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TASMANIA DEPARTMENT OF MINES

1976

GEOLOGICAL SURVEY EXPLANATORY REPORT

GEOLOGICAL ATLAS 1:250 000 SERIES

SHEET No. SK-55/5

QUEENSTOWN

by K.D. CORBETT, B.Sc. (Hons.), Ph.D.
and A.V. BROWN, B.Sc. (Hons.)

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ISSUED UNDER THE AUTHORITY OF THE HONOURABLE
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PREFACE

This explanatory report gives a brief outline of the area of the Queenstown 1:250 000 sheet. This sheet is one of a new series of geological maps which will provide a complete coverage of the State.

The geological information is derived from both departmental and external sources.

The list of selected references at the end of the report will serve as a guide to the more important geological publications which deal with the area.

J.G. SYMONS, Director of Mines

PHYSIOGRAPHY

The Central Plateau is a dolerite-capped surface at an average elevation of about 1200 m, and forms the north-east corner of the map area. It was affected by Pleistocene ice sheet planation, and contains numerous small glacial lakes (Jennings and Ahmad, 1957). Fringing the plateau to the west is a mountainous area which was dissected by large valley glaciers and is characterised by high dolerite-capped ranges and peaks. These include Mt Ossa [DP2164] (1617 m), the highest peak in the State.

The erosion surface between flat-lying Permo-Carboniferous rocks and the underlying folded rocks has been exhumed in many areas and is evident as isolated remnants in places such as Mt Dundas [CP7361] and Mt Sedgwick [CP 8549].

The topography of the Precambrian and folded Palaeozoic rocks is largely controlled by the major N-S structural trends. The harder quartzite and conglomerate units form a series of dissected mountain ranges (*e.g.* West Coast Range, Prince of Wales Range), on which many of the higher peaks show glacial cirque features. Drainage patterns tend to be trellised, with only a few major streams cutting across the grain of the country through a series of gorges (Davies, 1965).

Extending inland from the west coast is a dissected erosion surface (Henty Surface of Gregory, 1903) which slopes gently seaward from an altitude of about 330 m around the foot of the West Coast Range. The surface transects Tertiary beds as well as various Palaeozoic and Jurassic rocks, but is apparently older than Pleistocene moraines at the Henty River (Banks and Ahmad, 1959). It has apparently been affected by later faulting near the D'Aguilar Range [CN8585] and Mt Sorell [CP7918] (Scott, 1960*a*, *b*).

Holocene sand ridges form a coastal strip between Trial Harbour and Strahan, but elsewhere the coast tends to be rocky and erosional.

PRECAMBRIAN

The central portion of the map area forms part of the largest region of Precambrian rocks in Tasmania, the Tyennan nucleus. The northern and eastern parts of the nucleus consist of undifferentiated sequences belonging to both the quartzite-schist-minor amphibolite and eclogite assemblage, and the quartzite-phyllite assemblage (Williams, 1967). The rocks of these assemblages are of greenschist facies metamorphic grade and contain two main phases of deformation which define the Frenchman Orogeny (Spry, 1962). Sedimentary features indicate that the metamorphic rocks were derived mainly from siltstone and orthoquartzite.

Sequences belonging to the quartzite-schist-minor amphibolite assemblage are more common than sequences of the quartzite-phyllite association in the Upper Forth [DP2077] and Mersey Valleys [DP3577] (MacLeod *et al.*, 1961) and in the Raglan Range area [CP9835] (Gee, 1963). In the Raglan Range and Mt McCall [CP9507] areas, NW-trending recumbent isoclinal folds are attributed to the second main phase of deformation during the Frenchman Orogeny (Spry and Gee, 1964; Williams, 1971).

Rocks of both assemblages near Frenchmans Cap [DP0419] (Spry, 1963) also show the two main periods of deformation of the Frenchman Orogeny (Spry and Gee, 1964). Metamorphism accompanied the second deformation phase in the area between Flat Bluff, Mt Madge and Mt Mary [DP0227] (Turner, 1972). Similar rock sequences also occur to the east around Mt Mullens [DP1425]

(Spry and Zimmerman, 1959), and in the Collingwood area [DP0833] (McIntyre, 1964). A small body of eclogite near the Collingwood River [DP0636] (Spry, 1963*a*) is closely associated with talc-garnet-kyanite-quartz schist which is considered to have been formed at a temperature of 600° ±20°C and a pressure of $\geq$1 MPa (Råheim and Green, 1974).

In the Mt Arrowsmith-Mt Ronald Cross area schist, phyllite, dolomite and minor conglomerate occur with a regional north-west strike (Gulline, 1965).

