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GENERAL GEOLOGY

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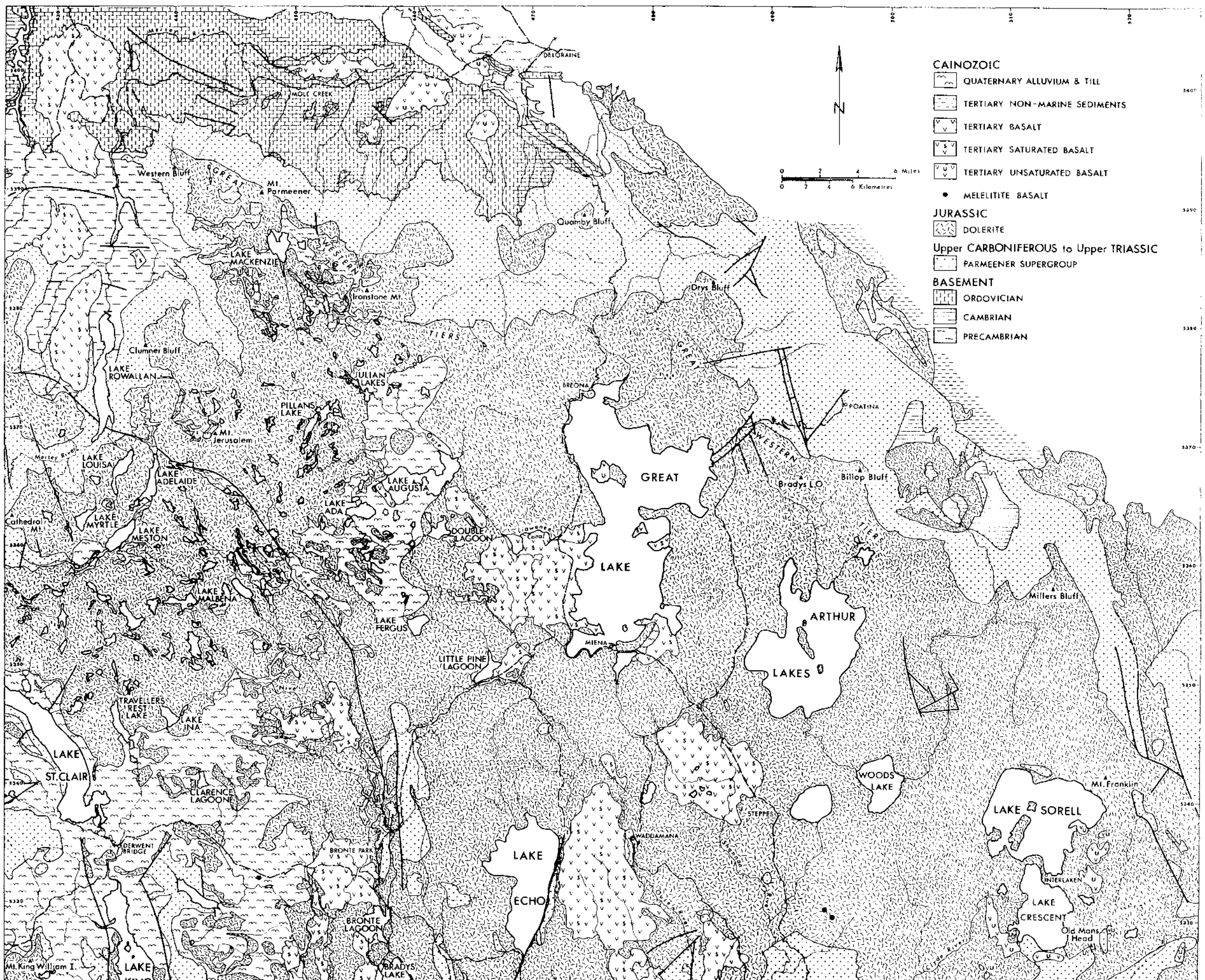
INTRODUCTION

We may think of the Plateau as consisting of two main, nearly horizontal, layers of rock resting on a basement of older, steeply tilted rocks. The surface layer, a few hundred metres thick, is dolerite about 165 million years old. This was injected into marine and non-marine sedimentary rocks deposited during a span of about 90 million years beginning about 290 million years ago. The part of this sequence originally over the dolerite has been removed by erosion, that beneath the dolerite is preserved as an almost continuous band around the northern base of the Plateau from Travellers Range to Table Mountain. The basement consists of metamorphic, sedimentary and igneous rocks some older than 570 million years, intruded by granite over 480 million years ago and again about 345 million years ago, and folded into a mountain range about 370 million years ago.

