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EXPLANATORY NOTES FOR THE 1:500 000 COBAR REGOLITH LANDFORM MAP

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ABSTRACT

These notes are designed to accompany the Cobar 1:500 000 Regolith Landforms map, first published as a hardcopy form by CRC LEME in 1996, and subsequently revised (new polygon symbols and reference) and published in digital and hardcopy form in 1999. The Cobar region is well endowed with mineral resources, but geochemical exploration is hampered by poor bedrock outcrop in low relief, regolith dominated terrains. The map is designed to show broad regolith-landform units, giving a valuable regional overview of the main regolith types and their associated landforms. This is of use to mineral explorers in the region wishing to place their tenements within the broad regional regolith-landform context, and also giving a general outline of the major areas of bedrock or regolith dominated terrain. It also highlights areas where further regolith investigations might be carried out.

These notes include ideas on the origin of features of the regolith and landscape in the area, an expanded description of the regolith landform units shown on the map, and a bibliography of relevant published material. Appendices include a table of new and old map symbols, and an extensive compilation of synopses of published descriptions of regolith materials in the region, arranged by map areas.

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1. INTRODUCTION

The Cobar 1:500 000 Regolith Landforms map (Gibson, 1996a) was rapidly produced to give an overview of regolith materials and landforms in the Cobar region. The map covers three 1:250 000 Sheet areas, Bourke, Cobar and Nymagee. This is an area underlain by Palaeozoic bedrock of the Lachlan Fold Belt (which for the purposes of this document, includes the Early Devonian Darling Basin and later Devonian rocks of the Barka Basin - terminology of Scheibner & Basden, 1996), and has a long history of copper and gold, and more recently, silver-lead-zinc mining. Discovery of copper and gold resources is continuing in the area.

The map was produced mainly from interpretation of landform on black and white aerial photos at 1:80 000 scale, along with information derived from 1:250 000 and 1:100 000 scale geological and metallogenic maps published by the Geological Survey of New South Wales. It was found that Landsat TM imagery was not particularly useful, as most of the area has been grazed or cultivated, and divided into paddocks. Radiometric imagery was not available over the area at the time of compilation. During map preparation, a very brief field trip was made to the area, to visit the McKinnons gold mine, and examine regolith materials along several major roads. Since then, the author has made several trips to the area, and studied the area around Elura Mine, 40 km NW of Cobar, in detail (Gibson, 1998a, b).

The map was compiled at 1:250 000 and 1:100 000 scales from polygon boundaries drawn on airphoto overlays and from information on the geological and metallogenic maps, then digitally scanned and reduced to 1:500 000 scale. Company data was not used in production of the map, because of time constraints and because exploration companies have traditionally regarded regolith materials as a hindrance to prospecting, and they have generally been poorly described in company reports. The scale of the map and lack of data in many areas has forced numerous generalisations. However, this is an overview map, intended to give a broad picture of the region, rather than showing all nuances of regolith origin and distribution. Thus the generalisations are considered valid at the map scale.

Twenty-one regolith units are shown on the map. Early hard copies of the map use a numerical polygon identification system. However, a system of polygon identification symbols based on AGSO's RTMAP system (Pain et al., 1991) was developed in 1997, and detailed polygon information entered into the RT MAP database in 1998 in preparation for release of a digital version of the map. Later hardcopy versions of the map show the new symbols. Both sets of symbols are given in the extended polygon descriptions in section 3 below.

These notes include ideas on the origin of features of the regolith and landscape in the area, an expanded description of the regolith landform units shown on the map, a bibliography of relevant published material, and appendices with synopses of published descriptions of regolith materials (arranged by map areas) and the oxidised zones of orebodies.