In the Lake Gordon storage area regionally-metamorphosed quartzite and pelite, with minor amphibolite, exhibit polyphase deformation (Brown *et al.*, in prep.).

North-west of Zeehan the Precambrian rocks comprise a belt of metamorphic rocks (Whyte Schist) near Granville Harbour [CP3575], representing a continuation of the Arthur Lineament (Gee, 1967), and a relatively unmetamorphosed sequence of quartzite, micaceous quartzite, siltstone, shale and dolomitic rocks of the Oonah Quartzite and Slate (Spry, 1958*a*; Blissett, 1962). The latter have structures predominantly attributed to the Penguin Orogeny, which is considered younger than the Frenchman Orogeny (Spry, 1964), and similar structures persist to near Renison Bell [CP6573], where there is an apparently conformable contact (in the upper Pieman River) with the lowermost unit of probable Cambrian rocks (Success Creek Group, Williams *et al.*, in press).

A small area of metamorphosed sedimentary rocks, the Concert Schist (Blissett, 1962), near Mt Dundas is transitional with the sequence mapped in the adjacent area as Oonah Quartzite and Slate (Turner, in prep.).

On the northern end of Cape Sorell [CP5027] sequences of laminated and cross-bedded orthoquartzite with minor siliceous conglomerate and pelites have undergone lower greenschist facies metamorphism and polyphase deformation (Baillie *et al.*, in press). South-east of this, a belt of undifferentiated proterozoic schist, quartzite and minor limestone trends south-west from the Modder River to Hibbs Bay [CN5885], with an adjacent carbonate-bearing sequence near Birthday Bay [CN5599] (Hall *et al.*, 1969).

East of the Tyennan nucleus, an unmetamorphosed sequence of siltstone, quartzite, dolomite and slate forms a steeply-plunging anticline at The Needles [DN5768] (Spry, 1962).

CAMBRIAN SYSTEM

Rocks of the Cambrian system occur on both sides of the Tyennan nucleus, the larger western belt representing the Dundas Trough (Campana and King, 1963) and its continuation into south-west Tasmania, and the eastern belt the Adamsfield Trough (Corbett, 1970, 1972).

Within the Dundas Trough five major stratigraphic-lithologic groups may be distinguished: (i) a Late Precambrian or Early Cambrian orthoquartzite-shale sequence with minor dolomite and volcanic rocks (Success Creek Group and correlates); (ii) unfossiliferous mudstone-greywacke sequences with associated minor volcanic rocks; (iii) ultramafic and mafic intrusive rocks; (iv) fossiliferous Middle to Late Cambrian greywacke-mudstone-conglomerate sequences, with an upper quartzwacke sequence in some areas; and (v) acid to intermediate volcanic rocks with minor intrusives (Mt Read Volcanics).

Success Creek Group and correlates

The Success Creek Group (Taylor, 1954), comprising over 750 m of quartzite, shale, breccia and tuff, occurs in the Pieman River, near Renison Bell. It was included in the Precambrian Oonah Quartzite and Slate by Blissett (1962) on the grounds of lithological similarity and lack of apparent structural discordance. However, Williams *et al.* (in press) suggest the group is separated from the Oonah Formation by a structural discordance correlated with the Penguin Orogeny. A dolomite-shale-chert sequence forming the host rocks for the Renison Bell tin mineralisation is probably equivalent to this group. At Rosebery [CP7775], a similar sequence of shale, quartzite and tuff, with minor dolomite and fuchsitic conglomerate (Rosebery Group of Taylor, 1954) appears to interfinger with the Mt Read Volcanics (Brathwaite, 1972).

East of the Tyndall Range [CP8758], a sequence of siliceous conglomerate, quartzite, slate and minor dolomite underlies and interfingers with the Mt Read Volcanics and is unconformable on Precambrian rocks of the Tyennan nucleus (Carey and Banks, 1954; Corbett *et al.*, 1974). A similar conglomerate-slate unit overlies Precambrian rocks and underlies acid volcanic rocks in the Thirkell Hill area [CN8876] (Martin, 1974).

Unfossiliferous sequences

Apparently conformably overlying the Success Creek Group at the Pieman River is a thick sequence of unfossiliferous argillite and greywacke, with minor basic lavas, called the Crimson Creek Argillite (Taylor, 1954). Correlates of this formation are widespread in the Zeehan area (Blissett, 1962).

In the Professor Range-Henty River area [CP6645], and along the lower King River [CP6728], unfossiliferous Cambrian sequences include greywacke, slate, and acid to intermediate tuff, with minor andesitic and dacitic lavas and possible intrusive rocks (Baillie *et al.*, in press).