THE BASEMENT ROCKS

The basement rocks include Precambrian (older than 570 m.y.) schists, phyllites, slates, quartzites and dolomite (distribution shown on map, fig.6). These are overlain at Quamby Brook and near Connorville by Cambrian rocks including slates, siltstones, greywackes and silicic and mafic volcanic rocks. Granite intruded along the margin of the Tyennan Geanticline during the Cambrian. Ordovician to Lower Silurian (500 to 430 m.y. old) shallow water marine sediments overly the Precambrian and Cambrian rocks. The Precambrian rocks occur both in the core of an uparched (anticlinorial) structure near Golden Valley and in the Mersey valley upstream from Western Bluff, where they form part of the core of Tasmania, the Tyennan Geanticline, which must underlie much of the Central Plateau. The rocks of this geanticline were folded at least once before the Cambrian. The Cambrian, Ordovician and Silurian rocks were folded about 370 million years ago, and then granite injected about 345 m.y. ago. The folding produced a high mountain range subsequently eroded presumably by sub-aerial agents and finally by part of an extensive ice sheet which deposited boulder clay as it retreated.



6. Generalised geological map of the Central Plateau.

THE PARMEENER SUPERGROUP

Introduction and Definition

The boulder clay is the lowest unit in a succession of rocks of Late Carboniferous (290 m.y.) age at the base to Late Triassic (205 m.y.) age at the top. The succession outcrops around the rim of the Plateau from Travellers Range to Table Mountain and could conveniently be called the Parmeener Supergroup (after Mt. Parmeener, 447.4E.539.00N). The Supergroup includes all the units from the Stockers Tillite at the base to the Brady Formation at the top and in the Plateau region is about 1200m thick. It rests with angular unconformity on older rocks and is capped by an intrusive dolerite sheet in most places. The units in the supergroup progressively overlap older units from the east and from the south towards Cradle Mountain. This overlap suggests that the surface of the basement rocks sloped down to south and east from Cradle Mountain in the Early Permian.

Lower Parmeener Supergroup

Details of the lower part of the Supergroup will be given by Mr. M.J. Clarke and his colleagues. Although the lower part of the supergroup includes some important marine beds, the upper part is entirely non-marine.

Upper Parmeener Supergroup

The upper part of the supergroup begins at the base of the Jackey Shale which is Upper Permian (Balme in Jennings 1963). The siltstones, sandstones and coaly streaks in this unit were deposited under humid, probably cool, conditions in swamps, lakes and river channels on a coastal plain initially, at least, close to the sea.

The subdued outcrops of the Jackey Shale are capped and, in most places, hidden by long ramparts of Ross Sandstone in cliffs up to 100m high. A thin bed of carbonaceous siltstone near the top of the Ross Sandstone contains spores of Early Triassic age (Playford 1965). Deposition of the sandstone on point bars in a migrating, slightly meandrine stream system is suggested by the grainsize and the cross-bedding in this unit along the Western Tiers. Near Lake St. Clair alluvial fans of easterly derivation are indicated at this time by gravel beds (Gould Conglomerate, Macleod *et al.* 1961). Mottled red siltstones in rocks of this age near Hobart show that the climate was monsoonal.

The grainsize decreases and the proportion of siltstone increases upwards into the Cluan Formation. These characters, the scale of cross-bedding, and the types of fossils present suggest that the river system had decreased in gradient and become more meandrine. Spores in siltstones show that club-mosses, horse-tails, ferns and seed ferns grew on this Early Triassic flood plain. In the rivers labyrinthodont amphibians lived, some to die in ponds left as the rivers dried up in the dry season. Their bones, especially their teeth and skull bones, were picked up with flakes of dried up clay by the floods of the wet season and dumped in clay-pellet gravel beds as the floods receded. The same species of labyrinthodont occurs in Early Triassic rocks near Derby in Western Australia (Cosgriff 1965).