2. NATURE AND ORIGIN OF REGOLITH AND LANDSCAPE IN THE COBAR REGION

2.1 Regolith in the Cobar region

There is a great variety of regolith in the region, dependent on underlying bedrock type, landscape position, weathering, and depositional history. Most fine grained sedimentary rocks of the Early Devonian Darling Basin (terminology of Scheibner & Basden, 1996) have been deeply weathered to depths locally in excess of 100 m. These weathered rocks (bleached and in places mottled) mostly form erosional plains and rises. Ordovician Girilambone Group low grade metasediments have been less weathered and to shallow depth, reflecting their more siliceous nature. These also mostly form erosional plains and rises. Granites in the north of the region have been mostly intensely weathered to great depths, but in the south, are variably weathered and commonly form rises and hills. Sedimentary rocks of the Mulga Downs Group (Barka Basin of Scheibner & Basden, 1996) are mostly unweathered or slightly weathered and generally form steep hills. Sediments of the Eromanga Basin in the north of the area crop out poorly, and are probably mostly deeply weathered.

The bedrock is covered by a variety of transported and precipitated regolith components. There are three major types of alluvial deposits in the region. Topographically inverted gravel deposits may be as old as Mesozoic, and are widespread. Alluvium dating back to at least the Miocene fills a system of palaeo-valleys eroded to a maximum of 140 m below present day ground surface along the Darling River, and tributaries to the Darling and Lachlan Rivers. Modern alluvium associated with present day drainage partly overlies these deposits, and extends further upstream. Aeolian sand is present in dunefields predominantly in the northwest of the area, and loamy soils and clay of uncertain origin are present in a zone south of the Darling River. Lacustrine deposits floor claypans, mostly in the north of the region, fringed to the east by aeolian sand and clay in lunettes.

Much of the region has low relief, and is covered by a thin mobile zone of soil and lag over bedrock. This veneer probably has a mixed aeolian and bedrock source, and has been moved by soil creep, sheetwash, and bioturbation. The soils in the northern part of the area are almost entirely red, but grade to brown and grey in the south. The lag includes angular fragments of bedrock (variously ferruginised) and vein quartz, rounded maghemite-bearing pisoliths, silcrete fragments (in part ferruginous, and mostly formed in alluvial sediments), and locally, reworked rounded clasts from old inverted alluvial deposits. Higher relief areas have colluvial mantles that have been transported by gravity and sheetwash.

Precipitated and cemented regolith includes silcrete, regolith carbonates and ferruginous materials. Silcrete has mostly formed in alluvial deposits, but locally occurs in saprolite. Siliceous hardpans are locally present in alluvium. Regolith carbonate has formed as a skin at the saprolite/mobile zone interface, as veins within saprolite, and as zones of carbonate impregnation within the mobile zone and alluvium. Some of the carbonate has a high dolomite content (K. McQueen, University of Canberra & CRC LEME, pers. comm. 1998). Magnesite is also locally present (see Appendix II). *In situ* ferruginous materials include iron-impregnated saprolite ('ironstone'), and oolitic ferricrete.

2.2 The Cobar landscape and its origin

Geological mapping and mineral exploration in the Cobar region is hampered by poor outcrop. Over much of the region, this is generally due to a thin veneer of mobile zone rather than thick cover, combined with generally low relief. For example, the discovery of the McKinnons gold mine south of Cobar was from a single geochemical sample taken from an insignificant outcrop only just exposed on a regolith-dominated plain (Bywater et al., 1996). In addition, much of the mapping of the Palaeozoic

