is a fine-grained brown siltstone. It is a dirty, poorly sorted sediment with an open framework. It weathers to a buff colour. Some of the larger boulders are up to 25 cm across, with an average pebble size of 1 to 2 cm and include Gordon Limestone, quartzite and igneous rocks.

It is overlain by 1.2 m of richly fossiliferous siltstones. In the overlying 12 m there is an alternation of sparsely fossiliferous sandstone, of a similar type to that described above and richly fossiliferous siltstone in beds 60 to 90 cm thick. Some of the richly fossiliferous siltstones have beds which are a mass of different species of *Wyndhamia*. Other fossils include fenestellids, *Stenopora tasmaniensis, S. johnstoni, Pseudosyringothyris, Grantonia,* a terebratulid *Peruvispira, Keeneia, Eurydesma,* and other pelecypods. Some of the sandstone layers contain boulders up to 15 cm across of sandstone, phyllite, schist and quartzite. Some of these boulders are faceted and are probably dropped pebbles.

The overlying 9.2 m is a well-bedded pebbly, and in some beds cobbly, sandstone with the sediment becoming finer upwards. The bedding is from 15 cm to 60 cm thick. Fossils similar to those noted above are fairly common in the bottom 120 to 150 cm but become quite sparse towards the top.

Dark-grey fine-grained, moderately fossiliferous calcareous siltstone (4.6 m thick) overlies the pebbly sandstone, and is best exposed at 4546E, 7299N. Fossils include spirifers, fenestellids, stenoporids and pelecypods. The top 3 m of the Bundella Mudstone is a pebbly sandstone which outcrops as a rock bar across the Tyenna River at Fitzgerald (4575E, 7382N). The rock fragments are up to 30 cm across and are mostly angular pebbles of quartz, quartzite and chert. When fresh, the rock is grey. There are few fossils, with only isolated stenoporids and brachiopods seen. Banks (1962*b*, Table III, p. 200) considered the Bundella Mudstone to be Upper Sakmarian in age.

Permian Undifferentiated

Outcropping on the lower half of Roberts Road between Pillingers Creek (4538E, 7358N, and 4552E, 7353N) are some 100 m of Permian sandstone and siltstones which cannot be fitted with certainty into any Permian formation. Both erratics and fossils (fenestellids, strophomenids, spiriferids, and stenoporids) are fairly common in the lower part of tbis section, but become much less frequent up the succession.

Mersey Group

The Mersey Group has a maximum thickness of 52 m in this area. No complete section is available but in the Tyenna River bed east of Fitzgerald there is a stratigraphic thickness of 52 m between the base of the Mersey Group and the first outcrop of the Cascades Group. The total thickness is probably not much less than this figure.

The basal 3 m is a fine-grained, dark grey micaceous siltstone, with bedding planes from 2 to 15 cm apart. Unidentifiable plant fragments are common. Sedimentary structures include clay pellet conglomerates and some pellets of slightly coarser micaceous quartz sandstone. Twelve metres of well-sorted, thinly bedded feldspathic sandstone overly the siltstone. Some beds contain appreciable quantities of muscovite and carbonaceous material. Unidentifiable plant fragments are present in the carbonaceous material which occurs in distinct layers. Clay pellet conglomerates and current bedding are frequent. The rest of the succession in the Tyenna River is obscured. Other outcrops of the Mersey Group occur at 4561E, 7330N and 4550E, 7299N.

At 4561E, 7330N the Mersey Group is faulted against rocks of the Cascades Group, so that neither the top nor the base of the Mersey Group is exposed. In this locality micaceous, carbonaceous shales and feldspathic sandstone dominate the succession. In thin section (No. 33847) the fine-grained carbonaceous sandstone is well-sorted and has a closed framework. The rock is composed of angular sub-spherical quartz grains (75%) with an average diameter of 0.1 mm, muscovite plates (5%) up to 1 mm across and fine-grained carbonaceous matter (20%). This last material is found as part of the matrix, and in thin irregular layers, associated with muscovite, in a sort of current bedding.

Almost all the Mersey Group sediments are well-sorted. There are a few beds of pebbly sandstone, some of which are cobbly. Bedding planes are from 15 to 30 cm apart. Worm tubes are the only evidence of animal life. Plant material includes unidentifiable leaf fragments and occasional seed cases. Small scale current bedding and sole markings are present in a dark grey carbonaceous shale at 4560E, 7330N. The Mersey Group is considered to be of Lower Artinskian age (Banks, 1962*b*, p. 205).