South of Macquarie Harbour, a narrow belt of Cambrian rocks at Double Cove [CP6312], and a broader belt in the Birch Inlet area [CN7097], comprise mainly unfossiliferous sequences or argillite, greywacke and conglomerate, with large thicknesses of intermediate to basic volcanic rocks in the Noddy Creek area [CP6801]. The latter are intruded by several small plugs of diorite and microgranite (Hall *et al.*, 1969).

In the Adamsfield Trough, an unfossiliferous, structurally complex, sequence of chert, argillite, greywacke, conglomerate and quartzite, with minor intermediate to basic volcanic rocks, is exposed along the Gordon Road and in the Wings Lookout-Pokana River area [DN3783] (Corbett, 1970; Brown and Turner, in prep.).

Ultramafic and associated rocks

Bodies of serpentinised peridotite-gabbro, and associated mafic rocks, occur in the Husskisson River-Serpentine Hill-Trial Harbour area of the Dundas Trough. Several of these bodies are sill-like, with faulted and re-in trusive contacts, and lie at the contact between unfossiliferous Cambrian sequences and Dundas Group correlates. The largest body is a transgressive sill, up to 300 m thick, which extends south from the Husskisson River [CP 7275] and consists largely of serpentinised pyroxenite (Taylor, 1954; Blissett, 1962). The Serpentine Hill Complex [CP6867], previously worked for asbestos, consists of orthopyroxenite, harzburgite, serpentinite, gabbro, dolerite and basic volcanic rocks, and may be a dismembered ophiolite (Rubenach, 1974). Detritus derived from the body occurs in the base of the overlying

Dundas Group correlates. At Mt Razorback [CP7064] the body consists mainly of serpentinised pyroxenite, and contains minor asbestos, chromite and osmiridium (Blissett, 1962). A small body at Trial Harbour [CP5056] consists of peridotite and dunite extensively altered to serpentinite, and contains minor nickel mineralisation. Gabbroic bodies occur west of Zeehan and in the upper Henty River area (Blissett, 1962), and one of these is dated at 518 ±133 m.y. (Brooks, 1966).

South of Macquarie Harbour an elongated strip of highly sheared serpentinite with minor pyroxenite, harzburgite and gabbro, extends north-east from Hibbs Lagoon [CN6185], and is faulted against Cambrian and Ordovician sedimentary rocks. Asbestos occurs within this belt, and in a smaller body at Asbestos Point [CP7107] (Hall *et al.*, 1969).

In the Adamsfield Trough, an alpine-type ultramafic body lies within a major fault zone. It consists of a sheath of sheared and blocky serpentinite around partially serpentinised and fresh peridotite (Brown, 1972). Osmiridium derived from this body has been mined from overlying Late Cambrian deposits and from alluvial gravels (Nye, 1929). In the Boyes River [DN3983], north of Adamsfield, sheared and blocky serpentinite, with minor orthopyroxenite, crops out along the northward extension of the major fault zone (Brown and Turner, in prep.).

Fossiliferous sequences

The best known fossiliferous sequence is that between Mt Dundas and Misery Hill [CP6761], known as the Dundas Group. The sequence comprises some 3800 m of alternating greywacke-conglomerate and mudstone-greywacke units, with minor volcanic rocks, and ranges in age from middle Middle Cambrian to middle Late Cambrian. A similar sequence occurs in the Husskisson River (Elliston, 1954; Blissett, 1962; Banks, 1962).

Near the Professor Range [CP6747], a sequence of siltstone, quartzwacke and siliceous conglomerate forms the top of the Cambrian sequence (Baillie *et al.*, in press), and contains a trilobite fauna of Late Cambrian age. A comparable quartzwacke-siltstone-conglomerate-quartzite sequence overlies the volcano-sedimentary sequence in the King River area [CP7127] (Baillie *et al.*, in press). South of Macquarie Harbour, a siltstone sequence of upper Late Cambrian age is conformably overlain by probable Early Ordovician rocks [CN6599] (Jago, 1972, 1973).

On the Scotts Peak Road in the Adamsfield area, a Middle to Late Cambrian fauna occurs in a sequence of mudstone, sandstone, and conglomerate with ultramafic detritus (Quilty, 1971). West of the Denison Range [DN3986], the Trial Ridge Beds (Corbett, in press) of interbedded conglomerate, sandstone, siltstone and greywacke have recently yielded late Middle Cambrian fossils (Brown and Turner, in prep.).

