DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

REGIONAL GEOLOGY DIVISION

MURLOOCOPPIE 1:250,000 SHEET

EXPLANATORY NOTES

by

G.M. PITT
GEOLOGIST
REGIONAL GEOLOGY DIVISION

Rept.Bk.No. 76/95
G.S. No. 5770
D.M. No. 534/75

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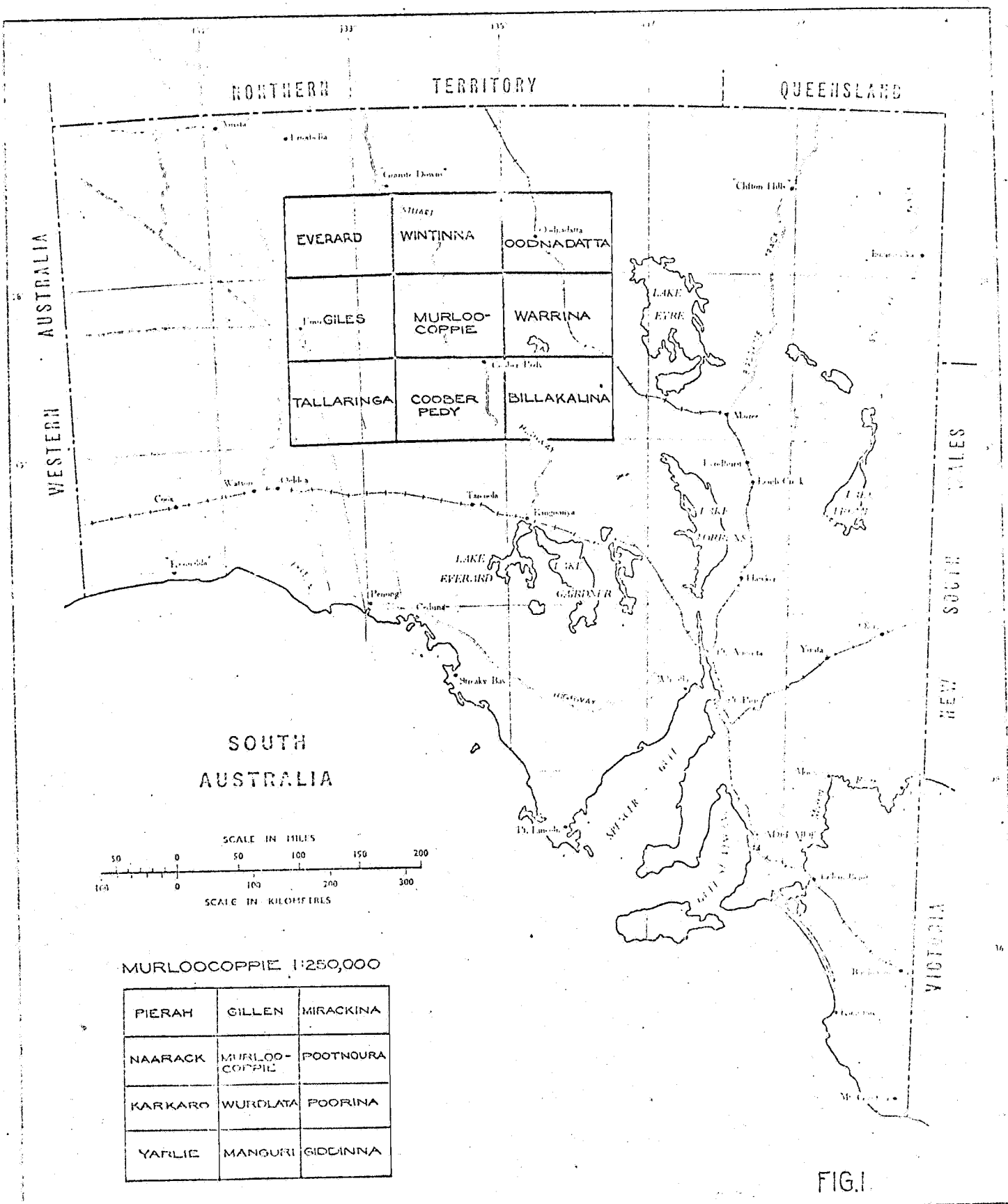
TABLE 1 - Stratigraphy



MURLOOCOPPIE 1:250,000

PIERAH	GILLEN	MIRACKINA
NAARACK	MURLOO-COPPIE	POOTNOURA
KARKARO	WURDLATA	POORINA
YARLIE	MANGURI	GIDDINNA

FIG.1

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Drawn A.G.R. Chkd

MURLOOCOPPIE 1:250,000 AREA

LOCALITY MAP

DEPARTMENT OF MINES
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MURLOOCOPPIE 1:250,000 Sheet
Explanatory Notes

ABSTRACT

The MURLOOCOPPIE 1:250 000 map area occupies the central platform area of the Permian Arkaringa Basin and an extreme west to southwestern portion of the Mesozoic Great Artesian Basin. The Arckaringa Basin contains glacigene sediments, overlain by marine shales and terrestrial coal-bearing sediments. These were deposited on a basement of granites and granite gneisses comprising the northern extremity of the Gawler Craton.

Unconformably overlying the Permian are rocks of the Great Artesian Basin, consisting of the basal terrestrial Algebuckina Sandstone, the transitional Cadna-owie Formation and the marine Bulldog Shale and Oodnadatta Formation.

The overlying sequence of Tertiary rocks presents a complex history of repeated phases of sedimentation and duricrust formation. Repeated "greybilly" silicifications and periods of erosion in the Eocene to ?Pliocene are followed by the formation of a ferruginous or lateritic unit with subsequent limestone deposition in depressions remnant from Miocene to Pliocene drainage systems.

Groundwater is economically important throughout the area, and is generally drawn from the Cadna-Owie Formation. A number of outlying fields of the important Coober Pedy Opal Fields occur on the sheet. Coober Pedy is 1.5 km south of the southeastern corner of MURLOOCOPPIE. There may be some potential, as yet untested, for uraniferous mineralisation in possible Tertiary channel deposits on western MURLOOCOPPIE and adjacent areas. The coal-bearing Mt. Toondina Formation has recently been the subject of much private company exploration.

INTRODUCTION

The MURLOOCOPPIE 1:250 000 sheet lies between Coober Pedy and Oodnadatta in the central Far North of South Australia and is bounded by latitudes 28°S and 29°S and longitudes 133°30'E and 135°00'E. The area is occupied by six pastoral stations, grazing sheep and cattle: Mable Creek and Mt. Clarence, south of the dingo-proof "Dog Fence",

and Mt. Willoughby, Evelyn Downs, Mt. Barry and Copper Hill to the north. The eastern extremity of the Great Victoria Desert occupies the western one-third of the sheet and is uninhabited.

The important opal mining town of Coober Pedy lies 1.5 km south of the southeastern corner of the sheet area, and the main route of access is the Stuart Highway which proceeds westerly from Coober Pedy, then north through the central portion of the sheet. Access south of the Dog Fence is good, particularly in the outlying opal mining areas. To the north, on Mt. Barry and Evelyn Downs Stations, all field-work necessitated cross country travel with four wheel drive vehicles. In the central northern "break-away" (scarp) areas of the Stuart Range, cross country work is difficult, and in the Great Victoria Desert it is often impractical, if not impossible, due to the thick growth of Mulga trees (Acacia aneura) on dunes. Work here was largely limited to traverses on the few tracks and seismic lines present and localities visited by helicopter.

The present programme of mapping was initiated in 1972 with a reconnaissance field trip and subsequent work using a Bell 47G helicopter (September-November, 1972), which covered MURLOOCOPPIE and adjacent areas. Follow-up field-work was conducted in 1973 and early 1974 by L.C. Barnes (S.A.D.M.) and the writer during which mapping was carried out on both MURLOOCOPPIE and WINTINNA. S.A. Department of Lands RC-9 aerial photography (Surveys 709, 710, 711 scale 1:79 200) was used for recording of field data and photo-interpretation. Later photography, Surveys 1501 and 1500 at a scale of 1:87 500, has also become available, and relevant LANDSAT-1 satellite imagery has been found useful.

The reader is referred to Pitt (1976) for a detailed report of the mapping and geology of this sheet.