Fragments of volcanic rock in the next highest unit, the Tiers Formation, as well as some of the minerals in the sandstones reveal that volcanic activity had started within the watershed of the river system. The presence of abundant plant fossils in some of the siltstones of this formation suggest a more equably humid climate than earlier. Spores from these rocks show that they are Middle Triassic. Close interbedding of sandstone and siltsone allow us to envisage deposition on levee banks and in back swamps on an extensive flood plain.

The highest formation in the Supergroup, the Brady, consists of approximately equal proportions of sandstone and siltstone with some thin coal seams. Fragments in the sandstone show the continued presence of, even increase in, volcanic activity. A flood plain dotted with cinder cones, swamps, ponds and lakes may be envisaged with scouring rushes, ferns and seed-ferns growing in and near the water, large club mosses, cycad palms and maiden hair trees further away. These fossils demonstrate the Late Triassic age of the formation. The abundance of plant fossils and the presence of coal suggest a high effective rainfall.

The Latitude Anomaly

The monsoonal climate postulated for the Early Triassic and the very abundant vegetation in the Late Triassic in Tasmania are difficult to reconcile with the high latitude (about 80^{o}S) inferred for the area from palaeomagnetic studies (Irving 1963).

Structure

Study of the dips of the Supergroup and of the heights of the contact between the lower and the upper parts of the Supergroup (see fig.7) suggest that it is gently folded. The axis of a shallow syncline may be inferred south of Warners Lookout and of a shallow anticline near Projection Bluff. Synclinal axes have also been inferred just east of Bronte and near the Ouse River, anticlinal axes under Lake Echo and near Hunterston (Fairbridge 1949). It seems likely that this folding occurred before the intrusion of dolerite sheets but it certainly occurred before the Early Tertiary as the Tertiary non-marine beds are not folded (Longman 1966 p.26).