Acid to intermediate volcanic rocks

A belt of Andean-type calc-alkaline rhyolitic to dacitic volcanic rocks, with some adesitic and basaltic types, extends from north of Rosebery to South Darwin Peak [CP8316], and is known as the Mt Read Volcanics. The complex sequence includes flow-banded and autobrecciated lava flows, ash-fall and ash-flow tuffs and breccias, subaqueous pyroclastic flows and slides, acid to basic intrusive bodies, and sedimentary lenses of mudstone and sandstone (Campana and King, 1963; Corbett *et al.*, 1974; Solomon and Griffiths, 1974; Williams *et al.*, in press). The zinc-lead-silver ore bodies of Rosebery and Hercules, and the copper ore bodies of Mt Lyell occur within this sequence. The volcanic rocks interfinger with sedimentary sequences along the western margin, while to the east they are either faulted against or unconformably overlie Precambrian rocks of the Tyennan nucleus. They exhibit spilite-keratophyre mineralogy, and consist largely of quartz, albite, chlorite and sericite, with minor hornblende and clinopyroxene.

In the Mt Darwin-Queenstown-Red Hills area, a sequence of mainly potash rhyolite and feldspar-porphyry lava is flanked by a dominantly pyroclastic sequence with quartz-porphyries and shales, and is overlain by a younger sequence of tuff, sedimentary rocks and minor lavas. The younger sequence contains Middle to Late Cambrian fossils in one area, and appears to be unconformable on older mineralised volcanic rocks near Queenstown (Corbett *et al.*, 1974). Bodies of hornblende-pyroxene porphyry are common near Queenstown, and a swarm of basic to intermediate dykes intrudes the volcanic sequence at Mt Lyell and near Mt Read [CP8065] (Corbett, 1975; Reid, in press). A small sub-volcanic granite body intrudes the potash rhyolite sequence near Mt Darwin [CP8418], and pebbles of this granite occur in the overlying sequence (Williams *et al.*, in press). A similar granite body occurs in the Murchison River near Mt Farrell [CP8875] (Bradley, 1954) and is probably continuous southwards with granite mapped in Anthony Creek [CP8868] (Corbett *et al.*, 1974). This granite has a minimum age of 515 ±15 m.y. (McDougall and Leggo, 1965).

In the D'Aguilar Range-Thirkell Hill area [CN8580], an acid volcanic sequence similar to the Mt Read Volcanics includes quartz-feldspar porphyry lavas, pyroclastic rocks, shales and intrusive porphyries (Martin, 1974).

LATE CAMBRIAN TO EARLY ORDOVICIAN SEQUENCES

The volcanism and greywacke-type sedimentation which characterised much of the Cambrian Period was replaced by deposition of siliceous conglomerate and sandstone in the Late Cambrian in most areas, with uplift of the Precambrian nuclei providing the detritus. On parts of the West Coast Range the siliceous influx began in the middle Late Cambrian, as it did in much of the Adamsfield area. However, some local basins were receiving coarse Precambrian detritus as early as late Middle Cambrian (*e.g.* Trial Ridge area [DN3986]; Corbett, in press; Brown and Turner, in prep.), while others did not receive siliceous material until the Early Ordovician, when there was widespread deposition of shallow marine sandstone.

A widespread unconformity underlies the Late Cambrian siliceous sequence in the Adamsfield area (Corbett and Banks, in press; Brown and Turner, in prep.). There is also unconformity below the siliceous conglomerate on parts of the West Coast Range, but on other parts there is apparent conformity via volcaniclastic beds to a Middle-Late Cambrian volcano-sedimentary sequence (Corbett *et al.*, 1974).

The major siliceous clastic unit is the Owen Conglomerate of the West Coast Range. This formation comprises up to 800 m of pebble to boulder conglomerate and red sandstone at Mt Owen [CP8539] (Wade and Solomon, 1958). A correlate on the Tyndall Range [CP8259] has a lower fossiliferous marine facies of quartzwacke, siltstone and conglomerate of middle Late Cambrian age (Corbett, 1975). The upper part of the Owen Formation comprises marine sandstone with worm burrows, and is probably Early Ordovician (Banks, 1962). Deposition of the conglomerate near Queenstown was largely controlled by an active fault scarp (Great Lyell Fault), and only the uppermost 10 m of the sequence (Pioneer Beds) overlaps this fault to the west. The base of the Pioneer Beds is an unconformity on the earlier Owen beds (Haulage unconformity of Wade and Solomon, 1958) and on volcanic rocks west of the fault

(Corbett *et al.*, 1974). A sequence similar to the Pioneer Beds unconformably overlies Cambrian rocks near the Henty River bridge [CP7349], north of Queenstown (Baillie *et al.*, in prep.).