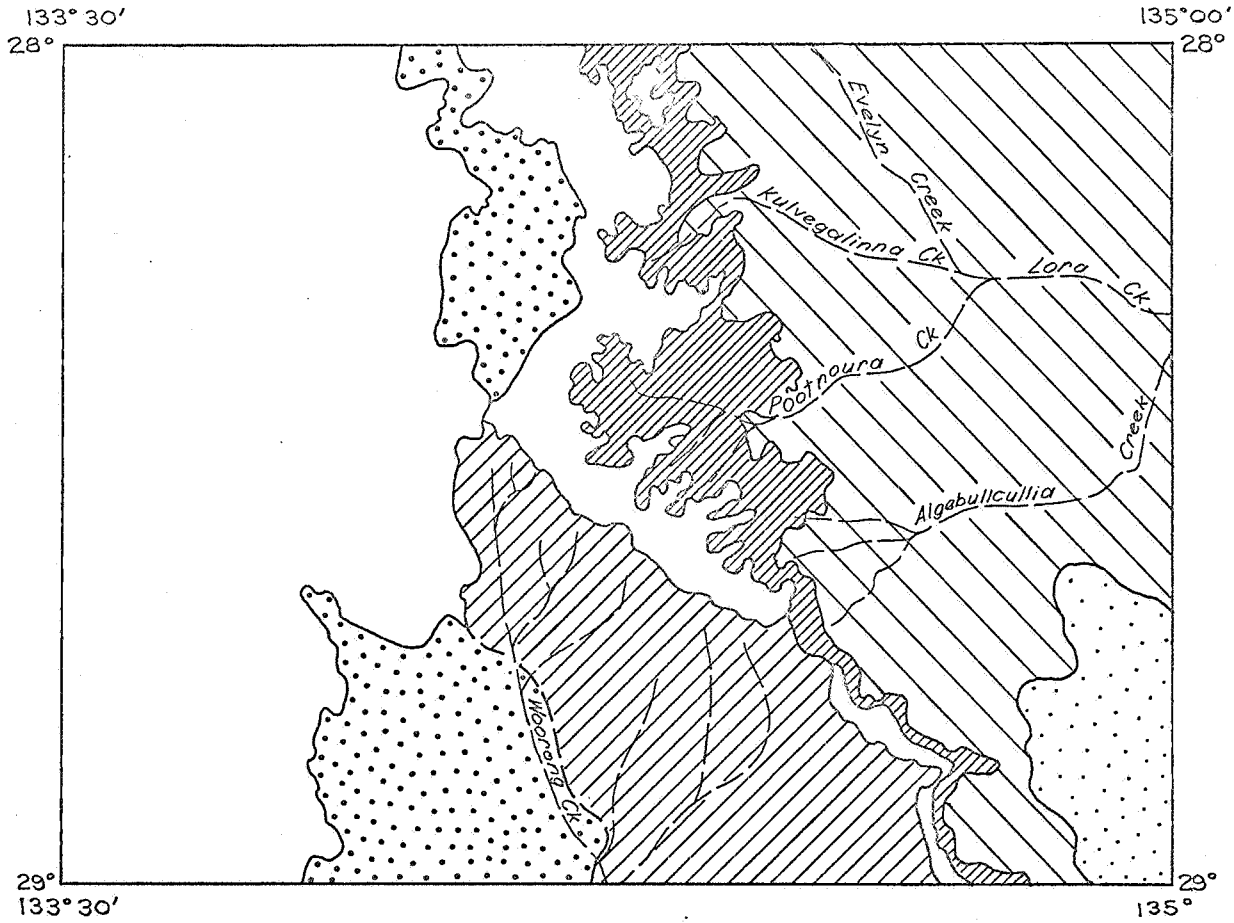
HISTORICAL AND PREVIOUS INVESTIGATIONS

According to Tindale (1940) the area under discussion was traditionally occupied by the Antakiringa tribe prior to European settlement. Signs of their presence are now rare. However, during field mapping two stone pattern sites were located, both on the Pootnoura Creek. Elsewhere, sites have been noted where even-grained, sandy variants of the Mirackina Conglomerate, now silicified to an orthoquartzite, have been used to make stone implements. The opaline "jelly-potch" of chalcedonic limestone was also a favoured lithology and occurrences of flakings are widespread.

The first European to explore the area was Stuart (see Stuart, 1858) on the first of his attempts to traverse Australia. He was followed by Ross in 1874 (Ross, 1875) who examined a great deal of the WINTINNA-MURLOOCOPPIE-COOBER PEDY area. His work is of significance in the naming of many of the geographical features in the area.

From 1882 to 1892 Carruthers included the area in a trigonometrical survey between Oodnadatta and the Western Australian border (Carruthers, 1892). As well as naming many other features, he re-named many of those of Ross's.

The first geological survey of the region was conducted by Brown (1890), to be followed by the Elder Expedition of 1891-1892 (Streich, 1892). In 1902, Maurice and Murray (Murray, 1902) traversed the eastern Great Victoria Desert, en route locating Tallaringa, a native well, for the first time. Their geological observations in this area are of some interest and importance.



ZONE 1 — Stuart Range

ZONE 2 — Breakaway areas

ZONE 3 — Southern Plains

ZONE 3A — Transitional area

ZONE 4 — Eastern Plains

ZONE 4A — Eastern Plains (see text)

ZONE 5 — Great Victoria Desert

SCALE

0 50 km

FIG. 2

DEPARTMENT OF MINES — SOUTH AUSTRALIA

	Dm. G.P.	MURLOOCOPPIE 1:250 000	SCALE: 1:1000 000
	Tcd. A.F.	PHYSIOGRAPHIC DIVISIONS	S 10957
	Chd.		
	Exd.		DATE: 27-8-74

500—2.69 555

Subsequent regional geological work was done by Brown (1905) and Jack (1915 and 1931).

The following list of references represents a sequence of papers and maps which illustrate the development of topographic and geological knowledge, and geographic nomenclature of the region: Stuart (1858), Ross (1874), Everett (1886, South Australian portion), Brown (1890), Carruthers (1892), Brown (1899, Northwestern portion), Brown (1905), Jack (1915) and Forbes (1961).

Recent regional studies are those of Forbes (1961) and Rochow (1963). Studies pioneering in the detailed mapping and stratigraphy of the Cainozoic of norther South Australia have great relevance to the geology of MURLOOCOPPIE. Important among these studies are those of: Firman (1970, 1971), Freytag (1966), Freytag et al. (1967), Jessup and Norris (1971), Major (1972, 1973(a) and (b)), Nichol (1971 (a)), Smale (1973), Stephens (1971), Stirton et al. (1961), Wopfner (1967, 1972, 1974), Wopfner, Callen and Harris (1974) and Wopfner and Twidale (1967).

PHYSIOGRAPHY

The physiographic divisions of MURLOOCOPPIE are closely allied to the Tertiary and early Quaternary geology of the area. With this in mind, the area is divisible into five distinct zones.

Zone 1 - Stuart Range. The plateau region of the Stuart Range is the major topographic feature on MURLOOCOPPIE extending north to southeast across the central portion of the map area. The range forms the major drainage divide between the drainage east into the catchment of Lakes Eyre and

Cadibarrawirracanna and that south into Lakes Phillipson, Woorong and Wirrida.

Gravity survey barometric levels show the plateau on northern MURLOOCOPPIE to be relatively level at about 270-280 m above sea level (a.s.l.). From here it dips gently towards Coober Pedy, dropping to about 240-250 m a.s.l. England Hill, the highest point on the sheet area, rises above the plateau to about 310 m a.s.l.

Zone 2 - Stuart Range Scarp area. The "Breakaway" area forming the eastern edge of the Stuart Range is characterised by complex mesa areas and steep, high scarps. Although cross country travel is often slow and tortuous, the area is ideal for detailed examination of numerous vertical cliff sections through the Tertiary and deeply weathered Cretaceous units.

Zone 3 - Southern Gibber Plains. This zone comprises the gently undulating plains of the south-facing watershed which drains the southwestern side of the Stuart Range. In general, "breakaway" scarps are rarely developed on this side of the plateau.

A transitional zone, designated Zone 3(a) is defined where the characteristics of Zone 3 gradually become subordinated to the red, sandy soils and the heavy mulga growth and dunes of the Great Victoria Desert (Zone 5).

Zone 4 - Eastern Gibber Plains. East of the Stuart Range and its scarp areas, the country consists of wide, rolling, open plains covered by a lag deposit of silcrete gibbers (i.e. "desert pavement"). The monotony of these plains is punctuated by isolated mesas, remnants of the Stuart Range tableland.

Zone 4(a) is distinguished by a remarkable gibber lag composed entirely of Precambrian lithologies, and devoid of silcrete clasts. Boulders up to 2 m across occur. Both

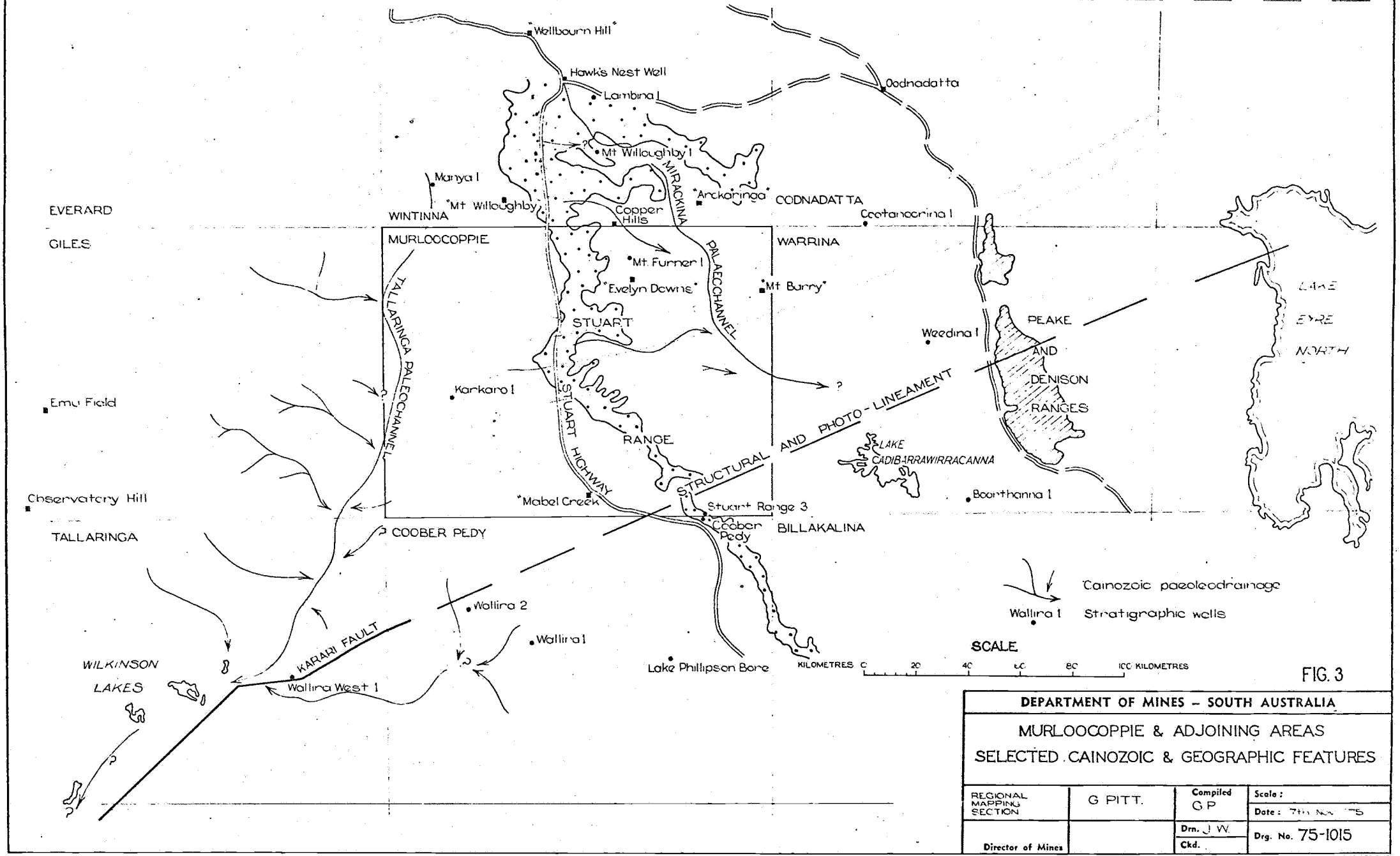


FIG. 3

DEPARTMENT OF MINES – SOUTH AUSTRALIA

MURLOOCOPPIE & ADJOINING AREAS
SELECTED CAINOZOIC & GEOGRAPHIC FEATURES

REGIONAL MAPPING SECTION	G PITT.	Compiled G.P	Scale :
			Date : 7th Nov '75
Director of Mines		Drn. J.W. / Ckd.	Drg. No. 75-1015