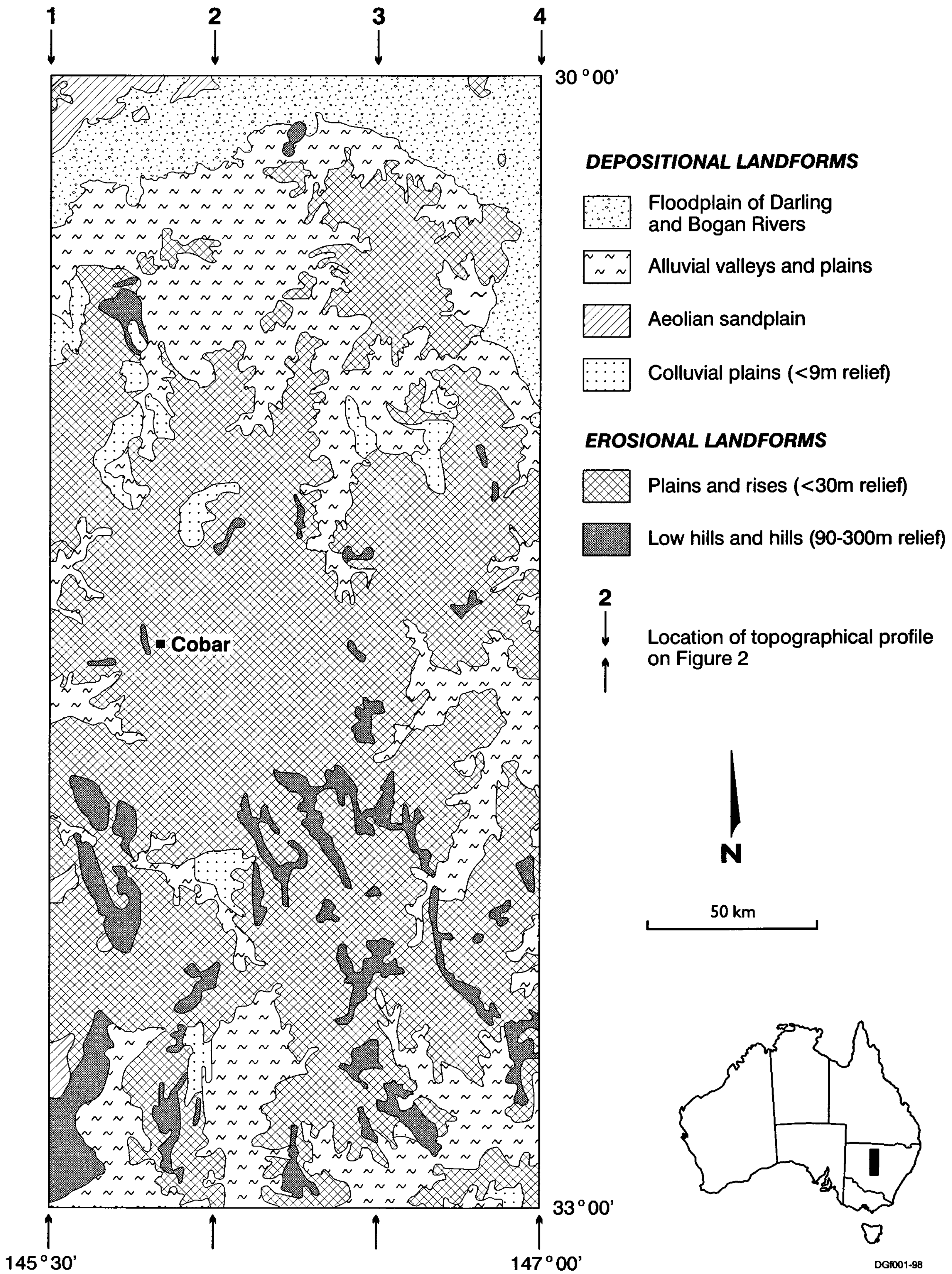


Figure 1. Landforms of the Cobar region.

