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# 1976/15. Geology of the Bells Lagoon and Gavin Tier area

*S.M. Forsyth*

The existence of ferricretes in an area 10 km north-west of Tunbridge was brought to the Department's notice by Mr M. Forster. Regional mapping of the Interlaken quadrangle has been redirected to the area containing these ferricretes. The area inspected is bounded by Tunbridge Tier Road, Verwood Road, Bells Lagoon and the foothills of Gavins Tier (fig. 1). Gravel pits in 'buckshot gravel' have been worked throughout much of the area.

## GEOLOGY

Nye (1921) reported two very small outcrops of white Permian mudstone overlain by conglomerate near the heads of Vicarys Creek and Blackwood Creek on the lower slopes of the Western Tiers. Reconnaissance mapping near Blackwood Creek in 1974 located Permian marine mudstone containing dropstones and a conglomeratic sandstone possibly correlating with the Blackwood Conglomerate (McKellar, 1957). The area of Permian sediments appears to be more extensive than reported by Nye and outcrops occur for at least one kilometre north and south of the Tunbridge Tier Road along the 450 m contour.

Upper Parmeener Super-group sandstone (Forsyth *et al*, 1974) containing up to 20% feldspar occurs topographically higher to the west of the Permian sediments. By comparison with sequences in the Oatlands Quadrangle, the higher feldspar content suggests that the sandstone belongs to the basal 60 m of the Upper Parmeener Super-group.

Jurassic dolerite occurs west of and topographically higher than the sandstone and possesses a chilled texture at the 470 m contour on the Tunbridge Tier Road. The tendency for the dolerite and sandstone outcrops to "follow the contours" has produced a re-entrant in the valley of Blackwood Creek, suggesting that the dolerite is basically sill-like in structure. The evidence is insufficient to prove, but does suggest that the dolerite of the Western Tiers has the structure of a sheet intruding basal Upper Parmeener sandstone.

Dolerite also occurs at the 320 m contour on Tunbridge Tier Road where the upper surface of a dolerite sheet is exposed in contact with Upper Parmeener sandstone. The chilled dolerite at an altitude of 470 m is interpreted as the base of this same sheet and a major fault zone trending NNW (possibly occupied by dolerite dykes) is thus implied to cross the Tunbridge Tier Road between the 320 m and 470 m contours. This interpretation conflicts with that of Nye (1921) who discounted the possibility of a major fault zone and of strata passing beneath the Western Tiers in this area.

Gavins Tier and the general gravel pit area is regarded as the eroded irregular upper surface of a dolerite sheet, occurring well east of the main Western Tiers fault zone, although some smaller faults may occur in the area. Variation in dolerite grain size and outcrops of Upper Parmeener sediments suggest that the remaining Tertiary sediments occupy depressed areas of the irregular sheet once occupied by Upper Parmeener sandstone.

### *Tertiary sediments*

Soft clayey medium-grain sandstone and poorly sorted granular sandstone are exposed in several waterholes between Blue Gate Marsh and the landing ground. The granules characteristically include black and also white cherty fragments, and colourless to dark and pink quartz. In thin section (76-11) the grains contain inclusions of glass shards, chips of micro-agate and other

fragments of silicified rocks. Within the gravel pit area, fine grain sandstone, sandstone with silt wisps, clayey sand, sandy clay and clay occur, with lateritic clay at least partly sedimentary in origin being most common. These sediments (except for some partially silicified siltstone) are softer, less consolidated and more porous than those in outcrops of equivalent Upper-Parmeener sediments which occur periferally to the Tertiary.

Traces of silicretes including fine-grained silicified sandstone and silicified sandy clay occur at several localities. The major outcrop occurs south-west of the Public Works Department gravel pit, where the rocks include white and mottled white and brown silcrete which is transluscent to transparent in places. At several locations milky white silicrete contains conifer-like branches, probable roots, fine vertical tubelets of varying diameter (0.5-3 mm) and annulated horizontal burrows(?) about 4 mm wide.

Very fine and uniformly laminated carbonate (up to 50 laminae per centimetre) of uncertain age occurs at three widely separated localities in the gravel pit area. All outcrops dip approximately 30° W with the strike ranging between 30-120° m. Near the gravel pit [28633790]* laminite occurs in close proximity to a compact fine-grained quartz sandstone with close affinity to the Upper Parmeener rocks. Several areas of fairly fresh dolerite have been interpreted as highs in the dolerite basement rather than deposits within the Tertiary, and it is possible that Upper Parmeener sediments may similarly form basement highs. Further work has revealed the laminite to be rich in microfossils including diatoms; a Tertiary age is indicated.

*Laterite surface*

Blotchy orange-brown clay containing dispersed sometimes strongly magnetic iron rich pisoliths occurs over much of the area. Some sections show stiff grey sedimentary clay without pisoliths, passing up through blotchy orange, brown, red, yellow, grey and green clays with few pisoliths to more orange-brown blotchy clays with higher concentrations of larger (up to 10 mm) pisoliths. This clay is commonly capped by a hard, cemented pisolitic laterite ranging in colour from yellow-brown through red to purple-red with black (magnetite?) patches. These sections have been interpreted as laterite profiles in which the pisoliths have been concreted in place.

The lateritic surface is elsewhere represented by a variety of ferricrete types, with colours ranging from white, grey, pale pink and yellow through brown, red and orange to purple-brown and black. The colour variability may reflect change in composition from more aluminous rocks to rocks richer in iron.