14,22,30,3,21,29,12,20,28

the Precambrian clasts and the accompanying soft gypseous soils were derived directly from the underlying Cretaceous unit.

The creeks draining Zones 1, 2 and 4 develop into wide, braided ephemeral rivers, supporting a growth of river red gum (Eucalyptus camaldulensis) in Zone 2, with gidgee (Acacia cambagei) becoming common in Zone 4. After a good season, waterholes are common and wildlife prolific.

Zone 5 - The Great Victoria Desert. This zone occupies the western one-third of MURLOOCOPPIE. It consists largely of unconsolidated but essentially non-mobile sand dunes overlying a compacted red-clay, sandy soil (Qrm, Major, 1973(b)) with rare outcrops of Tertiary limestones and Cretaceous rocks. Individual dunes may be up to 10-15 m high and many kilometres in length. The desert is generally heavily forested with mulga (Acacia aneura) and Acacia linophylla rendering cross country work difficult. Although mulga is the main agent in fixing the dunes, both the inter-dunal flats and the dunes themselves are covered in a profusion of native grasses, flowering bushes and shrubs and wildflowers, after seasons of exceptional rainfall, such as 1973 and 1974.

The major contributor to the physiography of the Great Victoria Desert on western MURLOOCOPPIE and eastern GILES is an extensive south-flowing palaeodrainage system which, though probably defunct since the late Pleistocene and now infilled with unconsolidated dune sand, still retains some topographic expression. The system has been named the Tallaringa Palaeodrainage System (Barnes and Pitt, 1976(c)).

STRATIGRAPHY

Only Lower Cretaceous and Cainozoic units occur in outcrop on MURLOOCOPPIE. Older rocks, specifically the Upper Jurassic of the Great Artesian Basin, the Permian of the Arckaringa Basin and Precambrian crystalline basement are present in the subsurface, and have been intersected in South Australian Department of Mines (S.A.D.M.) stratigraphic wells Karkaro 1 and Mt. Furner 1.

A summary of the stratigraphy of MURLOOCOPPIE is given in Table 1, together with thicknesses intersected in the above stratigraphic wells.

CARPENTARIAN

S.A.D.M. Karkaro 1 and Mt. Furner 1 entered granitic and gneissic basement at 472 m and 549 m respectively. These basement rocks represent the northern extremity of the Gawler Craton. A five-sample Rb-Sr isochron was obtained from Mt. Furner 1 giving an age of 1525 $\pm$ 99 Ma*.

(?) DEVONIAN

A sequence of dense dolomites, with minor grey shales and dolomitic sandstones has been defined as the Cootanoorina Formation (Townsend and Ludbrook 1975), from intersections made in Weedina 1, Mt. Willoughby 1 and Cootanoorina 1 on WINTINNA and WARRINA. The unit is responsible for marked positive gravity features and is restricted to the Wintinna and Boorthanna Troughs which are marginal to the Arckaringa Basin. The Cootanoorina Formation may not occur in the sub-surface on MURLOOCOPPIE, as that sheet occupies the central portion of the basin.

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* A.W. Webb, 1972. Amdel-S.A.D.M. Geochronology Project 1/1/122, Prog. Rept. 9 (unpublished).

TABLE 1

STRATIGRAPHY

Age		Stratigraphic unit, primary reference(s)	Map Symbol	Thickness (metres)	Lithology	Remarks
QUATERNARY	Holocene	Alluvium	Qra		Fluviatile muds sands and gravels.	Occupies modern drainage channels, flood plains and minor claypans.
		Sand	Qrs		Yellow-red aeolian quartz sands. Medium to fine grained unconsolidated.	Seif dunes and sand spreads of the Great Victoria Desert. Partially fixed by vegetation.
		Red-brown soils (Major, 1973(b))	Qrm		Shallow red-brown clayey - sandy soils	Characterised by the growth of thick stands of mulga. Underlies the sands of the Great Victoria Desert.
	Pleistocene to Holocene	Undifferentiated Quaternary	Q		Red-brown to grey, silty to sandy soils and weathering products with a surface log of silcrete gibber.	Derived from breakdown of underlying units. Often gypseous due to reworking of "Gypsite".
		Calcrete	Qca	<0.1 to 1.0	White to pale coloured platy to nodular calcrete	Superficial deposits veneering outcrop on western MURLOOCOPPIE. Regional correlations unknown.
		Gypsite	Qpr		Massive gypsum crusts and associated gypseous silts	Preservation of original gypsite crust is rare. Usually eroded and reworked into younger units.
					Disconformity	
	Pliocene to Pleistocene	Chalcedonic limestone (Mangatitja, Mt. Willoughby Limestone equivalent: Major (1973(a), Nichol, 1971 (a))	T-Q	<4	Cream to light grey, variably chalcedonic limestone. Lower portion often fragmentary and earthy.	Fresh water or brackish lake deposit. Remnants occupy the "Tallaringa Palaeochannel" and are characterised by the growth of a red-flowering Dodonaea.
		Doonbara Formation equivalent (Wopfner, 1974)	T-Q	<4	Red-brown, silty to sandy, friable ferruginous rocks. Variably pisolitic, lateritic and/or calcareous. Often silicified, producing a "jasper breccia".	One of the major rock types forming the cap of the Stuart Range plateau. Developed as a partly alluviated and reworked palaeosol under moist, humid (oxidising) conditions.
					Disconformity	
TERTIARY	Miocene to Pliocene (? upper limit)	Mirackina Conglomerate (Barnes and Pitt, 1976(b))	Tmk	2-15	Channel-confined deposits of silcrete clast-bearing conglomerates, sands and silts. Variably silicified and/or ferruginised.	Occupies the "Mirackina Palaeochannel" and tributaries, an exhumed Tertiary palaeodrainage system. No fossils have been found, apart from silicified wood pebbles.
		Unnamed widespread silicified sands (Barnes and Pitt, 1976(a))	Tms	1-5	Widespread, relatively thin polished silcrete pebble-bearing sands or silty sands. Often massively silicified.	Extensive sandy equivalent to the channel-confined Mirackina Conglomerate. Invariably occurs as a massive silcrete on MURLOOCOPPIE - elsewhere may be more thickly developed and only partially silicified as at Mt. Sarah (DALHOUSIE)(see Barnes and Pitt, 1975(a).
					Erosional disconformity	
	?Oligocene	Silcrete (Wopfner, 1974)	Tsi		Quartzose silcrete of the duricrust profile (Wopfner, 1974): "grey-billy" silcrete	Rare isolated remnants only: these are usually broken down and incorporated into younger units in part. Otherwise present only as clasts in Tmk and Tms
					Erosional unconformity	
CRETACEOUS	Albian	Oodnadatta Formation (Freytag, 1966)	Klo		Grey to greenish grey claystones and siltstones	Generally strongly bleached and altered in outcrop. Minimal outcrop occurs on MURLOOCOPPIE. Marine.
		Coorikiana Sandstone Member (Freytag, 1966)	Klk	10-14	Fine to coarse grained, clean, micaceous glauconitic and/or kaolinitic sandstones, variably massive fissile and/or cross-bedded, with silty interbeds.	Basal member of the Oodnadatta Formation. Often extensively bioturbated and may be strongly ferruginised. Marine.
	Aptian	Bulldog Shale (Freytag, 1966)	Klb	120	Dark grey silty shale variably carbonaceous, pyritic or glauconitic with a scattering of Precambrian cobbles and boulders. Some fossiliferous limestone or concretion horizons, often well-developed near base.	Usually deeply weathered to a light grey or off-white. Thickness increases to some 400 m in centre of the Great Artesian Basin. Base in Giddinna area taken as a major brown-weathering, fossiliferous limestone horizon. Marine.
		Unnamed transitional unit (Pitt, 1975, and this paper)	Klt	?10+	Largely "shale, dark grey, organic-rich ... with partings of quartz sand, very fine grained pale grey, silty and micaceous"(Lindsay,1975) with lenses of conglomeratic sands and "cone-in-cone" limestones. Gypseous throughout and may be somewhat glauconitic.	On MURLOOCOPPIE outcrops only in Giddinna area where it is characterised by a remarkable "boulder field" - a heavy boulder lag developed on soft gypseous soils. Restricted marine.
	Neocomian	Cadna-owie Formation (Wopfner, et.al., 1970)	Klc		Grey to off-white, finely micaceous, pebbly to cobbly medium to fine grained quartz sandstone. Becomes fine grained in the upper portion with micaceous siltstone and claystone interbeds.	Major aquifer of the Great Artesian Basin in this region. Transitional marine.