Underlying the Owen Conglomerate in many areas is a variable thickness (up to 300 m) of locally-derived volcaniclastic conglomerate correlated with the Jukes Formation (Bradley, 1954; Wade and Solomon, 1958; Banks, 1962; Campana and King, 1963). This unit conformably overlies the volcano-sedimentary Comstock Formation in some areas (Corbett *et al.*, 1974) and is included with that formation as a subdivision of the acid volcanic sequence. Elsewhere the Jukes Formation is unconformable on older volcanic rocks.

In the Zeehan area, the Mt Zeehan Conglomerate forms a wedge up to 450 m thick, and is overlain by a more extensive marine sandstone unit up to 600 m thick (Blissett, 1962). Near the Professor Range south of Zeehan, the conglomerate is disconformable on Late Cambrian marine quartzwacke-siltstone-conglomerate sequence (Baillie *et al.*, in prep.), but at Misery Hill [CP6761] there is apparent gradation to underlying Dundas Group beds (Blissett, 1962; Williams, 1975).

Along the exposed margin of the Tyennan nucleus, between Frenchmans Cap and the Olga River area [CN9870], the clastic unit consists mainly of siliceous sandstone with lesser conglomerate, and includes fossiliferous and tubicolar beds and limestone intercalations (Carey and Banks, 1954; Banks, 1962; H.E.C. unpublished reports).

On the D'Aguilar Range [CN8685], siliceous conglomerate rests abruptly on acid volcanic rocks, but just west of this at Mt Lee [CN8580] and Thirkell Hill [CN8471], the conglomerate is underlain by a sandstone-shale-volcaniclastic sequence which is unconformable on volcanic rocks (Martin, 1974). Near Birch Inlet [CN7093], a 600 m sequence of sandstone and siltstone is unconformable on Cambrian rocks, but to the west of this [CN6496] a narrow strip of quartz sandstone with minor conglomerate bands is conformable on upper Late Cambrian beds (Hall *et al.*, 1969; Jago, 1972).

In the Adamsfield area the Late Cambrian-Early Ordovician clastic sequence is very well developed and constitutes the Denison Subgroup (Corbett, in press). A basal siltstone-quartzwacke turbidite unit (720 m) is unconformable on the Middle Cambrian Trial Ridge Beds, and contains a middle Late Cambrian marine fauna. Conformably above this is a shallow marine-deltaic sandstone unit (510 m), also probably Late Cambrian, grading into a thick non-marine conglomerate-sandstone unit (1500 m). The upper formation (600 m) comprises shallow marine sandstone, siltstone and impure limestone, and contains an abundant Early Ordovician shelly fauna. The lower marine formations wedge out to the north and to a large extent also to the south and east (Corbett and Banks, in press; Brown and Turner, in prep.). At Tim Shea [DN5670], near the type area of the original Junee Series (Lewis, 1940; Brown *et al.*, in press), the clastic sequence comprises a lower unfossiliferous sandstone unit, and a fossiliferous Early Ordovician mudstone-sandstone unit (Corbett and Banks, in press).

ORDOVICIAN LIMESTONE SEQUENCE

Conformably overlying the Early Ordovician sandstone-mudstone sequences in most areas is a fossiliferous limestone sequence with intercalated siltstone and sandstone in some areas. In the Florentine Valley [DN5580] the limestone sequence is about 1800 m thick and constitutes the Gordon Subgroup. It ranges in age from upper Early Ordovician to about middle Late Ordovician

(Corbett and Banks, 1974, in press). Lithology and bedding characters in the limestone are very variable.

The limestone sequences in western Tasmania are generally poorly exposed and deeply weathered. Near Zeehan and Queenstown the thickness ranges from a few tens of metres to several hundred metres, and fossil horizons of Middle to Late Ordovician age are known (*e.g.* Banks, 1957, 1962; Blissett, 1962). The limestone has been quarried as a smelting flux at Zeehan and Queenstown and near Mt Darwin.

LATE ORDOVICIAN-EARLY DEVONIAN SEQUENCES (ELDON GROUP AND CORRELATES)

Conformably overlying the Ordovician limestone in most areas, but with possible disconformity in others, is a sequence of shallow-water marine sandstone, mudstone and minor limestone correlated with the Eldon Group of the Zeehan area (Gill and Banks, 1950). At Zeehan the basal formation consists of quartz sandstone and grit up to 480 m thick, followed by a mudstone unit up to 240 m thick, a thin quartzite (60 m), a richly-fossiliferous sandstone (480 m) of Early Devonian age, and an extensive upper mudstone unit at least 420 m thick, also of Early Devonian age (Blissett, 1962). In the Teepookana area [CP7330], a basal unit of quartzite-mudstone-grit (800 m) is faulted against fossiliferous Early Devonian sandstone at least 1200 m thick. Overlying this is a correlate of the upper mudstone unit, at least 1500 m thick, with sedimentary structures suggestive of very shallow-water marine deposition (Baillie and Williams, in press; Baillie *et al.*, in press).