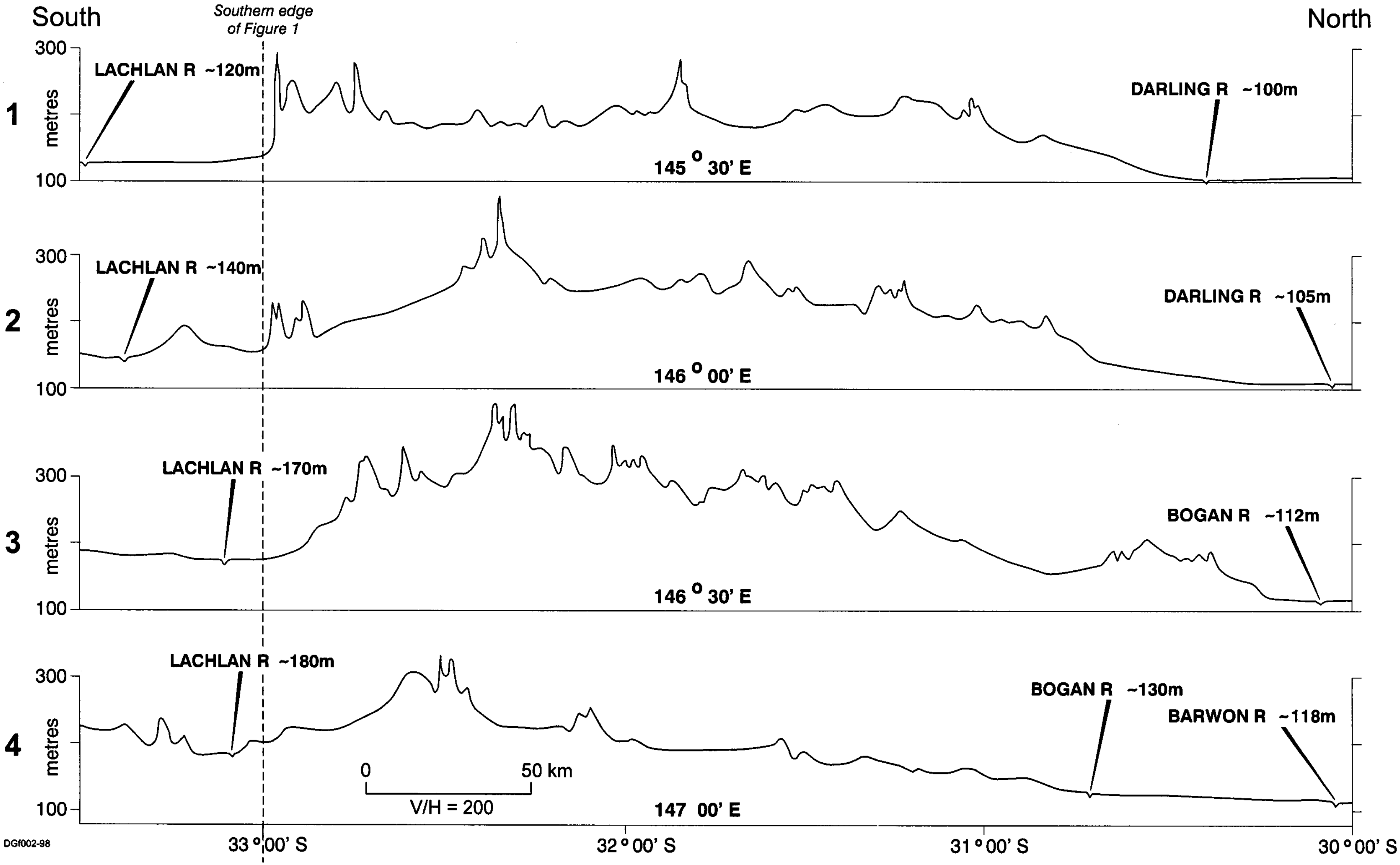


Figure 2. North to South topographic profiles from Darling to Lachlan Rivers. Location of profiles shown on Figure 1. Horizontal scale as for Figure 1.