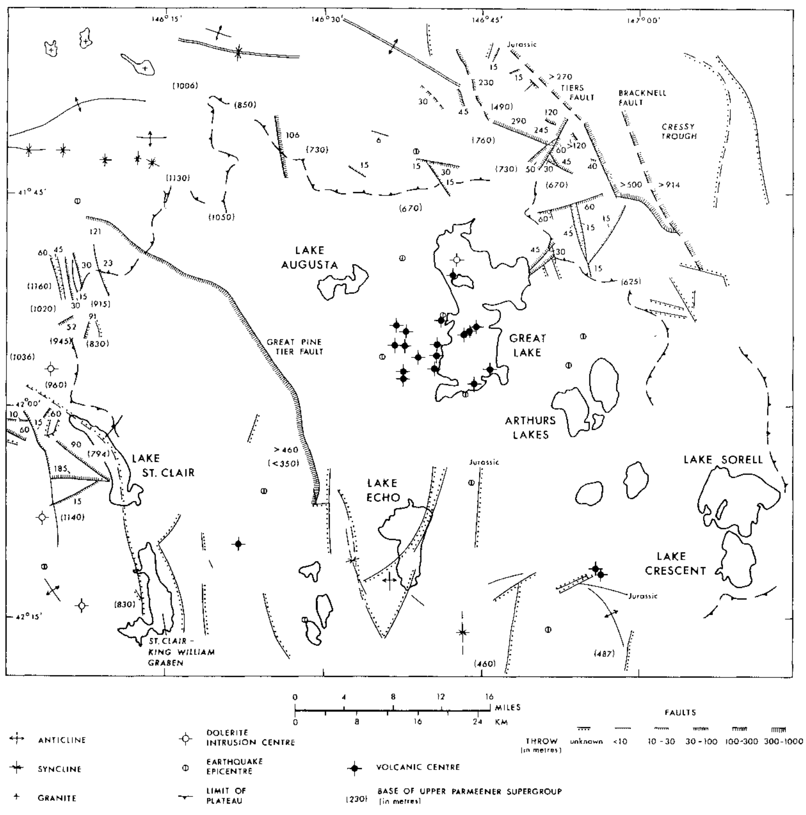
INTRUSION OF DOLERITE

The next recorded event in the history of the Plateau was the injection into the Parmeener Supergroup of vast masses of molten dolerite. This occurred about 165 million years ago during the Jurassic Period as the supercontinent of Gondwana began to break up. The dolerite of the Plateau appears to be predominantly a single sheet and outcrop appears to be unbroken around the edge of the Plateau from Travellers Range to south of Bradys Lookout. At least one feeder for this sheet has been postulated, a circular pipe rising from within the basement and penetrating the Parmeener Supergroup under Great Lake. More details on this rock are given elsewhere in the book by F.L. Sutherland.

The injection of a sheet several hundred metres thick not far beneath the earth's surface is likely to have raised the surface but the form of this new surface cannot yet be reconstructed.

AN INTERVAL OF EROSION

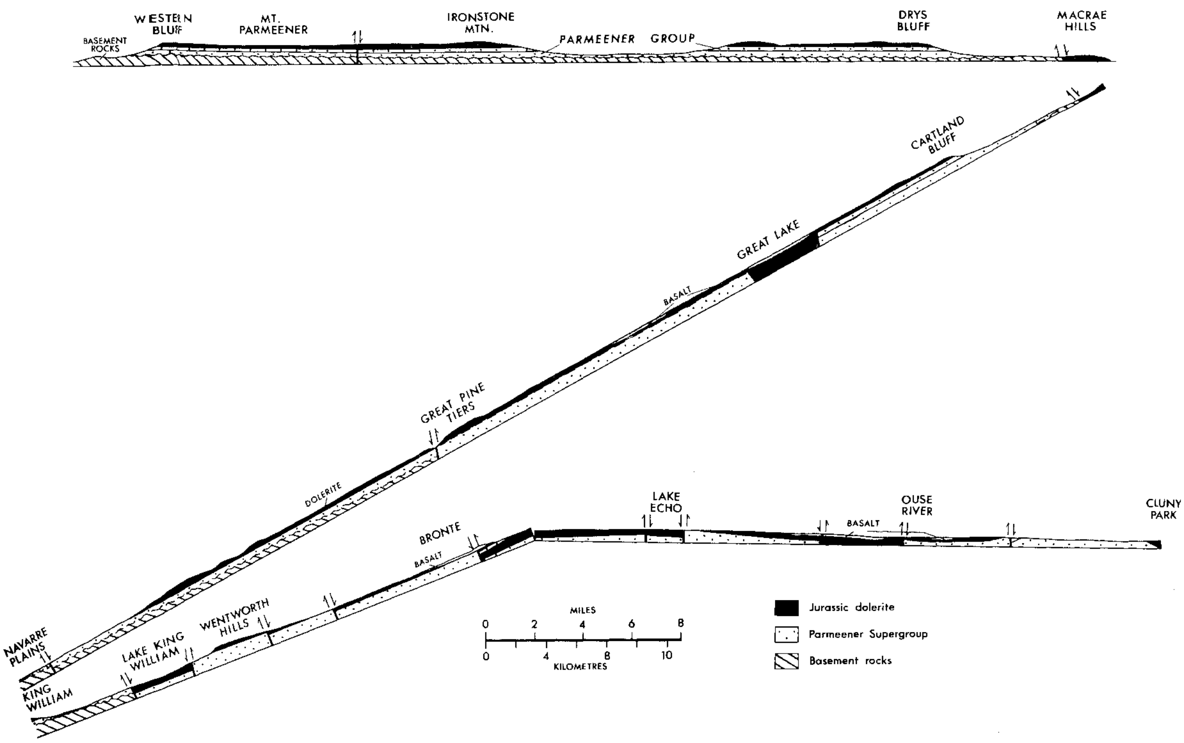
After injection of the dolerite, weathering and erosion gradually removed its sedimentary cover but remnants of it occur near the Walls of Jerusalem (Macleod *et al.* 1961), Great Lake (Jones *et al.* 1966) and elsewhere. By about the end of the Cretaceous Period or early in the Tertiary (65 million years ago), laterite and bauxite had developed on the dolerite under tropical or sub-tropical conditions and are preserved beneath Early Tertiary sediments near Launceston. The Plateau area had probably become by this time part of an extensive plainland or a very gently rolling terrain.



