DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

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NOTES ON THE CAINOZOIC STRATIGRAPHY OF THE ARROWIE 1 MILE AREA

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INTRODUCTION

The Arrowie area is situated in the Central Flinders Ranges and constitutes the southeastern corner of COPLEY (i.e. 1:250,000 sheet). Approximately 50% of the area is mantled by Cainozoic sediments distributed in part of the western edge of the Frome Embayment and in a small basin within the Flinders Ranges which is linked to the Embayment further to the south. The area is drained by two main creeks - Mt. Chambers and Teatree creeks, both of which flow eastwards into Lake Frome.

The geology of the Arrowie area has previously been described by Horwitz (1962). Revisional mapping on a 1:250,000 scale was commenced and completed in 1969 by R. Callen, R. Coats and T. Williams. The Cainozoic sediments were mapped by Williams with contributions by Coats and Callen. R. Callen (1970 and 1969) has described the structure of the Arrowie fault zone and has written notes on Tertiary deposits near Ironstone bore. Bore logs provided some information on subsurface stratigraphy in the Frome Embayment.

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STRATIGRAPHY

Cainozoic units recognized on the mapped area are, in order of increasing age:-

Creek alluvium and lake deposits

Slope alluvium

Pooraka Formation

Telford Gravel

Equivalents to the conglomerate at Lyndhurst.

Bungunnia Limestone

Avondale Clay

Silcrete

Pre-silcrete sediments - Murnpeowie Formation?

Nowhere is there a complete section showing relationships between all units so many conclusions are necessarily tentative.

THE PRE-SILCRETE SEDIMENTS

Several outcrops of white, slightly calcareous sandstones and quartzites occur on Arrowie (i.e. 1:63,360 sheet) e.g. near Ironstone Bore, Salt Springs and north of Teatree Outstation. In most cases, these are fine to medium grained, well rounded and sorted grey to pure white sandstones and quartzites. They may be cemented by either clay, silica or carbonate. At Ironstone bore, the sands contain carbonate nodules. Elsewhere, kaolinitic clays and silts and rare polished pebbles are associated with the sandstones.

The quartzites are usually grey, well indurated, weather very dark and appear lithologically similar to the quartzites in the upper portion of the Murnpeowie Formation (Forbes, 1966). They appear to be a result of silicification of the sandstones during the period of silcrete formation (see below).

About two miles east of Ironstone bore there is a small outcrop of well polished and rounded quartz, quartzite and agate gravel. This gravel may have been reworked from the characteristic conglomerate at the base of the Murnpeowie Formation

(Forbes 1966). Polished pebbles, in association with silcrete, also occur about two miles south of Moorowie Spring.

On the basis of the above evidence, these sandstone and quartzites are tentatively correlated with the upper units of the Murnpeowie Formation i.e. units 7 and 10 of the Reedy Spring section. (Forbes 1966).

About one mile north of Teatree Outstation there are outcrops of clean calcareous gritty sandstone dipping 65-80 degrees to the east. Nearby there is a gritty laterized sandstone which abuts against Avondale Clays. These sandstones are presumably Tertiary and could be equivalents of either the Murnpeowie Formation (Lower Tertiary) or the Etadunna Formation (Middle Tertiary) since both contain similar units to the north.

SILCRETE

Most outcrops of silcrete on Arrowie are associated with the Tertiary sands and quartzites. The silcrete may be massive and blocky, exhibit pipe structure or may weather to large boulders. Rare polished pebbles are sometimes present. The silcrete shows varying stages of maturity. Early stage include case hardening of masses of sand which at intermediate-stages are silicified, although retaining original textures. Final stages of complete silicification result in destruction of original textures producing an apparently homogeneous mass which may contain occasional pebbles. Immature silcretes observed in this area may be due to mild tectonism, altering the relationship between land surface and water table thus interrupting the normal pattern of silcrete formation. Any process leading to alterations in water table level would prevent formation of a mature silcrete.

At Ironstone bore, massive columnar silcrete is underlain by botryoidal quartzite. This appears as two distinct profiles but is probably part of

the one cycle of silicification.

In most cases, units overlying the silcrete have been eroded except at Ironstone bore where the Avondale Clay rests unconformably on massive columnar silcrete. Here the silcrete varies from five to ten feet thick but elsewhere the top is not seen. Pooraka Formation covers the silcrete in some cases.