Cascades Group

This group is about 80 m thick in the Maydena area. No continuously exposed section is available but on Jubilee Road, on the northern flanks of the Maydena Range, a moderately good exposure of the Cascades Group is present. The top 33.5 m are well exposed in the Styx Valley (4610E, 7303N).

A moderately well-sorted, well-bedded sandstone and siltstone, with many clear quartz pebbles is the principal rock type. Some of the lowest beds contain a few carbonaceous remains. Almost all outcrops of Cascades Group rocks are deeply weathered to a buff colour. They are usually light grey when fresh. Some beds, particularly at 4553E, 7332N, contain up to 20% pebbles of siltstone, sandstone and quartzite.

The Cascades Group is very fossiliferous. Fossils include plant material, conulariids, at least two species of *Fenestella, Stenopora, Wyndhamia jukesi, W.* cf. *jukesi, Cancrinella farleyensis,* at least six species of *Grantonia* including *G. hobartense, Pseudosyringothyris, Ambikella* cf. *profunda, A.* cf. *ovata, A.* cf. *parallela, Aviculopecten* cf. *subquinquelineatus, Deltopecten limaeformis, ?Eurydesma, Peruvispira* and other gastropods.

In the sandstone beds spirifers are the dominant fossils, whilst in the siltstone beds fenestellids and strophomenids dominate the fauna. *Cancrinella farleyensis* occurs only, and in large numbers, in a siltstone horizon about 15 m above the base of the Cascades Group. Banks (1962*b*, Table III, p. 200) considers the Cascades Group to be Middle Artinskian.

Malbina Siltstone and Sandstone

This formation is 64 m thick on the north-western slopes of Abbotts Lookout. The boundary between the Cascades Group and the Malbina Siltstone and Sandstone is seen very well in the Styx Valley at 4610E, 7303N. In the Maydena area four units are recognised within the Malbina Siltstone and Sandstone.

UNIT I

The bottom unit is a massive well-sorted sandstone, 20 m thick. It outcrops as prominent cliffs and is an excellent marker horizon. Within Unit I three pebble bands, 12 m below the top are useful stratigraphic markers. The pebbles in these beds have a preferred orientation with their long axes parallel to the bedding. This seems inconsistent with the view expressed by Banks and Read (1962) that such beds are turbidity current deposits. It seems more likely that such beds represent reworked sandstone beds which contained glacial erratics. A sandy limestone bed 4.5 m below the top of Unit I does not appear to be continuous. It was not seen away from locality 4570E, 7334N and is thus probably a thin lens. Unit I is very poorly bedded. The top metre of Unit I is a conglomerate with both angular and rounded quartzite boulders up to 20 cm across. Some of these boulders are distinctly faceted and are considered to have been dropped from icebergs.

Fossils are not common and occur mostly in the lower parts of the unit. They include *Stenopora, Ambikella* and other spiriferids, strophomenids, *Keeneia,* pectens, other pelycypods and *Peruvispira.* The top 4.5 m is very sparsely fossiliferous and only rare isolated spiriferids were observed.

UNIT II

This unit is a hard, poorly-sorted, moderately well-bedded quartz sandstone, 33.5 m thick, which is pale or dark grey when fresh but weathers to a buff colour. Quartz pebbles about 0.3 cm across are common. Most rock fragments are small, but one quartzite boulder 25 cm across was seen. Other pebbles include slate and schist fragments up to 5 cm across. Unit II is very poorly fossiliferous with rare spirifers, fenestellids, pectens and conulariids.

UNIT III

The third unit is a well-bedded, poorly-sorted, coarse sandstone, 9 m thick. The rock is composed of small, moderately well-rounded quartz grains (60%) up to 1 mm across, rock fragments (10%) up to 10 cm across and a matrix (30%) of fine-grained siltstone. The pebble content (of quartzite, quartz, schist, slate and white granite) gives the rock a conglomeratic aspect in some beds. The rock is closely jointed with the bedding planes 30 to 50 cm apart.