Intersections in stratigraphic wells: thickness (metres).	
Mt. Furner 1	Karkaro 1
42	60
Not recognised	
44	28

Transgressive disconformity. Units below occur subsurface only.

JURASSIC	Upper	Algebuckina Sandstone (Wopfner et.al., 1970)	Jua		White to pale grey medium grained to conglomeratic kaolinitic quartz sandstone. Planar, angular cross-bedding often well developed with pebble conglomerate layers at bases of sets.	Basal unit to the Great Artesian Basin in this region. Fluviatile.	27	Not intersected.
					Unconformity, erosion			
PERMIAN	Artinskian	Mt. Toondina Formation (Townsend and Ludbrook 1975)	Plt		Upper unit: Interbedded sandstones, siltstones, coals and carbonaceous shales. Minor calcareous and/or pyritic sandstones. Lower unit: Pale to dark grey, non-carbonaceous, sometimes calcareous, clayey sandstones, siltstones, siltstones and interbedded shales.	Lacustrine, fluviatile	390	230
		Stuart Range Formation (Townsend and Ludbrook 1975)	Pls		Greenish grey sandy to silty claystone.	Restricted marine.	27	104
	Sakmarian	Boorthanna Formation (Townsend and Ludbrook 1975)	Plb		Upper unit: Pebbly to bouldery sandstone graded bedding often well developed. Lower unit: Pebbly to cobbly claystone.	Lower unit: reworked glacigene material deposited under fluvial and partial marine conditions.	Not intersected	67
					Unconformity			
?DEVONIAN		Cootanoorina Formation (Townsend and Ludbrook 1975).	?D		Dense, pale grey dolomites, shales and dolomitic sandstones. Some evaporites.	Restricted to Boorthanna and Wintinna Troughs and is not likely to subcrop on MURLOOCOPPIE. Intersected in Weedina No. 1 Boorthanna No.1 and Mt. Willoughby No. 1	Not intersected	
					Unconformity			
CARPENTARIAN		Crystalline basement (Thomson, 1974)	ρ^{ϵ}		Granite and granite gneiss of the Gawler Craton (dated at 1529 ± 99 m.y. from a 5-sample Rb-Sr isochron from Mt. Furner core material (Webb, 1972))		T.D. 472	T.D. 549

Archaeringa Basin sediments

PERMIAN

The Lower Permian of the Arckaringa Basin has been divided into three units defined by Townsend and Ludbrook (1975): the Boorthana Formation, Stuart Range Formation and Mt. Toondina Formation. Townsend (1975) gives a detailed description of these units.

The lowermost unit, the Boorthanna Formation, unconformably overlies the Cootanoorina Beds. Two subunits may be distinguished: a lower diamictite (equivalent to the Permian rocks outcropping along the margin of the Peake and Denison Ranges) and an upper conglomerate. The latter displays graded bedding possibly attributable to turbidity currents.

Intersections in stratigraphic wells suggest that the lower diamictite is restricted to marginal troughs of the Arckaringa Basin whereas the upper conglomerate laps onto the western and southeastern parts of the central platform area of the Arckaringa Basin, but is absent over the central to northeastern part of the platform. Thus, with respect to MURLOOCOPPIE, the Boorthanna Formation is probably present only in the far west and northwest of the sheet.

Townsend and Ludbrook (1975) give an age of lower Sakmarian for the Boorthanna Formation, based on determinations by Balme (1964), Ludbrook (1961, 1967(a) and (b)) and Harris and McGowran (in Thornton 1970, 1971 and Townsend 1970, 1971, 1975).

The Stuart Range Formation consists essentially of a homogeneous green-grey claystone. The unit is very distinctive on lithological and electric log characteristics and is interpreted as having been deposited under restricted marine conditions. It apparently conformably overlies the Boorthanna

Formation on western MURLOOCOPPIE, and elsewhere on the sheet rests directly on crystalline basement.

The formation is considered to be Sakmarian-Artinskian in age (Townsend and Ludbrook, op. cit.).

Apparently conformably overlying the Stuart Range Formation, the Mt. Toondina Formation is divisible into a lower non-carbonaceous unit of sandstone, shales and siltstones and an upper unit bearing sandstones, siltstones, coals, carbonaceous shales with some pyritic and calcareous sandstones. This upper unit is the subject of much exploratory work on the part of private companies, and large reserves of coal within it are already proven at Lake Phillipson.

On MURLOOCOPPIE, private company work to date has shown that pre-Upper Jurassic erosion has stripped the Mt. Toondina Formation in many areas although some remnants of the coal-bearing upper unit are still present (see for example, MacLean, 1975). Townsend and Ludbrook (1975) suggest a Sakmarian to Artinskian age for this formation.

JURASSIC

Unconformably overlying the Permian sediments, the Algebuckina Sandstone forms the basal unit of the Great Artesian Basin in this region. It is of limited extent on MURLOOCOPPIE and occurs in the subsurface on the eastern half of the sheet only.

The unit was defined by Wopfner et al. (1970) as a terrestial-fluviatile sequence consisting of medium-grained to conglomeratic, kaolinitic arenite beds with well-developed angular, planar, current bedding.

On the basis of plant fossil and palynological work

by Harris (1962 and 1970, also in Wopfner et al., 1970), the Algebuckina Sandstone is regarded as Upper Jurassic.

CRETACEOUS

The Cadna-owie Formation overlies the Algebuckina Sandstone, the boundary being marked by a transgressive disconformity. Wopfner et al. (1970) have defined it as a sequence of transitional and shallow marine sands underlying the deeper water Bulldog Shale.

It typically consists of a fine to medium grained quartz sandstone, but in the upper portions fine grained sandstones or sandy ,micaceous siltstones may be present. . The unit may contain thin coal bands and often has a high content of pebbles and boulders derived from Proterozoic rocks. The origin of such clasts is discussed in Wopfner et al. (1970).

The Cadna-owie Formation outcrops on MURLOOCOPPIE only along the western margin of the sheet, in the Great Victoria Desert.

The unit is considered to be Neocomian to early Aptian on the basis of palynological and foraminiferal evidence (Harris 1965; Wopfner et al. 1970, Ludbrook 1966, 1967(a)).

Cadna-owie Formation underlies the Bulldog Shale throughout the sheet area, and much of it, particularly in the southeast, may be the deltaic Mt. Anna Sandstone Member.

In the southeastern corner of MURLOOCOPPIE a distinctive unit has been mapped which is transitional both lithologically and stratigraphically between the Cadna-owie Formation and the overlying Bulldog Shale. It consists largely of dark chocolate brown shales, interbedded with conglomeratic sandy lenses and "cone-in-cone" limestone in

this area. The unit is equivalent to the 8 m thick "Unnamed Transitional Beds" of Ludbrook (1967 (a)) underlying Marree Formation in Stuart Range No. 3 Bore. (The unit should not be confused with the "Transition Beds" of Whitehouse (1954) which is correlated with the Cadna-owie Formation). On MURLOOCOPPIE the unit has a distinctive top and base. These consist of, respectively, a persistent brown-weathering limestone horizon in the basal Bulldog Shale, and the coarse sands of the Cadna-owie Formation.

As it cannot be assigned satisfactorily to either the underlying Cadna-owie Formation or the overlying Bulldog Shale, it is best regarded for the present as a separate, informal transitional unit. Although of minimal thickness, the area of outcrop is disproportionately great and for this reason the unit may assume some importance in future mapping in the region.

Tentative subsurface identification has been made of this "transitional unit" during S.A.D.M. drilling operations in the Stuart Range area (P. Smith, S.A.D.M., personal communication, 1975). However it has not been recorded on western MURLOOCOPPIE (in the Great Victoria Desert) due to lack of information.

A fauna containing abundant Textularia anacooraensis and other foraminifera was recorded by Lindsay (1975) from a sample of this unit, indicative according to Ludbrook (1966) of the lowermost Aptian. Lindsay (1975) also notes "... the degree of diversity of the foraminiferal microfauna suggests at least a partially marine environment of deposition, but the lack of other fossils, the wholly agglutinated assemblage and the organic-rich lithology indicate restricted and/or marginal marine conditions".

The Bulldog Shale conformably overlies the Cadnaowie Formation (and the "transitional unit") forming the bulk of Cretaceous outcrop on MURLOOCOPPIE. When fresh it is a dark grey, fossiliferous, silty, variably carbonaceous, pyritic or glauconitic shale. However, it is usually seen in outcrop as a deeply weathered light grey off-white shale, occasionally silty or sandy. Fossiliferous concretionary limestones form horizons particularly in the lower part of the unit. Clasts of typical Precambrian lithologies occur sporadically. The shale may be silificied to a cream or multicoloured porcellanite, or bleached and ferruginised to a red, orange or purple colour such as in the Mt. Gillen area.

In general, only the basal member of the conformably overlying Oodnadatta Formation, that is, the Coorikiana Sandstone Member, is preserved above the Bulldog Shale, but beneath the Tertiary rocks of the Stuart Range. It consists essentially of fine to medium grained, massive to cross bedded sandstone with rare interbeds of grits. Bioturbation, worm tubes and such structures are extremely common. A glauconitic content, often recorded in the subsurface may be represented in outcrop by ferruginisation of the coarser sands.

The unit is perhaps the most prominent of a number of thin sandy intercalations which occur sporadically within the lower Cretaceous sequence.

Within the Stuart Range escarpments, the passage upwards from Bulldog Shale into Coorikiana Member is gradual and this, allied with the strong alteration of both and the coarsening of the Bulldog Shale in the Coober Pedy area renders their identification and mutual distinction subjective. The base in this area was therefore chosen at the lowermost grit bed - a lithology not typical of the underlying Bulldog Shale.

Few remnants of the rest of the Oodnadatta Formation have been observed above the Coorikiana Member in the Stuart Range, but where present it consists of deeply weathered and bleached shales.