In the lower Gordon River area [CN8599] (Gee *et al.*, 1969) an Early Devonian sandstone-siltstone sequence is faulted against the Ordovician limestone, and includes a pure bioclastic limestone unit at least 24 m thick. The latter is correlated with similar limestone which occurs at Point Hibbs [CN5981] within a succession, at least 600 m thick, of sandstone, siliceous conglomerate and richly-fossiliferous limestone of upper Early Devonian age (Banks, 1962; Flood, 1974).

TABBERABBERAN OROGENY

A widespread period of deformation between the Early Devonian and late Middle Devonian affected all the Early Palaeozoic rocks in the area, and to some extent also the rocks of the Tyennan nucleus. Large, open, NW-trending folds within the garnet schists and quartzites of the Raglan Range and Mt McCall areas are reflected in the adjacent Palaeozoic rocks and are considered to be Tabberabberan structures (Spry and Gee, 1964; Williams, 1971).

The most prominent Tabberabberan folds are a series of early-formed, large, open, N-S to NNW-orientated synclinoria of Ordovician limestone and Eldon Group correlates. Major anticlinoria are less prominent, the most obvious one being that developed in the Owen Conglomerate along the West Coast Range. Rejuvenation of major faults, such as the Great Lyell fault at Queenstown, accompanied this early phase, which may have been largely due to differential vertical movements (Solomon, 1962, 1965). Superimposed on, and interfering with, these major structures in some areas are NW to WNW-orientated folds and faults. These are particularly obvious in the Queenstown-Zeehan area, and are interpreted as being due to NE-SW compression (*ibid.*). Associated with these near Queenstown is a major E-W to WNW-orientated fracture zone which extends eastwards into the Tyennan nucleus and westwards to Trial Harbour (Solomon, 1962; Baillie *et al.*, in press). A strong cleavage affects all rocks except the Owen Conglomerate in the Queenstown area, and has a predominant north-west trend (Wade and Solomon, 1958).

Analysis of folding in the Early Devonian rocks of the Strahan area (Baillie and Williams, in press) suggests that NW-trending folds in the southern part of the area were followed by a NNW-trending series in the northern part. In the lower Gordon River area, the Early Devonian sequence is affected by a series of NNW-trending, doubly-plunging folds associated with dip-slip strike faults (Gee *et al.*, 1969).

The NW-oriented Tabberabberan folds are apparently absent from the Adamsfield area where broad, open N-S folds, slightly oversteepened from the west, form a large synclinal structure (Corbett, 1970).

LATE DEVONIAN-EARLY CARBONIFEROUS GRANITIC ROCKS

Granite intrusions accompanied and followed the Tabberabberan Orogeny in western Tasmania. The largest granite mass is the Heemskirk Granite [CP 5060], which intrudes Palaeozoic and Proterozoic rocks to the north of Trial Harbour (Blissett, 1962). It is dated at 352 ±4 m.y. (Brooks, 1966). It consists of an upper sub-horizontal layer of red granite overlying white granite, and the contact zone between the two types contains abundant quartz-tourmaline nodules and minor tin mineralisation (Klomínský, 1972).

At Pine Hill [CP7169], a complex sill with associated dykes of quartz-feldspar-porphyry contains quartz-cassiterite veins. Several parallel dykes of similar composition occur on Renison Bell Hill and are dated at 355 ±4 m.y. (Blissett, 1962; Brooks, 1966).

East of Rosebery, the Granite Tor body [CP9775] has discordant contacts with Proterozoic rocks, and consists of biotite-muscovite granite dated at 355 m.y. (McDougall and Leggo, 1965). A small granite body near Bluff River, south-east of Granite Tor, has associated tin mineralisation (Noldart and Jennings, 1968).

A small granitic intrusion within Precambrian rocks of the upper Forth Valley [DP2176] is presumed to be Devonian and has associated wolfram, tin and copper mineralisation (MacLeod *et al.*, 1961). A granite body has caused contact metamorphism of Precambrian phyllite about 3 km south of Cape Sorell lighthouse [CP5124] (Baillie *et al.*, in press).

The galena-sphalerite mineralisation of the Zeehan and Dundas [CP7062] fields, and the cassiterite-pyrite-pyrrhotite mineralisation at Renison Bell, are believed to be associated with sub-surface granitic intrusions (Both and Williams, 1968).