Fossils are moderately abundant, and in some beds make up 10% of the rock. They include occasional plant fragments, conulariids, fenestellids, stenoporids, *Licharewia, Ambikella* cf. *subradiata, A. undulosa,* at least two undescribed species of *Wyndhamia,* pectens and gastropods.

UNIT IV

The top member, Unit IV, is a highly fossiliferous moderately well-sorted sandstone, with very few pebbles. It consists of moderately well-rounded clasts of high sphericity, most of which are composed of quartz and rock fragments, with an average diameter of 0.25 mm. About 30% of the rock is composed of fossils, with individuals of *Wyndhamia ovalis* making up 70% of the fauna. Other fossils include fenestellids, *Terrakea, Ambikella,* other spiriferids, *Peruvispira* and pectens.

Unit I of the Maydena area corresponds with Member *A* of the Granton section (Banks and Read, 1962), Units II and III correspond collectively with Members *B, C* and *D* and Unit IV is equivalent to Member *E* of Banks and Read.

Ferntree Group

RISDON SANDSTONE

A well-sorted buff feldspathic sandstone, 2.4 m thick, overlies Unit IV of the Malbina Formation. The best outcrop is seen above a quarry at 4563E, 7335N. Well-developed vertical jointing at 15° and 290° gives the outcrop the appearance of a jumbled mass of boulders.

The Risdon Sandstone may be divided into two units in the Maydena area. The bottom unit is 1 m thick, and not as well-sorted as the upper unit. It contains a few marine fossils, notably spirifers, plus unidentifiable plant material, is much more pebbly than the upper unit and contains rock fragments up to 5 cm across. The pebbles are almost all well-rounded quartzite fragments with rare pieces of slate, white granite and schist. No fossils were seen in the upper unit.

The manner in which a body such as the Risdon Sandstone is deposited is not clear. It persists over a large area with fairly uniform lithology. Banks (1962*b*, p. 215) suggested a turbidity current origin for the Risdon Sandstone while Leaman and Naqvi (1968) favour a beach deposit. However, allowing for an average overall thickness of 5 m and an aerial extent of some 20,000 square miles gives the Risdon Sandstone a volume of about 60 cubic miles. It is difficult to see how such a volume of sediment could be deposited in the form of beach deposits over such a large area.

McGugan (1965) discussed lithologic units, 30 m or less in thickness, from the Permian of western Canada, which persist throughout large areas (up to 180,000 square miles). He concluded that they are condensed diachronous shelf deposits of a transgressing sea. It is possible that the Risdon Sandstone has a similar origin.

FERNTREE MUDSTONE

The Ferntree Mudstone is at least 95 m thick in the Maydena area, and probably has a total thickness of 140 to 150 m. The bottom 35 m are well-exposed, resting conformably on the Risdon Sandstone near the end of Roberts Road (4562E, 7331N). Underlying the Cygnet Coal Measures on Roberts Road at 4563E, 7346N there is at least 60 m of the top of the Ferntree Mudstone exposed. Below this 60 m of sediment, the outcrop is deeply weathered. This fact and the presence of faults makes thickness measuring difficult. However, beds 33 m above the base of the Ferntree Mudstone exposed at 4562E, 7331N contain pebbles up to 30 cm long. These beds were not seen in the 60 m of sediment immediately below the Cygnet Coal Measures. Thus the two sections do not overlap. Ferntree Mudstone outcrops in the bed of Maydena Creek on the north-western side of Abbotts Lookout, where a total thickness of about 140 m occurs.

On Roberts Road the basal 35 m of Ferntree Mudstone is a well-bedded, poorly sorted dark grey sandstone. In thin section (No. 33775) it is composed of angular quartz particles (25%) up to 2 mm across, angular plagioclase fragments (10%) up to 1 mm across and rock fragments (10%) up to 15 mm long. These include pieces of quartz, quartzite, carbonaceous shale, ultrabasics, chert and slate. Dark minerals (3%) include amphibole. Iron oxide and pyrite (5%) occur as small blebs and irregular wisps about 0.01 mm wide, in a matrix of siltstone. It has an open framework. Bedding planes are usually 30 to 45 cm apart and become more clearly defined and further apart higher in the section. Siltstone beds 10 to 15 cm thick start to appear 10 m from the base of the Ferntree Mudstone and there is a sandstone/siltstone alternation in the remaining 25 m to the end of Roberts Road.