An abundant shelly fauna from the Lower Cretaceous units indicates an Albian age for the Oodnadatta Formation, a transitional Albian to Aptian age for the Coorikiana Member and an Aptian age for the Bulldog Shale (Ludbrook, 1966).

TERTIARY TO EARLY QUATERNARY

With the exception of the Tallaringa Palaeochannel, Tertiary sediments and duricrusts are confined to the Stuart Range and outliers. The rocks capping this dissected plateau consist of a complex of sediments and duricrusts whose ages range from (?)Oligocene to late Pleistocene. A major objective in the present mapping programme has been the delineation of those units and their sequence and environments of formation.

The earliest known Tertiary rock unit in the area is a silcrete now preserved only in the form of clasts in younger units but has nowhere been recorded in situ. It may be equivalent to the "Silcrete of the Cordillo Surface" (Wopfner 1974). The "Silcrete of the Cordillo Surface" is of probable Oligocene age and throughout northern South Australia affects the Paleocene to Eocene Eyre Formation and, according to Wopfner (1964), older units from Cretaceous to Precambrian. Eyre Formation has not been mapped on MURLOOCOPPIE,

and silcrete-related alteration (bleaching and silicification) of the exposed Cretaceous rocks is the first event of Tertiary age preserved in the geological record in the area.

The Mirackina Conglomerate consists of a fluviatile sequence of conglomerates bearing silcrete, quartz and shale clasts, massive to cross bedded sandstones and some shales. Sediment for this unit was derived from erosion and pre-existing silcrete, Eyre Formation (Wopfner et al., 1974) bleached Cretaceous shales, and Cretaceous sandstones. The top of the unit is massively silicified to a "greybilly" silcrete, similar to the clasts contained within it.

Distribution of the unit strongly suggests deposition within a large palaeodrainage system, composed of a number of tributaries and a main channel - the "Mirackina Palaeochannel" - which is over 200 km long (Barnes and Pitt, 1976(a) Part 2, and 1976(b)). Equivalents of the Mirackina Conglomerate possibly occur in the Tallaringa Palaeochannel, as discussed in Barnes and Pitt (1976(a) Part 4).

Thin, widespread, strongly silicified sands, bearing polished silcrete pebbles, and thought to be equivalent to the Mirackina Conglomerate, form the most prominent silcrete on MURLOOCOPPIE. These sands are to be named the Mt. Sarah Sandstone (Barnes and Pitt, 1976(a) Part 3, 1976(d)).

In the absence of palaeontological evidence an age for the Mirackina Conglomerate and ?associated sands has been deduced from lithology and field observations. The presence of silcrete clasts, perhaps derived from the silcrete of Cordillo Surface, suggests a post-Oligocene age whilst the stratigraphic position beneath the Pliocene or early Pleistocene Doonbara Formation and its equivalents (see later) suggest a pre-Pliocene age. The Mirackina Conglomerate and

the Mt. Sarah Sandstone are thus probably of Miocene or Pliocene age.

Further studies are aimed at establishing the relationships between the Mirackina Conglomerate and mid- to upper Tertiary units occurring within the Lake Eyre Basin, in particular, the Etadunna Formation.

Post-dating and unconformably overlying the Mirackina Conglomerate and equivalents is a friable, red, ferruginous, clastic rock which forms a major portion of the complex of units capping the Stuart Range plateau. This unit is equated with the Doonbara Formation (Wopfner 1974). Silicification occurs within it but is irregular and has produced a brittle "jasper breccia", or "puddingstone".

It is thought the unit developed as a ferruginous colluvial mantle from break-down of underlying rocks under humid conditions. Minor mass movement served to transport some of the debris into local depressions. It must thus be regarded as a palaeosol only in part, and it is important to recognise that it has a significant, though variable, sedimentary aspect. Detailed work has shown that the local depressions were remnants of the palaeodrainage system within which the Mirackina Conglomerate was deposited.

Following the development of the Doonbara Formation, carbonate deposition took place in a restricted lacustrine environment (again usually confined to the local depressions) resulting in chalcedonic limestone now mapped as the Mt. Willoughby and Mangatitja Limestones (Nichol 1971(a) and Major 1973(a)). Limestones of this type have also been recorded in the "Tallaringa Palaeochannel".

The age of these limestones is as yet ill-defined, but believed to be between upper Pliocene and middle Pleistocene.

SUMMARY OF TERTIARY EVENTS

The following comments are intended to be explanatory to the schematic section on the accompanying MURLOOCOPPIE sheet.

The earliest Tertiary events of importance to the region are the deposition of the upper Paleocene to Eocene Eyre Formation (Wopfner, Callen and Harris, 1974) and its subsequent silicification probably during the Oligocene. The resultant silcrete was termed the "Silcrete of the Cordillo Surface", by Wopfner (1974) and is, for ease of reference, informally numbered Si_1 on the Schematic Section. Eyre Formation has not been recorded on MURLOOCOPPIE and Si_1 affected Cretaceous units exposed at the time.

The next identifiable Tertiary event on MURLOOCOPPIE is a major fluvial phase involving erosion of the Cretaceous rocks and Si_1 silcrete and the deposition of the Mirackina Conglomerate. The occurrence of "greybilly" silcrete clasts in sequences of the Mirackina Conglomerate which are capped by a "greybilly" silcrete demonstrates that a phase of silcrete genesis Si_2 - postdated this fluvial phase and clearly shows that there were two distinct phases of "greybilly" silcrete genesis.

The silcrete relationships observed in the Mirackina Conglomerate and discussed above are also present in the Mt. Sarah Sandstone. In the past, these relationships were interpreted as indicating reworking contemporaneous with silicification, however Barnes and Pitt (1976(a), (d)) believe two distinct generations of silcrete are implied.

At Hawks Nest Well (WINTINNA) Doonbara Formation is irregularly silicified into a jasper breccia - Si_3, and furthermore overlies with a sharp contact, and contains boulders of, Mirackina Conglomerate. This demonstrates that

Si_3 is distinct from the prior silicification Si_1 and Si_2.

A fourth, separately identifiable silicification - Si_4 - is present in the form of chalcedonic veining and replacement within the Mt. Willoughby and Mangatitja Limestones and equivalents. Field relationships of this silicification are not well understood - as the Mt. Willoughby limestone overlies the Doonbara Formation largely conformably, Si_3 and Si_4 may be one and the same. Recent work around Coober Pedy, however, suggests Si_4 is significantly younger (L.C. Barnes, personal communication, S.A.D.M. 1975).

Ferruginisation has likewise been subdivided into a number of phases. It occurs, firstly, both in the basal and uppermost portions of the Mirackina Conglomerate (designated Fe_1). Petrographic examination (Whitehead 1974) indicates it predated the silicification (Si_2) on the Mirackina Conglomerate. The most distinctive ferruginisation is that associated with the Doonbara Formation and equivalents - Fe_2 - the "ferralitization" of Wopfner (1974). Deposition and ferruginisation of the Doonbara Formation are regarded as virtually contemporaneous by the present writer.

The limitations to the ages of these silicifications and ferruginisations are clearly defined by reference to the ages of the various units in which they were developed and/or reworked as presented in Table 1.

QUATERNARY

Massive, crystalline gypsum crusts, directly correlated to the "Gypsite" of Wopfner and Twidale (1967) occur only rarely on MURLOOCOPPIE. In general, the gypsum derived from this crust has been eroded and is being continually recycled through all surficial units. Thus the age of gypseous impregnations or crusts in most cases is not definable, and

conclusive identification of the "original" gypsite crust is hazardous.

Eastern MURLOOCOPPIE is characterised by deflated mesas or terrace levels which were probably derived by reworking and lowering of the "Gypsite" crust. The ill-defined scarps bounding these levels are mapped on the accompanying MURLOOCOPPIE sheet, and recorded in the legend, however the reader should note that they generally do not represent in situ "Gypsite."

Wopfner and Twidale (1967) regard a certain ferruginisation phase and minor silicification to be associated with the development of the Gypsite. These are designated Fe_3 and Si_5, however their genetic relationship is still considered not fully proven.

Calcretes have been recorded only in the Great Victoria Desert, associated with outcrop of limestones and Cretaceous units. They are rarely well developed and occur usually as thin veneers over older rocks. There is little evidence available to relate them to calcretes elsewhere in the State.

A red-brown clayey-sand (Qrm: Major (1972)) occurs throughout western MURLOOCOPPIE and underlies aeolian dune sands. In some areas a deepening in colour of the latter suggests derivation from Qrm, which outcrops in interdunal areas.

Recent work in the Coober Pedy area has investigated the distribution of at least two Quaternary units until now regarded as unmappable. These units have not been represented on the MURLOOCOPPIE sheet. The older, a red-brown gravelly to clayey sand appears to be widespread on the southern Stuart Range. It apparently is derived by reworking of the

Doonbara Formation which it superficially resembles. Previously it has been recorded in creeks incising the Stuart Range on northern MURLOOCOPPIE. Barnes (S.A.D.M. personal communication, 1975) has suggested a correlation with the Illeroo Pedoderm of Jessup and Norris (1971). The younger, consisting of silts and gravels with a prominent red brown clay, may correlate with the Pooraka Formation (Firman, 1969) or Callabonna Clay (Firman, 1970).

STRUCTURE

The geological structure on MURLOOCOPPIE consists of parts of two major, largely undeformed, superimposed sedimentary basins, overlying the crystalline basement of the Gawler Craton. These basins are the Permian Arckaringa Basin and the Mesozoic Great Artesian Basin.

The overall configuration of the Arckaringa Basin has been amply described and discussed by Townsend (1975). It consists essentially of a central platform area, within which MURLOOCOPPIE is situated, surrounded on the northeast and northern, eastern and southern sides by deeper troughs - the Wintinna, Boorthanna, Phillipson and Wallira Troughs respectively. The whole basin is some 200 to 300 km across. Pre-Permian sediments are restricted to the Wintinna and Boorthanna Troughs.