PARMEENER SUPER-GROUP (LATE CARBONIFEROUS-PERMIAN-TRIASSIC SYSTEMS)

Flat-lying Late Carboniferous to Triassic sedimentary rocks overlie folded Proterozoic and Palaeozoic rocks with landscape unconformity. The sequence is known as the Parmeener Super-Group (Banks, 1973), and comprises a lower glacio-marine sequence, a lower freshwater sequence, and an upper glacio-marine sequence (constituting the Lower Division, and mainly of Permian age), and an upper freshwater sequence (Permian), and a fluvio-lacustrine sequence (Triassic) constituting the Upper Division (Forsyth *et al.*, 1974). The sequence is similar to that of the Great Western Tiers (Williams and Turner, 1974).

The basal unit of the lower glacio-marine sequence is either a tillite (Strahan area), containing boulders of basement material, or a conglomerate with rare thin beds of shale (Du Cane-St Clair area). Conformably overlying the basal conglomerate in the Central Plateau area is a fossiliferous marine sequence of grey to black siltstone with minor sandstone and conglomerate lenses (MacLeod *et al.*, 1961; Gulline, 1965). The sequence as a whole thins southward towards Mt Ronald Cross [DP2522], but the thickness of the conglomerate is extremely variable, reaching 70 m near Mt Gell [DP2031]. Tillite occurs in several places north of Zeehan (Blissett, 1962), and also at Mt Dundas, Mt Read and Mt Sedgwick, where it rests unconformably on a striated pavement of Cambrian rocks and is overlain by fossiliferous pebbly siltstone and sandstone (Banks and Ahmad, 1962). Tillite, with intercalated rhythmites, is overlain by fossiliferous pebbly siltstone and sandstone between Strahan and the lower Henty River (Baillie *et al.*, in press). At Point Hibbs [CN5880] basal tillite and conglomerate, with sandstone and pyritic siltstone, is overlain by quartzose sandstone, conglomerate and siltstone (Banks and Ahmad, 1962). At least 45 m of tillite, overlain by massive grey siltstone and fossiliferous pebbly sandstone and siltstone, occurs in the Florentine Valley (Corbett, 1964).

The lower freshwater sequence consists of estuarine and lacustrine deposits of micaceous, arkosic and quartz sandstone with thin units of carbonaceous shale and impersistent coal seams. Coal seams are prevalent within the sequence in the northern part of the Central Plateau but are absent at Mt Rufus [DP2835], and the freshwater sequence attenuates to the south (Mac Leod *et al.*, 1961; Gulline, 1965). Correlates of the sequence occur in the lower Henty River area (Banks and Ahmad, 1962) and in the Florentine Valley (Corbett, 1964).

The upper glacio-marine sequence in the Central Plateau area comprises fossiliferous siltstone with dropstones and massive unfossiliferous pebbly sandstone, with several limestone units between Mt Manfred [DP1948] and Mt Rufus (MacLeod *et al.*, 1961; Gulline, 1965). Fossiliferous pebbly siltstone and sandstone are correlates of the sequence in the lower Henty River area (Banks and Ahmad, 1962), and in the Florentine Valley (Corbett, 1964; Jennings, 1955).

The Upper Division of the Parmeener Super-Group on the northern Central Plateau begins with massive arkosic sandstone interbedded with plant-bearing black shale, constituting the upper freshwater sequence. The carbonaceous shale content decreases southwards, and shales are absent on Mt Gould [DP2281]. Disconformably overlying the above sequence is a fluvio-lacustrine sequence of cross-bedded sandstone, arkose and conglomerate with thin intercalated shale units. The base of this fluvio-lacustrine sequence has been previously regarded as the base of the Triassic System (MacLeod *et al.*, 1961). Near Lake St Clair [DP3340] the upper freshwater sequence is a relatively thin succession of feldspathic sandstone and carbonaceous shale, with pebbly beds and thin coal lenses, and the overlying fluvio-lacustrine sequence comprises coarse conglomerate and sandstone followed by interbedded coarse sandstone and grey-green shale (Gulline, 1965). In the lower Henty River area, a correlate of the upper freshwater sequence consists of interbedded quartz sandstone and carbonacous siltstone, with plant fossils and some horizons of worm burrows (Banks and Ahmad, 1962). Correlates of the upper freshwater and fluvio-lacustrine sequences occur in the Florentine Valley area (Corbett, 1964; Jennings, 1955).

JURASSIC DOLERITE

In the Central Plateau area, tholeiitic dolerite occurs as large flat-lying sills and sheets intruding Parmeener Super-Group rocks, and capping most of the higher peaks. Most of the sills have been dislocated by later tectonic activity (MacLeod *et al.*, 1961), but in some areas such as at Mt Olympus [DP2645] and Mt Ida [DP3148], large unbroken masses of dolerite are considered to be a single sill (Gulline, 1965). Remnant sill thicknesses of up to 300 m have been estimated, *e.g.* Wylds Craig [DN5098] (Jennings, 1955).