The percentage and size of erratics increases markedly in the sandstone beds from 27 to 35 m above the base of the formation. The erratics, which are both rounded and angular (Plate I, Fig. 2) are up to 30 cm across and include quartzite, schist, gneiss, slate, white granite and sandstone fragments. Worm tubes, found particularly at 4572E, 7330N, are the only evidence of life. The upper 60 m of the Ferntree Mudstone is a sandstone/siltstone alternation in beds from 15 to 60 cm thick. The rock is pale grey when fresh, and weathers to a buff colour. Erratics are uncommon and are mostly small quartzite fragments, but one quartzite erratic 20 cm across was noted in a bed 7 m from the top of the formation.

CYGNET COAL MEASURES

Banks and Naqvi (1967) have revised the term 'Cygnet Coal Measures', and some of the rocks previously considered to be part of this formation have been placed in the overlying unit.

In the Maydena area the Cygnet Coal Measures conformably overly the Ferntree Mudstone, and are disconformably overlain by the basal Triassic sandstones (Plate I, Fig. 3). A complete section of the Cygnet Coal Measures is found on Roberts Road (4564E, 7345N), where it is 4.4 m thick. It is a fine-grained, well-sorted, very micaceous, carbonaceous sandstone containing clay pellets as well as frequent quartz sandstone 'stringers'. Beds are 10 cm thick. Some siliceous beds are present. Unidentifiable plant fragments are abundant and worm tubes are common.

Triassic Rocks

The Triassic sediments are about 320 m thick on the north-western slopes of Abbotts Lookout. A section measured on a track leading from Roberts Road to the top of the Maydena Range is described below.

A massive sandstone, at least 15 m thick, is the basal Triassic unit. The bottom metre is a feldspathic sandstone, containing plant fragments and graphite particles, which is overlain by 60 cm of well-sorted, cross-bedded quartz sandstones. Thin (1 mm) carbonaceous bands between 0.5 and 1 cm apart are noticeable. The cross-bedding indicates currents from the north. This is overlain by at least 13.5 m of massive feldspathic sandstone, which also contains plant fragments, and cross-bedding indicating currents from the south and south-west. About 4.3 m above the base of the Triassic sediments there is an irregular layer of inclusions (up to 30 cm across) of micaceous, carbonaceous siltstones, similar to the siltstones of the Cygnet Coal Measures. These inclusions are further evidence of disconformity. The basal member corresponds in character and position to the Barnetts Member of the Springs Sandstone of Banks and Naqvi (1967).

There is a break in section in the overlying 30 m. The next outcrop is seen in the bed of Pillingers Creek (4570E, 7342N). Here 9 m of fine-grained, slightly micaceous siltstone, associated with beds of micaceous sandstone, up to 75 cm across, outcrops. The sandstone weathers to a greenish colour. The siltstone is pale brown and has rather fissile bedding. Some beds contain many unidentifiable plant fragments.

In the overlying 55 m there is no outcrop. However, float material indicates the presence of a well-sorted sandstone for most of this interval. Four and a half metres of moderately well-sorted slightly micaceous sandstone outcrops at 4572E, 7343N. About 80% of this rock is composed of angular quartz fragments with a high degree of sphericity and an average diameter of 0.25 mm. The rock has a fine-grained silt matrix. There is no outcrop in the overlying 15 m.

The next outcrop is a fairly thinly bedded, well-sorted, quartz sandstone at least 30 m thick, composed of poorly rounded, clear, sparkling quartz grains (80%) with a high degree of sphericity in a silt matrix. The overlying 17 m of sediment is obscured. The next outcrop up the succession is a well-sorted pale brown micaceous siltstone, at least 6 m thick. The overlying 7.5 m is not exposed. A small exposure of dark carbonaceous siltstone with a high muscovite content is seen 7.5 m above the pale brown siltstone. The overlying 18 m is covered with dolerite talus.

The next 75 m of sediment is a well-bedded, well-sorted feldspathic sandstone. In thin section (No. 33758) a sandstone, from the highest outcrop of Triassic sediment seen, is composed of angular quartz grains (60%), with a high sphericity, ranging up to 0.3 mm in diameter but mostly with a diameter of 0.15 mm, angular feldspar (mostly altered plagioclase) fragments (10%) with an average diameter of 0.15 mm and hydrous iron oxides in a clay matrix. It has a closed framework. Beds up to 60 cm thick occur in the lower part of this 75 m but beds near the top are frequently only 3 to 4 cm apart. Some beds contain up to 10% muscovite and the proportion of feldspar increases up the succession. There are a few well-rounded sandstone and siltstone pebbles up to 2.5 cm across. Current bedding is present.