Over most of the central platform area, including MURLOOCOPPIE, Permian rests directly on basement, and is generally flat lying and undeformed except where locally disturbed by faulting as at Mt. Toondina, on OODNADATTA.

In the Mable Creek area, the Mable Creek High forms a basement ridge over which Permian is probably absent. In the northeast and northwest corners of the MURLOOCOPPIE sheet,

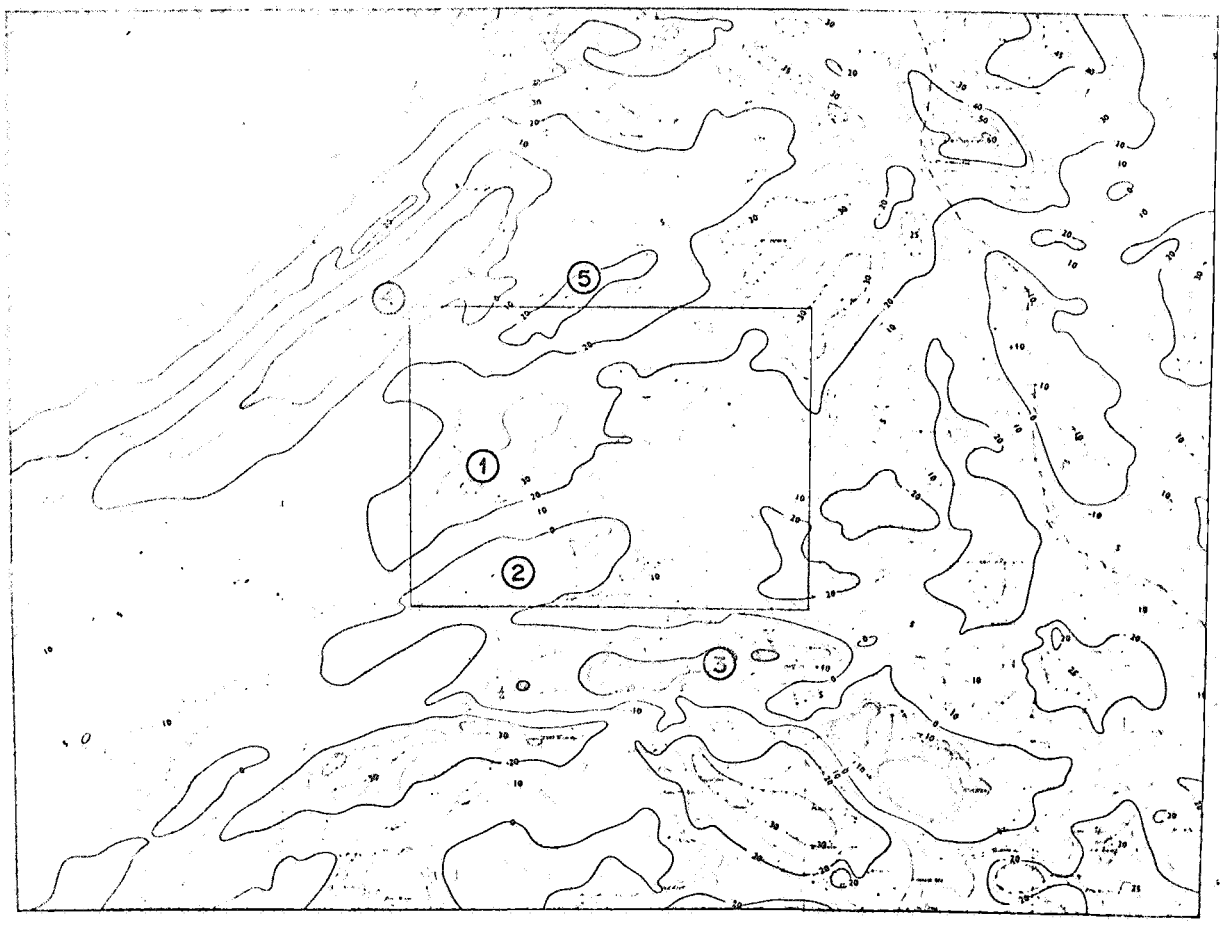
the basement deepens towards Wintinna and Boorthanna Troughs. (?)Devonian dolomites (the Cootanoorina Formation) are confined to these two troughs.

Unconformably overlying the Arckaringa Basin sediments are those of the Great Artesian Basin. Again, these units are virtually undeformed and flat lying. In the Giddi Giddina/Oolgelima area, however, dips of 3^{o}-5^{o} were recorded on outcropping sands and shales of the unnamed transitional unit. These dips appear to outline a gentle west-plunging anticline which exploratory drilling and structure contouring (Mason, 1975(b)) shows to be part of a dome. The remarkable freshness of the units exposed within the anticline and dips recorded on surrounding gypsite crusts suggest the structure is quite young and post-dates the most recent phase of deep weathering.

A major lineament which forms an extension of the Karari Fault extends from eastern TALLARINGA to Lake Eyre North, traversing the southeastern corner of MURLOOCOPPIE. This feature is visible on LANDSAT-1 imagery and preliminary geological sheets and has a pronounced effect on water quality in the Oolgelima Creek due to enhanced local recharge (Mason, 1975(b)).

GEOPHYSICAL SURVEYS

Most geophysical data available in the area has been obtained through systematic investigations, largely by the S.A.D.M., of the Arckaringa Basin. This work began in 1961 and led to intensive studies in 1968 and 1969 allied with the drilling of a number of stratigraphic wells. The results and implications of the latter are summarised in



KEY TO 1:250,000 SHEETS

EVERARD	WINTINNA	OODNADATTA
GILES	MURLOOCOPPIE	WARRINA
TALLARINGA	COOBER PEDY	BILLA KALINA

REFERENCE

20 ·····BOUGUER GRAVITY CONTOURS (INTERVAL 5 MILLIGALS)

MAJOR GRAVITY FEATURES

1 ·····KARKAROO GRAVITY LOW

2 ·····MABEL CREEK BASEMENT HIGH

3 ·····COOBER PEDY BASEMENT HIGH

4 ·····WINTINNA POSITIVE ANOMALY

5 ·····WILLOUGHBY GRAVITY LOW

EXTRACTED FROM BOUGUER GRAVITY MAP OF SOUTH AUSTRALIA

FIG. 4

	DEPARTMENT OF MINES—SOUTH AUSTRALIA	SCALE AS SHOWN
DRAWN G.M.P.	MURLOOCOPPIE 1:250 000 AREA	DATE FEB. '76
TRACED R.G. CKD	REGIONAL BOUGUER GRAVITY CONTOURS	PLAN NUMBER S12268

Townsend (1973). Seismic and other work conducted at this time is described in Milton (1970 and 1969(a)). Other reports dealing with this work are detailed below and/or appear in the Bibliography to these Notes.

Aeromagnetics

Aeromagnetic data over the sheet area have been compiled by the Exploration Geophysics Section of the S.A.D.M. from surveys by Delhi (Aeroservices Corporation, 1961 and 1962), S.A.D.M. and Exoil. Total magnetic intensity map coverage is available at a scale of 1:250 000 and contour interval of 50 gammas.

Detailing the aeromagnetic features of the sheet area is beyond the scope of these Notes, however, it may be noted that they reflect largely the relatively shallow magnetic (in this area, crystalline) basement.

Gravity

Figure 4 is extracted from the S.A.D.M. 1:1000000 Bouguer Gravity Anomaly Map of South Australia (Coppin et al., 1973). Information inthe area under discussion was compiled largely from S.A.DM. gravity surveys in 1968-1969 (Hall and Townsend, (1971), Nettleton (1970)). Major features are the Mabel Creek basement high (which shows as a marked gravity high), a gravity low in the Karkaro area, and the Willoughby gravity low where some 1,200 m of Permian and Mesozoic sediments overlie basement.

Seismic

Intensive seismic investigations have been conducted over much of the Arckaringa Basin (Milton, 1964(a), (b)), with resultant basement contour interpretations as detailed by

Milton (1960(a), 1972 and 1973). For the drilling of stratigraphic wells S.A.D.M. Karkaro 1 and Mt. Furner 1 on MURLOCCOPPIE, preparatory seismic refraction lines were shot. The wells themselves were located on the basis of gravity data.

One recent practical application of the regional gravity surveys stemmed from the recognition of the Mabel Creek and Coober Pedy basement rises and their probable presence as little as 30 m beneath the surface. These rises were subsequently investigated to detect areas of near-surface basement rocks as potential sources of aggregate for the Tarcoola-Alice Springs Railway, using shallow seismic techniques (Nelson, 1971(a), (b)). The reader is also referred to Nelson (1973(a), (b)), for details of shallow seismic investigations of bridge sites for the Railway.

ECONOMIC GEOLOGY AND POTENTIAL

OPAL

The important Coober Pedy opal field lies 1.5 km south of the southeastern edge of the sheet area. Outlying fields are present up to 40 km away, including, on MURLOOCOPPIE, fields such as Shell Patch, Nineteen Mile, Fourteen Mile, Sixteen Mile and Hans Peak. The opal occurs in deeply weathered siltstones and shales of the Bulldog Shale. In contrast to earlier concepts of opal deposition at Coober Pedy it does not appear to be aquiclude-related. The real controls of deposition are at present ill-understood. (See Hiern 1965(a), (b), 1967(a), (b), Ward 1915, 1917).

Opal mining has also been attempted at England Hill

and Lavinia Hill in the far northern-central portion of the sheet.

KAOLIN and ALUNITE

Near Imbitcha Bore, on WINTINNA, Heath (1962) described kaolin deposits which, though of high grade, were uneconomic due to factors of isolation and difficult extraction. The deposit occurs in high cliffs bordering on the Arckaringa Creek stratigraphically within, or adjacent to, sands and siltstones of the thin Coorikiana Member. Recent field mapping has shown this to be a relatively common relationship and it appears likely that the occurrence of veins of kaolin and/or alunite accumulations does show some stratigraphic control. This factor may have application regionally in the search for kaolin or alunite deposits.

