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PERMIAN GLACIALS IN CENTRAL AUSTRALIA

by

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ABSTRACT

Between Tarlton Downs, Northern Territory and the Georgina River, Queensland, a ground moraine and fluvio-glacial sandstone, siltstone and conglomerate containing silicified Coniferous wood unconformably overlie Ordovician and Proterozoic sediments, and are lateritized, and in places overlain by Cretaceous sandstone and shale. They are terrestrial glacial sediments, most probably of Permian age.

INTRODUCTION

While examing the area south of Tarlton Downs Homestead (Lat.22°36'S., Long.136°51'E.) to compare the Lower Palaeozoic sequence with that developed farther west, we came upon areas strewn with pebbles and boulders apparently of glacial origin. These were found to come from a thin sequence resting unconformably on the Ordovician sediments. This sequence was examined in the Tarlton area and eastward beyond the Queensland border, and established as a terrestrial glacial sequence probably of Permian age.

TARLTON FORMATION (new name)

The Tarlton Formation is defined as the terrestrial glacial sediments, comprising basal ground moraine boulder clay, and fluvio-glacial sandstone, siltstone and conglomerate, resting unconformably on Ordovician, ?Cambrian and Proterozoic sediments and either overlain by Cretaceous sandstone or shale or forming a strongly lateritized ground surface, in the area north of the Simpson Desert between the Hay and Georgina Rivers.

The name is taken from Tarlton Downs Station (Homestead at Lat.22°36'S., Long.136°51'E.) where the sequence was first seen and is best exposed.

The type locality (Fig. 1) is eleven miles south of Tarlton Downs Homestead; there the type section (Fig. 2) is exposed in a scour on the south-eastern scarp of a mesa.

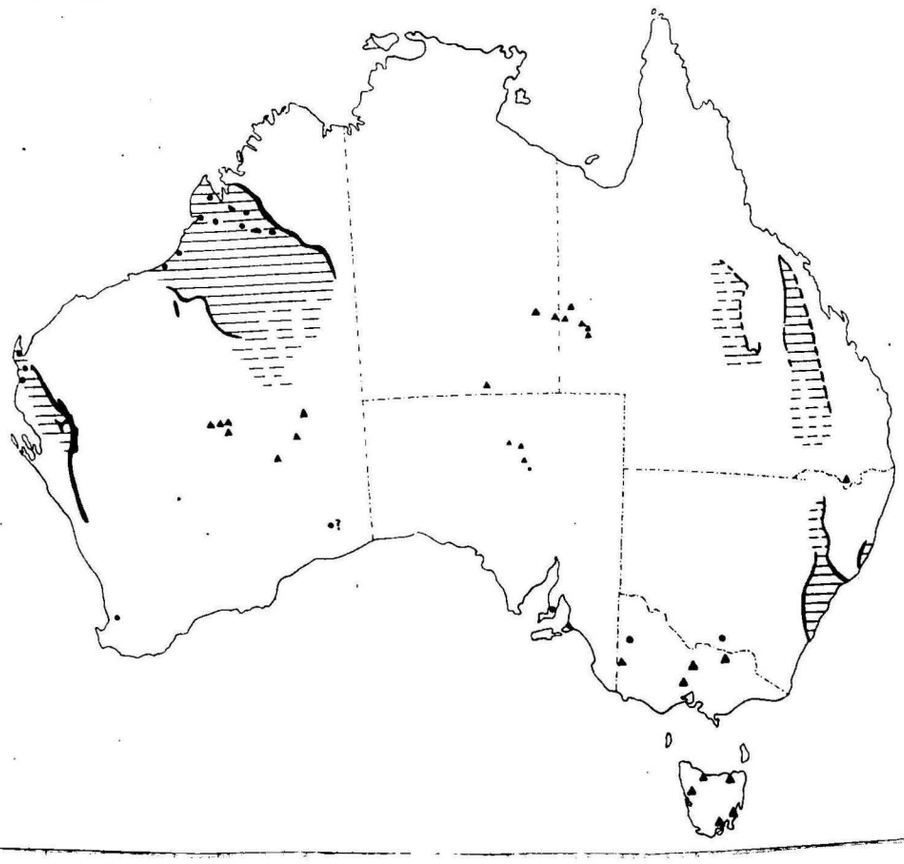

FIGURE 1 - Locality Map of Australia

Showing areas of Permian glacigene sediments
Triangle - Terrestrial sediments; Solid areas - outcrop, Hatched areas - subsurface aqueo - glacial sediments; Circle - bore with glacigene sediments