The contact between the Triassic sediments and the Jurassic dolerite is not exposed, but there is probably no more than 30 m of Triassic sediments between the last outcrop of Triassic sandstone described above and the lowest outcrop of Jurassic dolerite.

Quaternary Rocks

(i) *Dolerite Talus*

A substantial area of the north-western slopes of Abbotts Lookout is covered by talus (in sense of Jennings, 1963, p. 74) of Jurassic dolerite boulders up to 1.5 m across in a dark brown matrix of weathered dolerite. The talus is 6 to 7 m thick in the bed of Pillingers Creek (4570E, 7342N) and extends well down into Risbys Basin along Pillingers Creek (Fig. 1). This talus could be of periglacial origin formed during the Pleistocene.

(ii) *River Deposits*

Extensive areas of river gravels and alluvium are found in the beds of Pillingers Creek, Tyenna River and Styx River.

Igneous Rocks

Jurassic Dolerite

Jurassic dolerite of a type found throughout much of Tasmania caps the highest parts of the Maydena Range east of the Pillinger Fault, and appears to be a sill at least 150 m thick.

STRUCTURAL GEOLOGY

The structure of the northern half of this area as presented by Lewis (1940, Plate VIII) is largely incorrect. The fault names used by Lewis have been used where applicable.

Pre-Ordovician Rocks

The Kallista Fault is inferred because the ferruginous sandstone and siltstone abuts on to the basal quartzite 0.5 km east of Kallista, causing a distinct break in slope. The fault has an unknown vertical displacement. It does not affect the Permian rocks to the south and is thus of pre-Permian age. Because the structural trends of the pre-Ordovician and Ordovician rocks differ by 30°, an unconformity is postulated between these two groups.

Ordovician Rocks

The Ordovician rocks have been folded with north-west trending axes into a series of anticlines and synclines (Lewis, 1940; Hughes and Everard, 1953). These rocks are cut off to the east by faulting.

Two small north-westerly trending anticlines in Florentine Valley Mudstone are well exposed in rail cuttings about 1.5 km west of Maydena. The eastern one is excellently exposed and plunges 15° in a direction 323°. Sole markings and ripple marks indicate that the beds are upright. The structures described above are ascribed to the Lower-Upper Middle Devonian Tabberabberan Orogeny.

Permian Rocks

Flatly dipping Permian sediments rest unconformably on the older rocks. The only contact seen is in the Styx Valley (4530E, 7287N) where Permian varved siltstones overly Precambrian quartzite (see above). The Wynyard Tillite also overlies the older rocks unconformably in the Risbys Basin-Burma Road area. Elsewhere the contact between the Permian and pre-Permian rocks is due to faulting.

The Roberts Fault (trends 35° to 62°) downthrows south about 300 m. The Depot Fault (trending about 290°) has a throw of the order of 150 m, south side up. Both are normal faults. The Pillinger Fault (trends 310° to 320°) is normal with a throw of about 210 m west side up. The Permian sediments are badly distorted in the vicinity of this fault, particularly where the Pillinger and Depot Fault intersect. The Pillinger Fault cuts off the Jurassic dolerite to the west of Abbotts Lookout indicating that it is of post-Middle Jurassic age.

Other faults affecting Permian rocks include one inferred on the northern slopes of the Maydena Range, probably passing through Maydena with a north-westerly trend. There is no exposure of this fault but along Jubilee Road there is an apparent thickness of 130 m of Cascades Group whereas the actual thickness should only be 80 m. This indicates a fault with a throw of 50 m east side down. This fault is termed the Jubilee Fault although the Junee Fault of Lewis (1940) is apparently in a similar position. However, Lewis' map is confusing and a new name is preferred. Two small faults are present at 4563E, 7332N. The larger north-westerly trending faults are downthrown to the east. This probably indicates that they are associated with the formation of the Derwent Graben in the Tertiary.