7. Structural map of the Central Plateau.

UPLIFT OF THE PLATEAU

This terrain was disrupted by many fractures about 65 million years ago as Antarctica moved away from the Australian continent (Griffiths 1971). The Plateau began to rise along north-west or northerly trending lines such as the Bracknell Fault (Longman and Leaman 1971, p.7), and the fault just east of Lake King William (fig.7) leaving fault controlled lowlands to the north-east, the south-east and the south-west. In general the Plateau appears to be a major horst (upfaulted block) trending NW or NNW in the north and almost due north further south. The northern part of the horst is relatively unbroken but to the south the horst is increasingly broken into minor horsts, grabens (downfaulted blocks) and half grabens as the main Derwent "Graben", which borders the Plateau to the south, is approached (figs. 7 and 8).



8. Geological cross-sections of the Central Plateau.

The whole area seems to have been tilted down to the south-east as the heights of the base of the upper part of the Parmeener Supergroup (fig.7) show. The tilt is about 1 in 130. The age of the tilting is unclear. A basalt dated radiometrically at about 26 million years occupies a valley some tens of metres deep at Skittleball Plains south-west of Great Lake, a valley probably cut by a predecessor of the Ouse, flowing south-east and south to the Derwent. This suggests that the Plateau was already tilted enough to allow such a valley to be cut. Basalt-filled valleys at Maggs Mountain and Mole Creek show the Tiers to have had a relief of at least 1060m when the basalt was erupted (Jennings 1963) and the north-western rim of the Plateau a relief of at least 700m. The age of this basalt is unfortunately not yet known.

Alluvial and lacustrine sediments, some containing fossils of a diverse broad-leafed flora and ancient relatives of the native pines accumulated in the Early Tertiary in the down-faulted areas of the St. Clair-King William Graben, the Derwent "Graben" at Ouse and in the Cressy Trough east of Macrae Hills

(Prider 1948, Longman 1966, p.19-21, Longman and Leaman 1971). The sediments at the southern end of the St. Clair-King William Graben have structures within them suggesting deposition on a north-west sloping floor onto which streams were flowing from the north-east (Prider 1948, p.145). The flora and sediments in the Cressy Trough suggest a hot, humid climate. Minor developments of fluvial sediments occur beneath basalt at a few places - Tarraleah (Prider 1948) near Hunterston (Fairbridge 1949,p.122) and in isolated patches along the eastern shore of Great Lake (Jones *et al.* 1966, Sutherland and Hale 1970). These sediments represent the channel and flood plain deposits of pre-basaltic ancestors of the Nive, Ouse and Shannon Rivers.

VOLCANIC ACTIVITY

A basalt flow at Skittleball Plains (Sutherland and Hale 1970, p.19) seems to have dammed a wide, flat-floored valley to form a lake in which extensive ash beds and entrail breccias were formed *ibid* pp.19-23 and Sutherland, this book). This lake was about twice as wide as the present Great Lake and extended from Maclanachans Point and Christmas Bay at least as far north as Reynolds Island. It seems likely that this lake was drained by the river, predecessor of the Shannon, which deposited the gravels at Tods Corner now covered by basalt dated as about 21.8 million years old.

The basaltic lava eruptions are dealt with elsewhere in this book (by F.L. Sutherland). The lavas flowed into or down earlier river valleys, some narrow (Prider 1948, p.142), others broad (Fairbridge 1949, p.138). The lava forced the drainage to one side (Ouse, Shannon, upper Nive) or both sides (Lower Nive and Derwent) of the valley (Prider 1948, Fairbridge 1949 pp.138-140). Some fluvial sediments are interbedded with basalt north of Tarraleah and it is interesting to note that one such sand is partly of aeolian origin (Prider 1948, p.145).

SUBSEQUENT GEOLOGICAL HISTORY

The events which have affected the Plateau since the outpouring of the lavas are considered in the Geomorphology section.