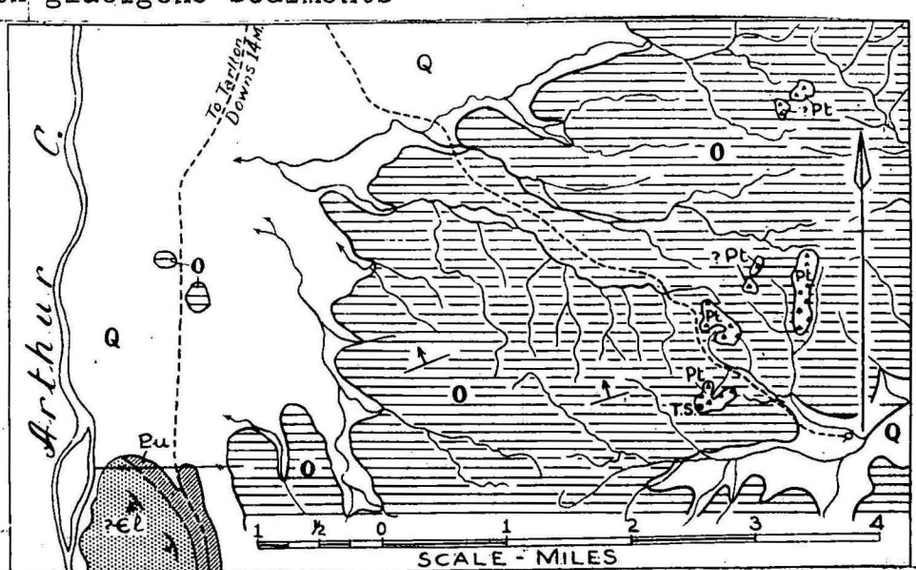

FIGURE 3 - Type Locality, Tarlton Formation

Q - Quaternary superficial deposits
Pt - Tarlton Formation
O - Ordovician sediments
Cl - Possibly Cambrian sediments
Bu - possibly Proterozoic sediments including glacigene sediments
T.S. - Type section

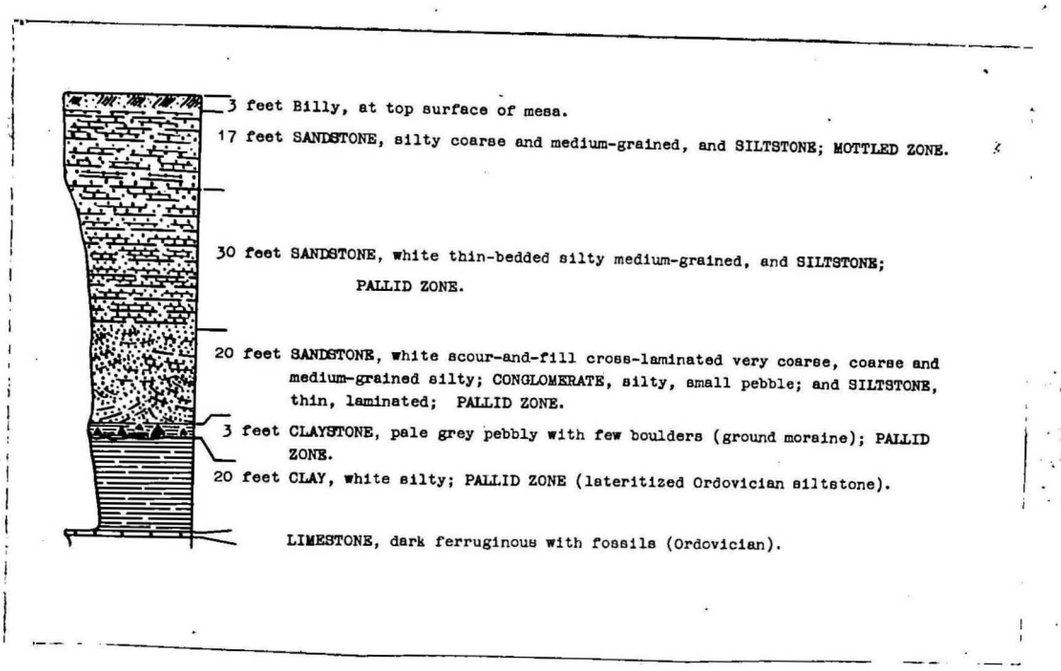

Figure 2. - Type section, Tarlton Formation.