The Permian sediments on the western end of the Maydena Range to the west of Pillinger Fault show a broad synclinal structure plunging gently to the east. This may be due to compaction on an uneven basement perhaps along a Lower Permian east-west trending glaciated valley. However, some of the dips may be a little excessive for a differential compaction origin. The syncline could be part of a dome and basin structure of a type similar to that suggested by Fairbridge (1949). Jointing is well developed in the Permian sediments, particularly below the Mersey Group. The majority of joints are concentrated along the trends 45° and 320° (Fig. 3).

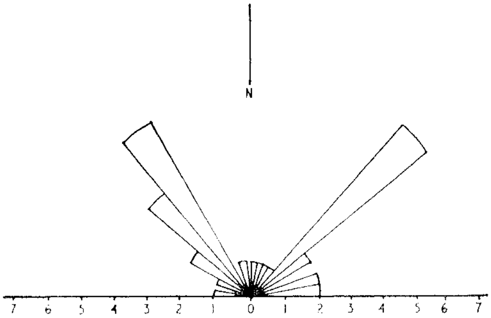


FIG. 3.—Rose diagram showing joint directions in the Permian sediments below the Mersey Group in the Styx Valley. Maxima are at 320° and 45°.

SUMMARY AND CONCLUSIONS

1. The basal quartzites of the pre-Ordovician are probably Precambrian. The overlying pre-Ordovician rocks may be Cambrian. There is an unconformity between the pre-Ordovician and Ordovician rocks.

2. The Tim Shea Conglomerate is absent from the mapped area and the first positively dated unit is the Arenigian Florentine Valley Mudstone. The

major effect of the Tabberabberan Orogeny was the formation of north-west-plunging folds. The Tabberabberan Orogeny was followed by a long period of erosion, which gave the area a marked relief.

3. Upper Carboniferous to Lower Permian glaciation gave rise to a considerable thickness of tillite and associated conglomerates, possibly from a wet-base glacier, flowing from the north-west; in its last stages the glacier deposited possible kame and esker deposits near the end of Burma Road. A shoreline is postulated between the Styx Valley and Burma Road outcrops during the last stages of glaciation in the Lower Sakmarian. The fossiliferous conglomerate at the top of the Wynyard Tillite in the Styx Valley is probably a shoreline deposit. The silts of the Woody Island Siltstone were deposited in quiet reducing conditions in Sakmarian times. Conditions were uncongenial for marine life and it is not until the upper parts of Woody Island Siltstone that moderately rich fossil faunas are found. These sediments became increasingly calcareous with time, this trend culminating in the deposition of the Darlington Limestone. Marine conditions continued in the Upper Sakmarian with the deposition of the sands and silts of the Bundella Mudstone. Early in the Artinskian siliceous and carbonaceous sands and silts of the Mersey Group were deposited, possibly in lakes and lagoons of a coastal plain. A return to marine conditions saw the deposition of the sands of the Cascades Group. Animal life flourished. Marine conditions continued during the deposition of the sands and silts of the Malbina Siltstone and Sandstone. Environmental conditions were apparently unfavourable for a rich animal life for much of Malbina time. The last Permian shelly faunas in the Maydena area are seen in the base of the Risdon Sandstone, which was possibly deposited as a diachronous shelf deposit. The silts and sands of the Ferntree Group accumulated in the Kungurian and evidence of continued glacial activity, to the west, is found in some beds. The fine-grained carbonaceous sandstones of the Cygnet Coal Measures containing abundant plant fragments indicate a return to terrestrial conditions.

4. A period of erosion followed the deposition of the Cygnet Coal Measures and the terrestrial Triassic sediments were deposited disconformably on the Cygnet Coal Measures. A thick dolerite sill intruded the Triassic sediments in the Middle Jurassic. Faulting, probably related to the formation of the Derwent Graben, took place in the Tertiary. The dolerite talus on the slopes of Abbotts Lookout is probably of periglacial origin dating from the Pleistocene ice-age.