A pink ferricrete occurs at 253423 while red ferricrete occurs at 266408. At 268042 chocolate brown pin head size clasts are dispersed in light brown-yellow ochre while black pisoliths dispersed in a blackish-purple matrix occur nearby. A yellow- purple-red ferricrete overlies yellow ochrous ferricrete with pinkish-brown spheroidal cores at 275395.

Some ferricretes occurring in association with weathered dolerite float in the field south of the Public Works Department gravel pits possess a 'swiss roll' structure with pinkish-black cores surrounded by a shell of massive purple-brown hematite and a shell of spotty brown ferricrete. Dark purple-brown and light yellow-brown diffuse blotches several millimetres across occur near the dolerite outcrop [282382] and may represent altered dolerite. Ferricrete occurring at 281379 may be formed on either Tertiary or Triassic sandstone. West of Bells Lagoon, the Tertiary ferruginous sandstone overlying

*All localities lie within the 100 km grid square EP.

dolerite contains a few scattered pisoliths *in situ* and is overlain by about 0.6 m of pisolitic laterite at 286406.

The laterite surface generally slopes gently to the east but dips more steeply into the present valleys, implying that some present valleys occupy pre-existing valleys in the laterite surface.

*Post laterite deposit*

A yellow-brown conglomerate outcrops over a small area [261412]. This deposit consists of a platey hornfels with rounded, deeply weathered, coarse-grained dolerite cobbles forming the larger clasts. Ferruginous pisoliths also occur, set in a slightly sandy argillaceous matrix. This conglomerate exhibits a degree of consolidation not shown by the Quaternary deposits.

*Quaternary sediments*

Lag deposits of loose ferruginous pisoliths (buck-shot gravel) and ferricrete chips occur where the laterite profile has been eroded.

Cobble beds composed chiefly of dolerite occur as alluvial fans or braided stream deposits where streams discharge from the Western Tiers scarp or pre-scarp tiers. A cobble deposit cut by Tunbridge Tier Road in the vicinity of the Public Works Department gravel pit access road, differs from other deposits in that it contains common cobbles and small boulders of granule conglomerate and sandstone possibly derived from Parmeener Super-group rocks, together with a block of silicified quartz sandstone (of uncertain origin) and silcrete and ferricrete probably stripped from nearby Tertiary areas. The clasts are coarser and more angular than those occurring in the deposits consisting chiefly of dolerite. The matrix of the coarse deposit is poorly consolidated and encloses a small proportion of weathered dolerite clasts which are not seen among the surface material which is probably reworked.

Finer grade alluvial deposits occur on flats bordering creeks, with sandy-silty clay enclosing ferruginous pisoliths most commonly occurring. Clayey sand forms lunettes in the Bells Lagoon area, whilst small patches of well sorted clear sand may also be windblown. Poorly laminated, soft crumble sands occur north of the Public Works Department pit.

## OCCURRENCES AND ORIGIN OF IRON-RICH FERRICRETE

Under suitable conditions of negligible mechanical erosion and a fluctuating shallow water table, prolonged leaching of rocks below the water table may remove iron, aluminium, alkalis and silica in solution, which may then be redeposited with changed physiochemical conditions. Iron and aluminium are commonly deposited above the water table or in the upper part of the water table where surface effects have some influence, whilst silica is generally removed. Deposition of ions in solution may occur in an entirely different medium, within the rock types undergoing weathering or under certain conditions, virtually at the site of the original leaching. Original rock textures may be preserved or destroyed by leaching. The commonly occurring minerals in Tasmanian bauxitic laterites are gibbsite, cliachite, kaolin, limonite and magnetite (Owen, 1954).

Iron-rich laterite may form when the original rock undergoing leaching is rich in iron or by substantial segregation of the iron precipitate. These may be affected by secondary events, and the iron content may be diluted by contamination in the medium in which deposition takes place. Relatively iron-rich laterites occur in several locations notably:

(*a*) The ridge between Bells Lagoon and Blue Gate Marsh [282408].
(*b*) In the area between 282382 and 277390.
(*c*) In the field south of the Public Works Department pit [287373].
(*d*) Within the Public Works Department pit [286380].

Occurrences (*a*), (*b*) and (*c*) are periferal to the main Tertiary area, are, associated with nearby dolerite outcrops and all probably overlie dolerite. Dolerite in Ferndale Creek several kilometres north is intensively leached. Pallid rocks occurring at (*c*) possess a typical igneous texture and may be leached dolerite. Silcrete occurs in close association with ferricrete at (*a*) and (*c*). Some ferricretes at (*b*) also have a texture which indicates an igneous origin. It is conceivable that iron leached from dolerite has formed the ferricrete, whilst the leached silica has produced the silcrete. This is particularly notable south of the Public Works Department gravel pit.

Differential weathering of the ferricretes at (*d*) has revealed concentric and box work structures. Weathering at this location has also left a lag of angular magnetic pieces not of pisolitic origin. The ferricrete at (*d*) overlies calcareous laminite dipping at 34° SW. The origin of this occurrence is unknown, but it may represent a lateritised basalt.

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# GEOLOGICAL SKETCH MAP
# BELLS LAGOON – GAVIN TIER AREA

0 1 2 kilometres

Geology by S.M.FORSYTH

Drafting by T.R.Bellis

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5 cm

- Q — Quaternary sediments
- C — Cainozoic conglomerate
- T — Undifferentiated Tertiary with laterite indicated
- Ts — Tertiary sediments
- Tf — Ironrich fericrete (Tertiary)
- Tsil — Tertiary silcrete
- Jdl — Jurassic dolerite
- Ru — Upper Parmeener sedimentary rocks

Reduce to 25%

410 × 371

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