The ground moraine consists of clay containing few to many sand grains, pebbles and cobbles and few boulders. Wherever seen, this material is within the pallid zone of the laterite profile and only the quartzose material has survived lateritization; completely leached cobbles can be found in place which by their texture were probably granite, gneiss, schist and limestone. The siliceous coarse material that has survived lateritization consists of pebbles, cobbles and boulders showing many features of englacial material: it is generally sub-rounded but includes many particles with plane (faceted) or dished (concave) surfaces; almost all surfaces are polished; many of the quartzite particles are striated; much of the fracturing is of the pressure-flaking rather than the impact type; equant shapes are rare; wedge, tetrahedral, ovoid, and oblate disc and spheroid shapes are common.

The fluvio-glacial sediments consist of torrent cross-bedded coarse to very coarse-grained silty sandstone with siltstone bottom-sets and thin beds of small pebble conglomerate. Overlying these are bedded medium-grained silty sandstone and siltstone with few beds of very coarse-grained silty sandstone.

The observed distribution of the Tarlton Formation is shown in Figure 3. A sequence similar to that in the type locality is seen two miles north of Burnt Well, Tobermory Station, five miles south-east of Burnt Well (where the fluvioglacial sediments are strongly contorted, perhaps by glacier thrust, and contain Coniferous wood), and nine miles south-east of Aroota Bore, Tobermory Station. Only the ground moraine is seen six miles west of Roxburgh Downs Homestead, in the Sun Hill (Glenormiston Station) and Sylvester Creek (Marion Downs Station) outcrops and in the outcrops five miles southward from Mithaka Waterhole, Tobermory Station.

The ground moraine is generally thin as at the type locality, but south of Mithaka Waterhole it is about 15 feet thick and at one place in the Sylvester Creek area it is at least 20 feet thick. Five miles south-east of Burnt Well, Tobermory, the fluvio-glacial sediments are about 100 feet thick but elsewhere they are thinner than in the type locality, or absent.

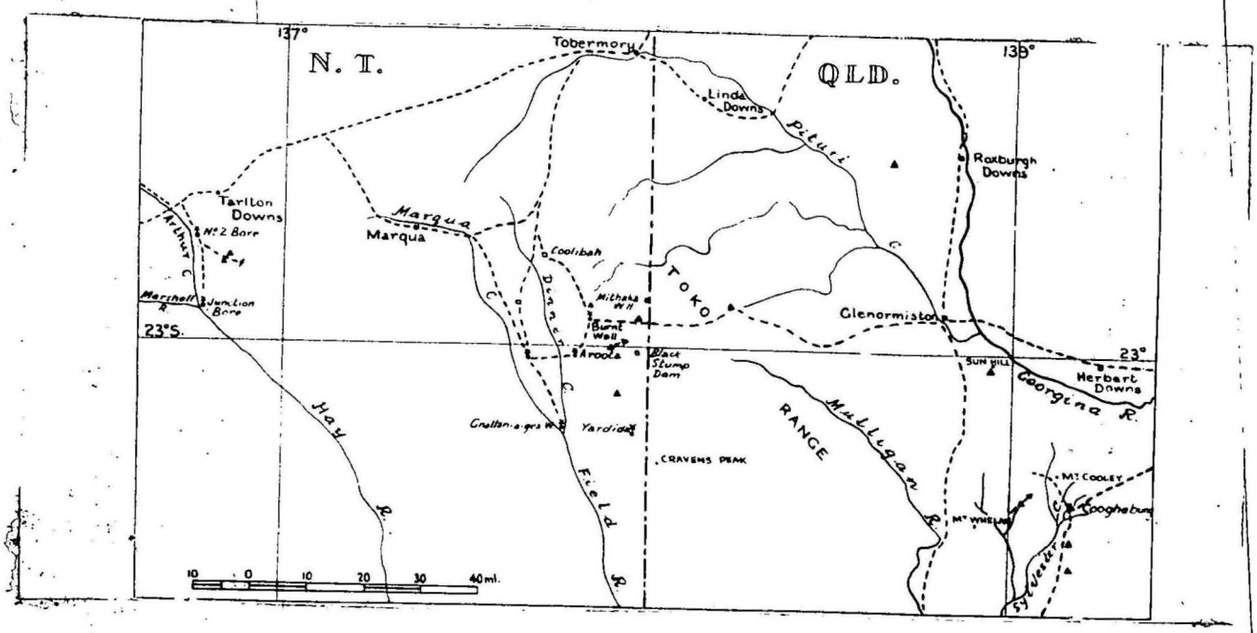

FIGURE 4 - Locality Map, outcrops of Tarlton Formation -(triangles).