AVONDALE CLAY (Firman 1967)

This unit, unconformable on the silcrete, is a mottled gypsiferous clay which may be stratified and occasionally exhibits pipe structure. The colour varies from white through yellow to red, brown and even black. It may be calcareous at the top with an occasional lime silt capping and containing balls and crusts of cemented calcite pisolites as is the case at Ironstone bore. The unit is occasionally sandy and contains some gravels and ironstone concretions. Thin rubbly limestones may occur within the unit. Gypsum may occur as crystalline aggregates up to three feet in diameter or as fine grain bands or as a gypsum sand.

The thickness varies from as little as ten feet to several hundreds of feet out in the Frome Embayment where bores have penetrated considerable thicknesses of multicoloured clays gravels and sands. These graben deposits are attributed to block faulting during the Lower Pleistocene (Firman, 1969).

BUNGUNNIA LIMESTONE EQUIVALENT - MIDDLE PLEISTOCENE

(Firman, 1965)

This unit is a dense, white to fawn, lacustrine, manganiferous, marly limestone which rests conformably on the Avondale Clay. Some gravels were observed e.g. a conglomerate occurs at the base of the unit near Teatree Outstation. Interfingering with terrestrial gravels is to be expected around the margins of the ranges. The limestone rests on basement at Teatree and is thus a transgressive unit marking a high level lake stand.

EQUIVALENTS TO CONGLOMERATES AT LYNDHURST (Firman 1969, Fig. 112)

These are subrounded gravels cemented by clean white calcite. The cement may have originated from dissolution of earlier deposited carbonate which was then precipitated in a purer form. Relationship between this gravel (exposed only in cliff sections) and the Bungunnia Limestone equivalent remains uncertain. Firman believes they are terrestrial equivalents to the lacustrine Bungunnia Limestone.

TELFORD GRAVEL (Firman 1967)

This gravel consists of subrounded pebbles and cobbles cemented by a fawn to dirty white carbonate. The gravel often occurs capping residual hills adjacent to the eastern edge of the Flinders Ranges or is observed in cliff sections. Fawn to white carbonate cement which occurs near the base is probably equivalent to Ripon Calcrete. Some sections show pockets of grey-green clay in the gravels. Younger uncemented gravels which occur in inter-montane basins are included in the Telford Gravel. These are older than the Pooraka Formation and relationships with the cemented gravels are uncertain. The Telford Gravel in most cases rests conformably on Bungunnia Limestone or Avondale Clay.

THE POORAKA FORMATION (Firman 1966)

This formation consists dominantly of silty clays with increasing proportions of sands and gravels away from the ranges. The clays are pale to red brown and exhibit blocky weathering with occasional pipe structure. Carbonate is usually developed at the base as nodules or as rubbly limestone especially if

the unit below is Avondale Clay. This carbonate is possibly Bakara type calcrete. In places, the Pooraka Formation may truncate the Telford Gravel surface.

Near the ranges, the Pooraka Formation contains talus deposits which may or may not be calcareous. These are predominantly subangular to sub-rounded gravels in a red brown clay. On the plains, the clay is reduced in thickness and sands and gravels form the lower units of the Pooraka Formation. Current bedding, sorting, and roundness imply a fluviatile origin for the formation.

CREEK ALLUVIUM, LAKE DEPOSITS AND TALUS

These sediments consists of Recent gravels and of varying degrees of coarseness with some clays and silts. The small lake on the eastern edge of the map contains flood deposits of silt, clay and fine gravel. Talus deposits are common along the edge of the ranges.

SUMMARY OF CAINOZOIC EVENTS IN THE ARROWIE AREA

(1) Deposition of sands and sandstones of the Murnpeowie Formation (age - Lower Tertiary).

(2) Period of uplift, folding and erosion with subsequent development of silcrete.

(3) Deposition of clays, sands and gravels - possibly Etadunna equivalents (present in some bores?) - age: Miocene or younger.

(4) Period of erosion followed by deposition of lacustrine Lower Pleistocene Avondale Clay and contemporaneous block faulting forming the graben structure of the Frome Embayment.

(5) Deposition of lacustrine Bungunnia Limestone equivalent and terrestrial gravels of similar age to the calcite cemented conglomerate at Lyndhurst. Mild tectonism producing dips up to 20^{o} along the eastern margin of the ranges.

(6) Uplift and deposition of Telford Gravel - Ripon surface and Ripon calcrete at base - Bakara surface and Bakara calcrete at top. (Calcrete not distinguished on map).

(7) Further erosional break followed by deposition of the fluviatile Pooraka Formation. Equivalent talus deposits on edge of ranges.

(8) Formation of Loveday Soil (not distinguished on map).

(9) Period of increasing aridity to present. Recent creek alluvium, lacustrine and talus deposits.

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