COAL

With the proving of considerable reserves of coal at Lake Phillipson on COOBER PEDY there has been much interest in the Permian on MURLOOCOPPIE and adjacent areas. The coal occurs in the upper member of the Mt. Toondina formation, as described earlier. Unfortunately in many areas conditions are not favourable, as much of the Permian has been stripped by pre-Jurassic erosion, and/or lies beneath a thickness of up to 200 m of Mesozoic rocks.

URANIUM

Although unevaluated, there is some potential for uraniferous mineralisation of the drainage system associated with the Tallaringa Palaeochannel. A small number of exposures of Mirackina Conglomerate within the Mirackina Palaeochannel (to which the Tallaringa Palaeochannel appears to be a comparable structure) were examined for radioactivity: rare

anomalous counts were recorded but were regarded as being due to detrital radioactive minerals. Any mineralisation of the largely eroded Mirackina Palaeochannel would have been removed by leaching. However, in the Tallaringa Palaeochannel only the surficial limestones are exposed, and conditions may be more favourable (c.f. the calcretes of Western Australia, e.g. Langford, 1974).

GEOLOGICAL HISTORY

The history of the Permian Arckaringa Basin is presented in detail by Townsend (1973). Deposition of (?)Devonian carbonates (the Cootanoorina Formation) occurred in fault-controlled troughs on a lower Proterozoic crystalline basement. Further faulting probably controlled the development of marginal troughs and the general configuration of the Arckaringa Basin which became established by the early Permian.

There then followed deposition of a sequence of Lower Permian sediments with units becoming progressively more widespread upwards. The sequence begins with the tillitic and conglomeratic Boorthanna Formation, followed by the fine grained marine Stuart Range Formation and finally the transitional to terrestial, coal bearing Mt. Toondina Formation.

From the mid-Permian to Upper Jurassic, the Permian sediments were eroded with significant removal of the Mt. Toondina Formation in some areas.

Deposition of the Mesozoic Great Artesian Basin sediments began with the fluviatile, Upper Jurassic Algebuckina Sandstone. Marine influence increased with the transitional Neocomian to early Aptian Cadna-owie Formation and its deltaic member, the Mt. Anna Sandstone. Deepening of the basin is

indicated by subsequent deposition of the marine Bulldog Shale (Aptina) and Oodnadatta Formation (Albian).

The deposition of the shales of these Lower Cretaceous units is punctuated by horizons of fine sands to coarse grits, the most important of which is the Coorikiana Sandstone Member, the basal unit of the Oodnadatta Formation.

The Tertiary history of the area is one of repeated phases of duricrust formation, erosion and terrestrial sedimentation. The first event of importance is the development of a deep weathering profile on peneplaned Cretaceous rocks and accompanying silcrete formation as a B_{si} horizon under arid conditions (Wopfner 1974). Jessup and Norris (1971) dispute the genetic association of the deep bleaching and silcrete formation. The age of this silcrete, the "Silcrete of the Cordillo Surface" (Wopfner, 1974) can only be established within wide limits. Field evidence shows it post-dates the Palaeocene to Eocene Eyre Formation and pre-dates the mid-Miocene Etadunna Formation.

Eyre Formation is not present on MURLOOCOPPIE and may in fact never have been deposited.

During the (?) Miocene, incision of the silcrete took place with the development of an extensive southeast flowing drainage system, the Mirackina Palaeochannel and its tributaries. Erosion of Tertiary silcrete and Cretaceous shale and sandstone provided much of the sediment which was deposited in the system as the Mirackina Conglomerate. Development of the south-flowing Tallaringa Palaeochannel may be contemporaneous in part and equivalent rocks to the Mirackina Conglomerate may have been deposited within it.

Following deposition of the Mirackina Conglomerate, ferruginisation of the base and top took place, to be followed

by a major silicification.

The pattern of late Tertiary clastic and limestone deposition clearly shows that the drainage systems, though largely defunct after this silicification, were still present in the form of shallow depressions. During the Pliocene, the land surface was exposed to erosion and soil formation characterised by "ferralitisation" (Wopfner 1974) - ferruginisation which may have taken place under warm, moist conditions. The fact that the land surface was slightly undulating resulted in minor mass movement and a somewhat thicker accumulation of the weathered debris in the local topographic depressions. Elsewhere, only a thin, in situ, ferruginious palaeosol was developed, or where the degree of local mass movement was somewhat greater, the Cretaceous shales were constantly exposed and strongly ferruginised. The resultant rock unit, which is thus both a palaeosol and sediment, is equated to the Doonbara Formation. The variations in lithology and thickness which result from the undulatory local topography can be seen on the Stuart Range today.

Probably by the late Pliocene, ponding of the drainage in these depressions had occurred and deposition of lacustrine limestones, the Mangatitja and Mt. Willoughby Limestones, took place.

The "porcellanitic" or "jasper-breccia" silicification of the Doonbara Formation and the chalcedonic or "jelly-potch" silicification of the limestones are presumed to have occurred in the late Pliocene or early to middle Pleistocene. The interrelationship of these two silcretes is unknown.

Following deposition of the limestones in the Tallaringa Palaeochannel, a mid-to-late Pleistocene reincision took place exposing the limestone as terraces. Subsequent

drier conditions resulted in the development of an (?)early Holocene red-clay, sandy soil (Qrm) and formation of the present semi-mobile longitudinal dunes of the Great Victoria Desert.

On eastern and southern MURLOCOCOPPIE, during the Pleistocene and Holocene, reworking of the Doonbara Formation supplied material for younger, typically red-brown units such as the Illeroo Pedoderm. Distribution of these units is the subject of study at present. The so called "gypsite" weathering impregnated these and pre-existing rocks and palaeosols and developed gypsum crusts in some areas. Erosion caused reworking and lowering of the gypsite crusts, and also led to the exhumation and reversal of topography with respect to the Mirackina Palaeochannel, exposing it in a sinuous chain of mesa-tops which now represent its course.

G.M. PITT
GEOLOGIST
REGIONAL SURVEYS SECTION

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APPENDIX 1

HYDROGEOLOGY OF MURLOOCOPPIE 1:250 000 SHEET

by

P.C. Smith
GEOLOGIST
Hydrogeology Section

Groundwater on the MURLOOCOPPIE 1:250 000 sheet is obtained from three distinct aquifer systems:

a. Algebuckina Sandstone/Cadna-owie Formation which underlie at varying depth most of the sheet.

b. Bulldog Shale which conformably overlies the Algebuckina Sandstone/Cadna-owie Formation and crops out over a significant area of the sheet. It is an "aquifer" in the central northern portion.

c. Quaternary - alluvial sediments associated with modern drainage lines particularly in the northeast corner of the sheet, e.g. adjacent to Lora, Evelyn, Pootnoura Creeks, etc.

Algebuckina Sandstone/Cadna-owie Formation (Jua/Klc):

This group of formations is the dominant aquifer system tapped for stock water in the mapped area. The Algebuckina Sandstone occurs in the subsurface only, whilst the Cadna-owie Formation crops out along the western side of the sheet.

Commonly, only the upper, Cadna-owie Formation is developed as an aquifer because of the relatively small yields required for stock watering.

Although this aquifer system is overlain by the Bulldog Shale for most of the sheet (a potentially good confining bed) the aquifer is generally unconfined (except near the eastern margin of the sheet). This is thought to be

caused by the paucity of recharge to the aquifer which leads to incomplete saturation of the sediments, i.e. the potentially confined aquifer is mainly at atmospheric pressure.

Water quality is extremely variable being from 1300 to 17,000 mg/l (sheep can tolerate water with salinity to 12,000 mg/l and cattle to 10,000 mg/l).

Because of the non-saturated nature of the sediments and their depth in the central and eastern portions of the sheet, water levels are as low as 125mbelow ground level. To the west where the Cadna-owie discontinuously crops out, water levels are higher, up to 20 m.

On the eastern margin of the sheet, where this aquifer becomes confined, a standing water level as high as 0.6 m has been recorded in Johnson No. 2 Bore. Just to the east, on WARRINA, Rasberry Creek Bore is a flowing well.

Recharge is thought to occur on the western margin of the mapped area via outcrop of the Cadna-owie Formation. Another potential recharge mechanism is through interconnected fractures within the Bulldog Shale from surface drainage features, creeks, clay pans, depressions, etc. (Mason, 1975b). Recharge also occurs to the east, on the western margin of the Peake and Denison Ranges through outcrop of the two formations.

Bulldog Shale (Klb):

This formation is used as an "aquifer" in the northern central region of the sheet where a relatively shallow (20 to 30 m) and extensive fracture zone is fed by local recharge from surface drainage areas. Wells such as Matheson's, Big Swamp and C.B. Bores obtain groundwater at shallow depth from this formation.

Water quality is excellent, from 100 to some 1000 mg/l,

with standing water levels between 10 and 30 m. Yields however are relatively low, generally less than 0.5 l/sec.

An interesting phenomenon associated with groundwater derived from the Bulldog Shale is the high nitrate (up to 80 mg/l) value recorded from some wells. This is almost twice the World Health Organisation upper limit of 45 mg/l for drinking purposes. The high nitrate in shallow groundwater is thought to be derived from the leaching of nitrogenous nodules associated with the roots of mulga plants - a legume.

Quaternary Alluvials (Qna):

As an unconfined aquifer, this group of sediments is only exploited in the northeast portion of the sheet.

Dominantly large diameter wells adjacent to, or within surface drainage features are used because of relative low yields and high standing water levels. Some holes are completed within the upper, weathered profile of the Bulldog Shale.

Salinity is extremely variable, between about 200 and 30,000 mg/l with standing water levels less than 10 m.