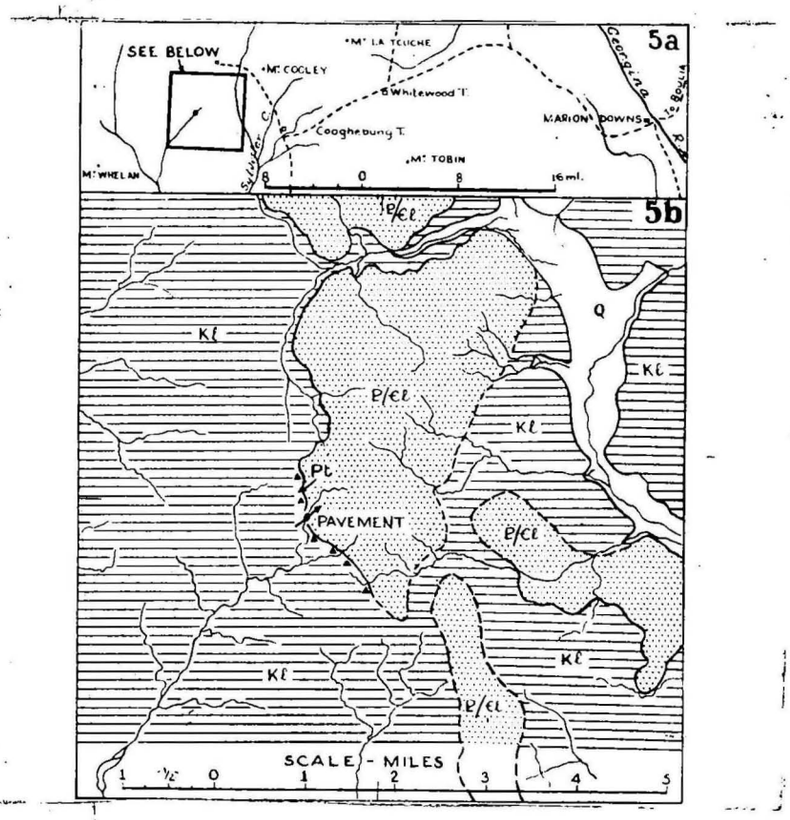

FIGURE 5 - Locality Map - glacial pavement

Q - Quaternary superficial deposits
Kl - Lower Cretaceous shale
Pt - Tarlton Formation
P/€l - Cambrian on Upper Proterozoic sandstone
Arrow shows indicated direction of ice movement

The ground moraine contains pebbles of fossiliferous Ordovician sandstone and silicified limestone in the mesa north of the type locality and two miles north of Burnt Well, Tobermory. It rests unconformably on Proterozoic glacigene sediments nine miles south-east of Aroota Bore, Tobermory; on Ordovician limestone, siltstone and sandstone between the type locality and the border; on arkose of Proterozoic or Lower Cambrian age at Sun Hill; and on sandstone of possible Lower Cambrian age in the Sylvester Creek area. The Tarlton Formation is younger therefore than the Middle Ordovician. North of Burnt Well, and half a mile south of Sun Hill, the Tarlton Formation is overlain unconformably by silty sandstone with a basal conglomerate; this silty sandstone is of the same lithology as that which near Burnt Well contains Rhizocorallium and which one mile north-west of Sun Hill contains Lower Cretaceous pelecypods. The Tarlton Formation is thus older than Lower Cretaceous. As Conifers are not known older than Permian and as the Permian glaciation is well established in Australia the Tarlton Formation is most probably of Permian age. It is most probably equivalent to the terrestrial glacials of the Finke River (Parkin, 1956), of the Warburton Ranges and Lake Carnegie area, Western Australia, of Halletts Cove and Inman Valley, South Australia, and of Werribee Gorge, Heathcote and Beechworth, Victoria.

In the Sylvester Creek area, Marion Downs Station, the Tarlton Formation passes under the Lower Cretaceous shale at the western margin of the Great Artesian Basin. As Permian glacial sediments also pass under the Mesozoic in the Drummond Range area on the eastern margin of the Artesian Basin, it is possible that Permian glacigene sediments underlie the Mesozoic of the Basin in many places.

GLACIAL PAVEMENT

A glacial pavement is well exposed in a small watercourse about midway between Mt. Whelan and Mt. Cooley, and about 60 miles south-westward from Boulia and about 33 miles south-south-eastward from Glenormiston Homestead (Fig. 5).

The pavement is exposed over an area about 20 feet along the watorcourse, by about 12 feet across. It is developed in close-jointed silicified sandstone with vertical "tubes", possibly of Lower Cambrian age, dipping at about 5 degrees south-westward.