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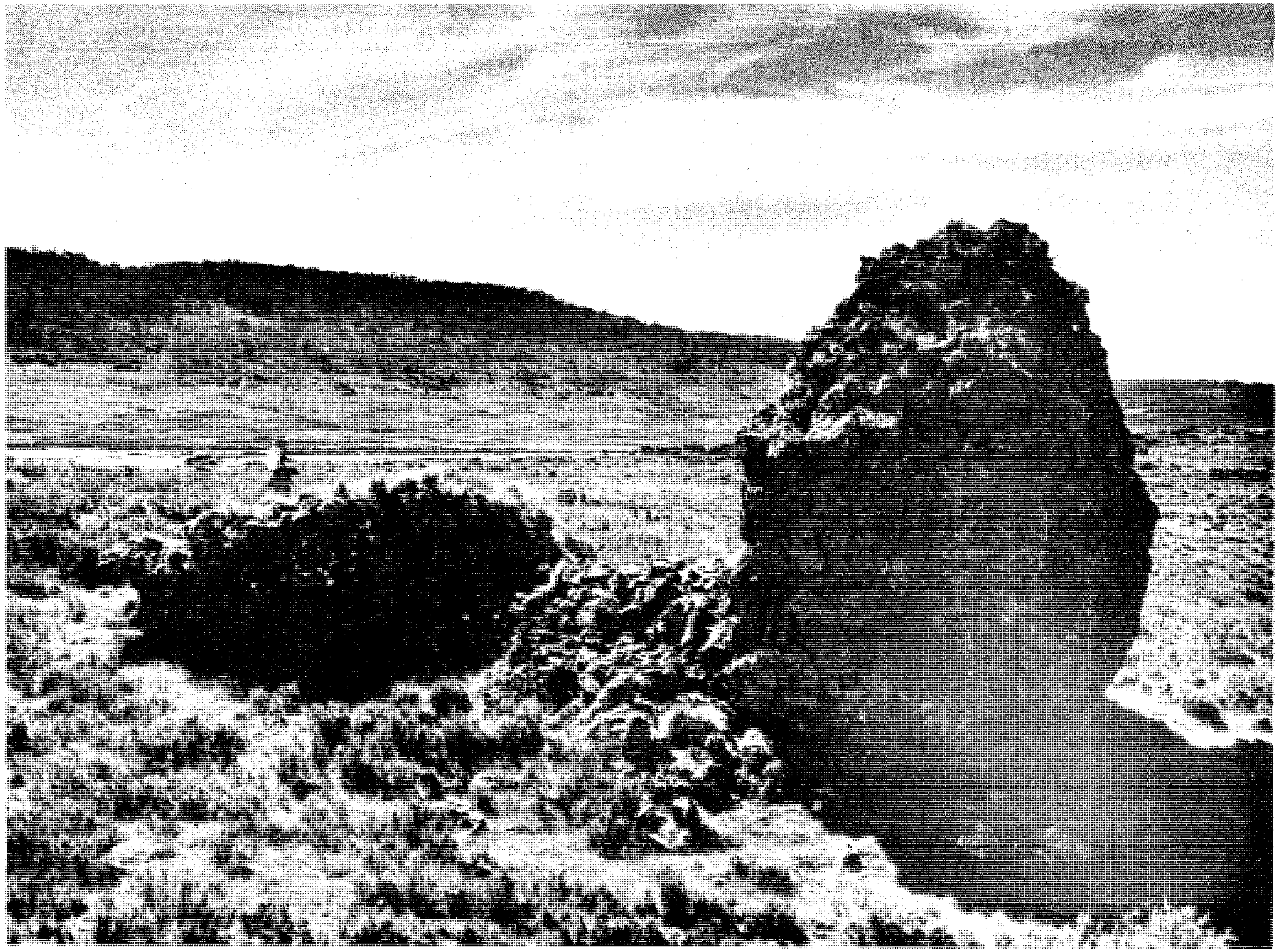
PLATE 1



"Skittleballs" on Skittleballs Plain near Little Pine Lagoon;
tors of scoriaceous tholeiitic basalt.

Photograph by Jack Thwaites.