Recharge is locally derived from rainfall and from surface runoff via creeks.

UNIT NO	BORE NAME	STATION	DEPTH M	SWL M	SALINITY Mg/l	EQUIP	REMARKS.
5640000WW00001	Gordons Corner	Mable Creek	52.7	46.63	3381	Pump Jack	
5640000WW00002	Pardon	" "		33.5	3580	Sthn Cross	
5640000WW00003	Turkey's Nest	" "	74.7	59.44	3354	Windmill	
" 4	Watchercallem	" "	67.0	50.95	2675	21ft Windmill	On flat scrubby ground.
" 5	Hawks Nest	" "	73.5	60.5	3184	21ft Windmill	"
" 6	Sth Paragon	" "	38.4	23.8	140	NIL	Open Hole probably contaminated.
" 7	Karkaro I	Mt. Willoughby	481	Dry		NIL	Stratigraphic bore, Arkaringa Basin.
" 8	Memory	" "		74.5	2115	Windmill	Bore in Cloarin
" 9	Corkscrew	Mable Creek	72.5	65.23	6821	"	
5641000NW00001	Boomerang Well	Mt. Willoughby	14.3	10.97	850	NIL	Well in Ck. Bed
" 2	Boomerang Bore	" "	Shallow		935	Windmill	On Bank of Ck.
5740000WW00001	Unnamed	" "	97.23	77	2400	17ft. Windmill	
" 2	No. 2	" "	97.9	81.07	3150	21ft Sth. Cross	Mill
" 3	Ridge Bore	" "	55.8		3077	" " "	Tank sample
" 4	No. 1	" "	30.5	19.5	5100	12ft. Windmill	Near Waterhole
" 5	No. 5	" "	Non 9.8	100.6	535	Windmill	Bore to be clean end out.
" 6	Middle	" "	40	70.4	3901	Windmill	"
" 7	Unnamed	" "	63.7	56.7	4588	Windmill	Nth. of Homestead
" 8	"	Mt. Clarence	87.79	82.9	4159	NIL	East side of waterhole
" 9	Woolly	" "	89.3	83.5	3750	Windmill	"
" 10	Unnamed	" "	29.8		699	Jack Pump	West side of w/h abandoned
" 11	Yellow Bullock	" "	110	104.2	3975	Windmill	6km east of homestead
" 12	Honeymoon	" "	86	74.7	4581	Windmill and pump jack	
" 13	No. 4	" "	101.5	93.9	4488	NIL	Abandoned
" 14	Junction	" "	79		3300	17ft. Windmill &	Pump jack.
" 15	Unnamed	Mable Creek	3			NIL	Abandoned
" 16	"	" "					"
" 17	"	" "					"
" 18	Grang	" "	56.69		3400	21ft. Mill	West of Hm/stea

.../2

UNIT NO		BORE NAME	STATION	DEPTH M	SWL M	SALINITY Mg/l	EQUIP	REMARKS
"	19	West Point	" "	54.86		3000	Windmill	On east side of Ck
"	20	Russel's	Mt. Willoughoy	112	105	2600	Windmill	Pumps into a dam.
"	21	Hard Rock	" "	89.3	48.9	2826	Windmill	
"	22	Camel Flat	Mable Creek	97.4		3886		Abandoned
"	23	Broken Bit	Mt. Willoughoy	123.7	75	2494	Windmill	
"	24	Unnamed	Mable Creek	51	7			ANR Well
"	25	"	" "	76.2	61	2755		Abandoned
"	26	"	" "					Foundation Well
"	27	"	" "	18190	Dry			" "
"	28	"	" "					" "
"	29	"	" "	20.25	Dry			" "
5740000WW000	30	"	" "	17.2	"			" "
"	31	A202	" "	100	73.35	5985	NIL	ANR Well
"	32	BI	" "	94.25	66	3385	"	"
"	33	B17	" "	132.30	104.88	3657	"	"
"	34	Pflaums	" "	98.5		6320	Windmill	
"	35	Woorong	" "	60.96	54.86	5963	Windmill	
"	36	Four mile	" "	54.25	53.00	6600	Windmill & Pumpjack	South side of a ck on flat ground.
"	37	Southern Cross	Mt. Clarence	104		6450	Windmill	200m from main roa
"	38	salty	" "	65	60.35	9800	Windmill	Near long creek
"	39	Box swamp	Mable Creek	51.1		589	Windmill	Tank samples
"	40	Unnamed	" "	12.5	Dry			Foundation Well
"	41	"	" "	15.0	"			"
"	42	"	" "	15.0	"			"
"	43	"	" "	8.05	Dry			"
"	44	"	Mt. Willoughby	72.5	"		NIL	Exploration Bore
"	45	"	" "	52	51.5	1810	"	"
"	46	"	" "	44	Dry		"	"
"	47	"	Mable Creek			2030	Pump Jack	Now station homestead bore
"	48	"	Mt. Clarence					Abandoned
"	49	"	" "			2700		Water hole
"	50	B37	Mt. Willoughby	1600	145.5	2712	Not equ.	ANR Well
5741000WW0000	1	SM	Evelyn Downs	94.5	76.2	2437	Windmill	Not used
"	2	Murloocoppie	Mt. Willoughby	148.3	142.8	2112	NIL	Abandoned
"	3	Pooramingie	" "	124	117.95	2090	Windmill	
"	4	Lesley's	" "	133	127.4	1785	Windmill	
"	5	South Big Swamp	" "	82	68			"
"	6	Big Swamp Bore	" "	29.2	12.30	290	Windmill	on edge of swamp
"	7	CB	" "	35.3	25	1330	Windmill	near creek
"	8	Matheson's	" "	29.6		695	Windmill	Tank & Turkey Nest Dam

UNIT NO		BORE NAME	STATION	DEPTH M	SWL M	SALINITY Mg/l	EQUIP	REMARKS.
"	9	Southern Cross	" "		13	349	Windmill	On flat scrubby ground
"	10	Dead finish	" "	94.5				Abandoned
"	11	Bransons	Evelyn Downs	19.8	10.05	17		"
"	12	Unnamed	" "	61	Dry			"
"	13	"	" "	45.7	"			"
"	14	Ross	" "	47.5	79.5	580		On flat ground
"	15	Bridget	" "	91.4	76.2	3488		
"	16	Geoffrey	" "	67.1	61.26			
"	17	Homestead	" "	67	60.96	4810	Pump Jack	Located at shearing shed
"	18	Mt. Furner NO.1	" "	555	59.5	4222	NIL	Stratigraphic well
"	19	B57	Mt. Willoughby	50.3	42	1455	"	ANR water well
"	20	Unnamed	" "	15.3	Dry		"	ANr foundation well
"	21	"	" "	15.0	"		"	"
"	22	"	" "	15.0	"		"	"
"	23	"	" "	14.3	"		"	"
"	24	"	" "	11	"		"	"
"	25	"	" "	12.5	"		"	"
"	26	"	" "	15.0	"		"	"
"	27	B53	" "	151	135	-	Not equip.	ANR water well
5741600MW000	28	B57a	Mt. Willoughby	46	-	-	-	Abandoned non productive
"	29	B76	" "	162.5	142	1785	-	ANR water well
"	30	B90a	" "	30	-	-	-	Non productive
"	31	B88	" "	38.0	26.4	2172	-	ANR water well
"	32	Homestead No. 2	Evelyn Downs	67.1	60.96	4100	Windmill	At shearing shed
"	33	B90	Mt. Willoughby	162	-	-	-	Non productive
[illegible]0000	1	Unnamed	Mt. Clarence	105.2	100	4364	NIL	Abandoned
"	2	Sputnik	" "	108.2	103	3675		By creek
"	3	Cottonbush	" "	79	73.15	6250	Windmill	
"	4	Rockhill	" "	89.6	85.3	7117	NIL	
"	5	Elba Swamp	" "	86.2			NIL	Abandoned
"	6	Saurina	" "	74		15672	NIL	"
"	7	Unnamed	" "	40	34.13	0000	NIL	"
"	8	Stuart Range I	" "	203		19009		Abandoned E&WS well
"	9	" " 2	" "	304	11.58	3936		E&WS well
"	10	No. 2 Willow	" "	42.6	38.1	3580	"	Abandoned
"	11	No. 3 Willow	" "	48.4	39.3			"

UNIT NO		BORE NAME	STATION	DEPTH M	SWL M	SALINITY Mg/l	EQUIP	REMARKS
"	12	No. 4 Willow	" "	41.7	39.9	300	"	"
"	13	Shell Patch	" "	125		4254	"	"
"	14	Dog fence	" "	42	31	15056	"	"
"	15	Giddi Giddina	" "	86.6	82	4320	"	Near Creek
"	16	Purple Crk. No.I	" "	40				Abandoned
"	17	" " 2	" "	42.6				"
"	18	" " 3	" "	12	Dry			"
5840000W.000	19	Stuart Range 3	Mt. Clarence	622	73.2	17136		Cons well
"	20	" " 4	" "	96	74.98	15000		"
"	21	Unnamed	Mt. Barry	56	16	4000		Coal exploration Bore
"	22	"	"	59	13	4800		"
"	23	"	"	111	7.3	3516		"
"	24	"	"	116	22	2900		"
"	25	"	"	116		3800		"
"	26	"	"	100	19	5000		"
"	27	"	"	104				"
5841000W.000	1	Well No. 1	Mt. Barry	12.80	~~27x27x~~	27121	NIL	Abandoned
"	2	No .6	" "	59.3	51.82	5748		"
"	3	Muddy Hole	" "	62.4	44.2	3770	"	"
"	4	Ricky's	" "	24.7	6.04	4350	Windmill	
"	5	Michaels	" "	61.0	30.48	3540	NIL	"
"	6	Robyn's	" "	61.0	18.29	5025	Windmill	100m north of a crk
"	7	Johnson No. 2	" "	145	6	4050	Windmill	At homestead.