The glacially eroded features include flutings 3 feet to ten feet long, one to three feet wide, and one to three inches deep, with roughly sine-wave section (Fig. 6a); features similar in form to current crescents (Peabody, 1947); and gouges (Fig. 6b) grading, from 3 inches wide and 2 inches deep with sharp lip, gradually over a distance of about 2 feet to 6 inches wide and $\frac{1}{2}$ inch deep with smooth lips. The horse-shoe shaped gouges (Fig. 6c) have an over-all width of 6 to 18 inches and an overall length of one to three feet; the furrow is of almost circular arc section in the portion concentric to the central boss; the parallel furrows from each end of the concentric furrow each become progressively wider and shallower away from the boss; the long axis of the feature is parallel to the direction of the flutings and gouges, and the shallowing of the furrows is in the same direction as in the simple gouges. The feature apparently is produced by glacial erosion, and the term "Gouge crescent" is suggested for such features.

No exposure of the ground moraine was seen above the pavement but there are abundant glacially abraded rudites in the vicinity between the outcrops of the ?Lower Cambrian sandstone and the Lower Cretaceous shale.

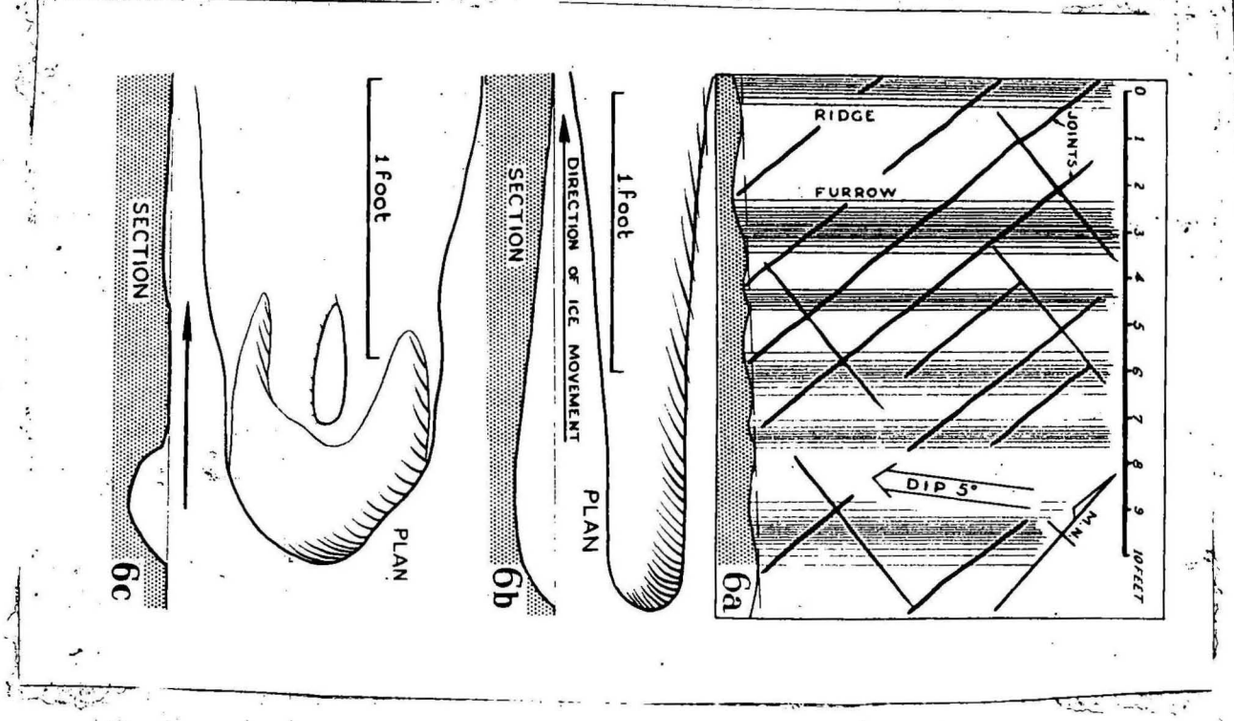

FIGURE 6 - Details of features on glacial pavement, Marion Downs

6a - Flutings showing relation to bedding plane and joints, and section.

6b - Gouge

6c - Gouge crescent

ACKNOWLEDGMENT

Mr. R.B. Leslie, with whom M.A. Condon discussed this discovery, directed attention to the Sun Hill area where he had seen material of glacial origin. He also found the fossiliferous Ordovician silicified limestone pebbles in the ground moraine north of Burnt Well, Tobermory.

Mr. J.N. Casey directed M.A. Condon to most of the outcrops in the Toko Range and Marion Downs areas: he regarded them as Cretaceous basal conglomerate which contained boulders with possible glacial markings but which he considered to be derived from the upper Proterozoic glacial beds which outcrop in the Field River area to the west.

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