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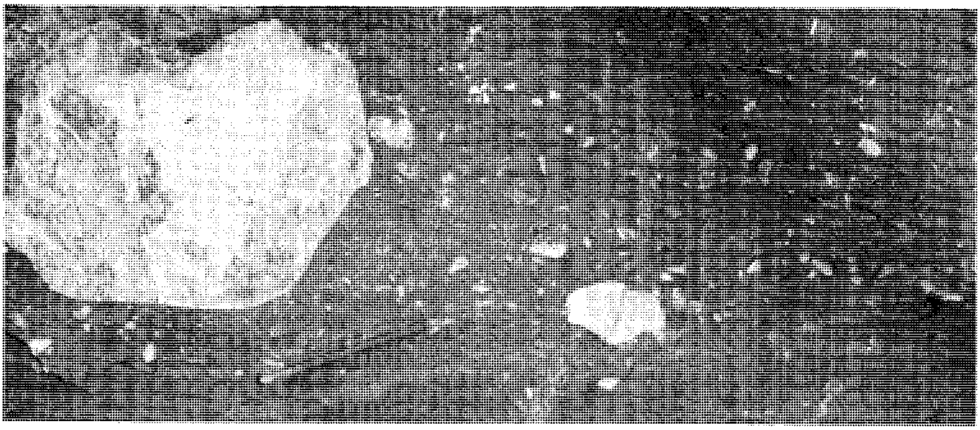
PLATE I



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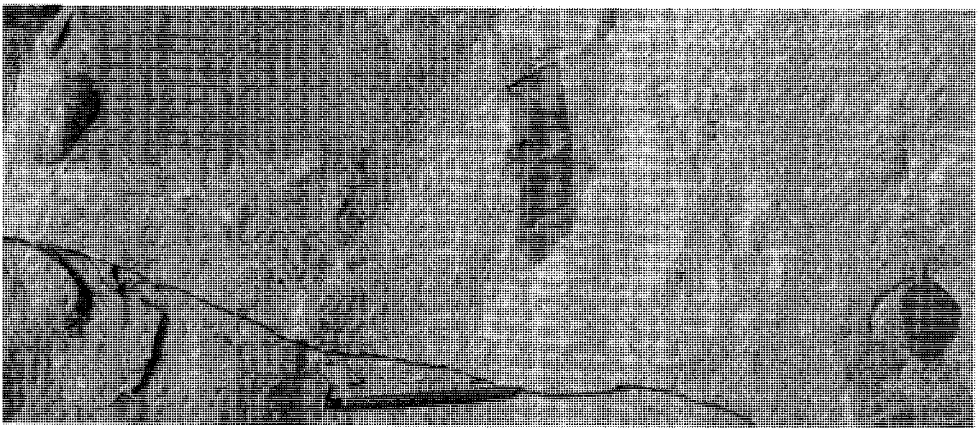

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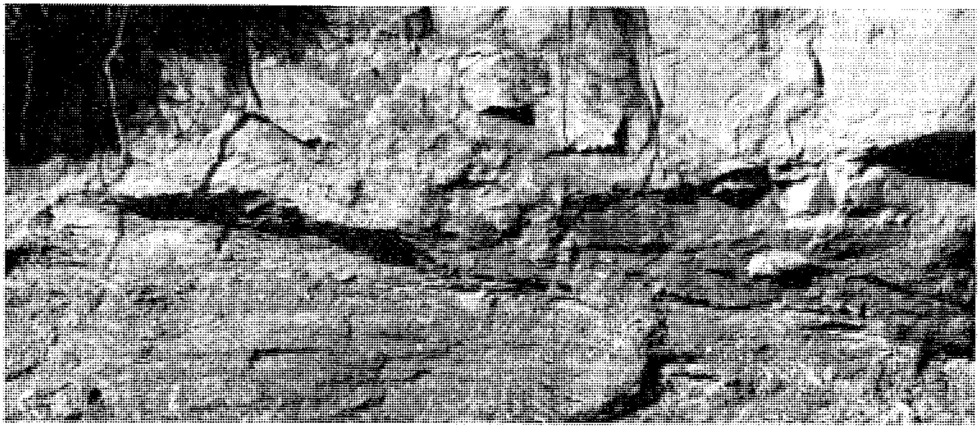

3

FIG. 1.—Pebbles in Darlington Limestone (4540E, 7303N), showing facets indicating a glacial origin.
FIG. 2.—Pebbles in Ferntree Mudstone, end of Roberts Road (4572E, 7330N).
FIG. 3.—Disconformity between Cygnet Coal Measures and Triassic sandstones, Roberts Road (4564E, 7345N).