The Eureka Cone Sheet [CP5070], north of Zeehan, is an oval body with a core of Proterozoic rocks (Blissett, 1962). The tops of Mt Dundas and Mt Sedgwick are composed of flat-lying dolerite, and the remains of a faulted dolerite sill occur near Trial Harbour. Dolerite occurs at sea level at Point Hibbs where it is faulted against Parmeener Super-Group beds (Hall *et al.*, 1969).

?CRETACEOUS INTRUSIVE ROCKS

Lamprophyre dykes occur in widely scattered areas of western Tasmania, *e.g.* Queenstown, Raglan Range, Gordon dam site [DN1668], Point Hibbs, and by analogy with dated specimens from King Island may be of Cretaceous age (Sutherland and Corbett, 1974). A small complex intrusion of mixed biotitic and feldspathic granitoid rocks at Varna Bay [CN5696] appears to be related to an adjacent lamprophyric rock, and may also be of Cretaceous age (*ibid.*).

TERTIARY SYSTEM

The Tertiary Macquarie Harbour graben extends from south of the Wanderer River [CN8065] to north of Strahan, and is about 10 km in width. It is filled to a depth of at least 220 m with a non-marine sequence of poorly consolidated sands and gravels with siltstone, clays and lignite bands. At least 170 m of the sequence is below present seal level (Scott, 1960*a*). Basal boulder beds containing Jurassic dolerite occur at the basin margin near Mt Strahan [CP7523] and on the lower Henty River (Baillie *et al.*, in press). Microplankton and spores from deposits at Strahan indicate a Palaeocene age (Cookson and Eisenack, 1967; Harris, 1968).

Sub-basalt fluviatile deposits of sand, silt and clay beds crop out to the north and east of Granville Harbour [CP3770], and a small outcrop of silicified marine bryozoal limestone is associated with these sediments 4 km east of Granville Harbour. Scattered outcrops of gravel occur on hilltops north of Zeehan (Blissett, 1962).

Olivine-bearing Tertiary basalt fills pre-basalt depressions and caps hills to the north of Tarraleah [DP5516] (Prider, 1948). The basalt overlies Miocene sediments near Tarraleah, and has a possible maximum thickness of about 200 m near Wentworth dam [DP5125] (Gulline, 1965). Basalt near Maggs Mountain [DP3277] includes a 12 m semi-ophitic zone overlain by 80 m of porphyritic olivine basalt (Spry, 1958*b*). Near Granville Harbour basalt forms a low undulating plateau and occurs as small hills and ridges further east (Blissett, 1962). Individual flows are rarely more than 10 m thick, and in places overlie late Oligocene to early Miocene limestone.

QUATERNARY SYSTEM

Pleistocene glacial features and deposits are widespread in central and western Tasmania. At its maximum extent the Central Plateau ice cap was about 65 km in diameter, and extended west to the Du Cane Range-Lake St Clair area. An inner zone of predominant erosion is bounded by an outer zone, about 10 km wide, or predominant deposition, including bouldery moraine, glaciofluvial and glacio-lacustrine deposits. An extensive plain of morainal material occurs in the vicinity of Lake St Clair and Lake King William [DP3030] (Derbyshire, 1968). Major outlet glaciers flowed into the Mersey and Forth Valleys to the north, the Canning Valley [DP0565] to the west, and the Franklin Valley [DP2129] to the south, and glacial deposits are common in these areas (Davies, 1962).

A second glacier complex in the Eldon Range [CP9552]-Mt Tyndall [CP 8459]-Mt Murchison [CP8770] area had major outlet glaciers into the Henty [CP7654] and King Valleys [CP8045], and end moraines occur at the Henty Road bridge [CP7350] (Banks and Ahmad, 1959) and near Crotty [CP8933] (Ahmad, Bartlett and Green, 1959). Moraines in the Linda [CP8441], Comstock [CP8446] and Nelson Valleys [CP9339] resulted from ice pushing up tributary valleys from the main King glacier (*ibid.*). Fossil wood from the Linda moraine has been dated at 26 480 ±800 years B.P. (Gill, 1956). Smaller moraines are associated with cirques on most of the higher peaks in the area, *e.g.* Frenchmans Cap, West Coast Range, Denison Range, King William Range.

Holocene deposits of talus and scree are abundant in the Central Plateau area and on the slopes of the dolerite-capped mountains. Alluvial sands, silts and gravels occur in most of the major river and creek valleys. Raised beaches and stabilised dune ridges occur near the coast between Trial Harbour and Macquarie Harbour, and are associated with mobile sand dunes in some areas.

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