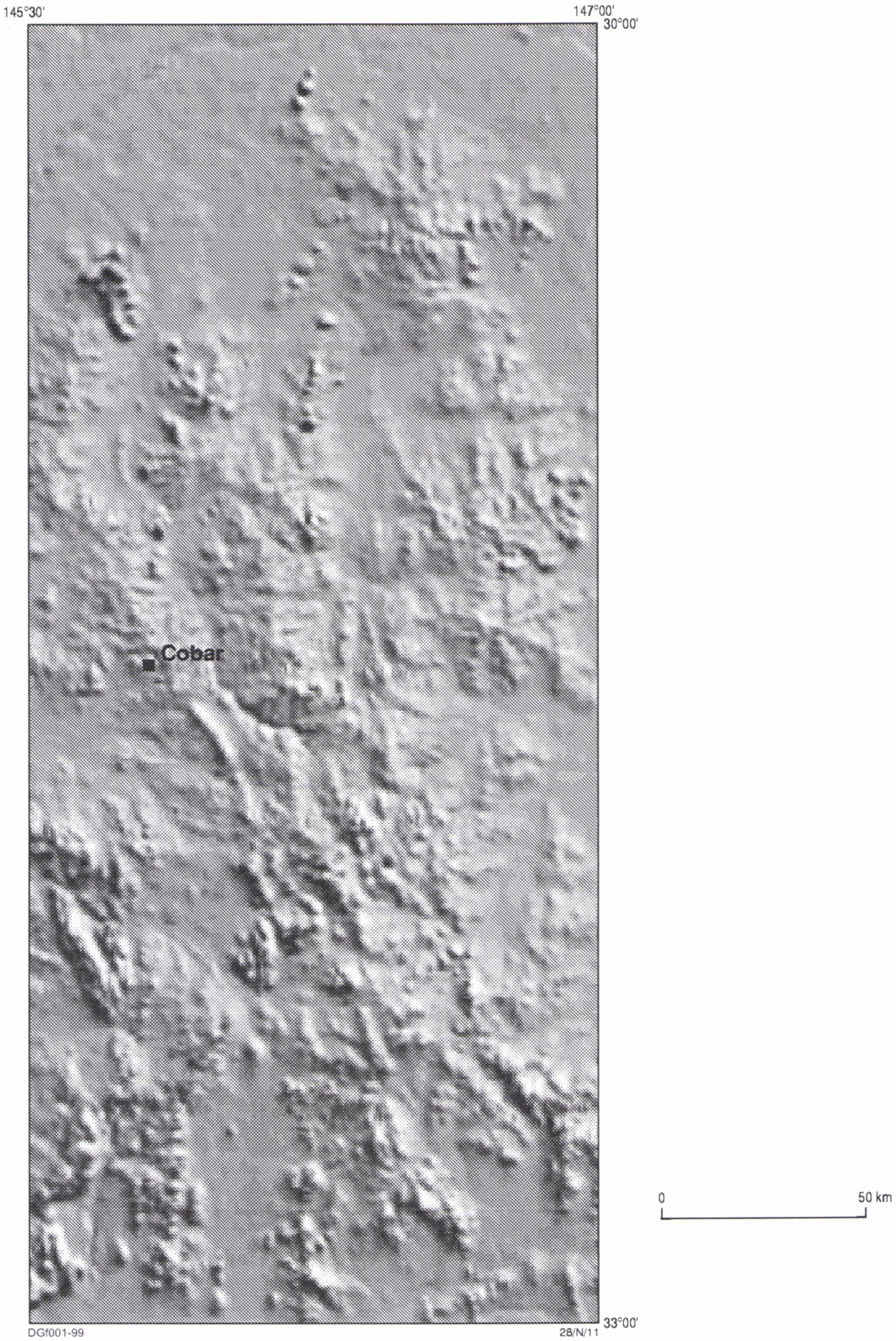


Figure 3. Digital elevation model of the Cobar region. Relief has been exaggerated to contrast erosional and depositional areas.

bedrock units by the Geological Survey of NSW has been dependent on the recognition of lithologies from rock fragments in surface lag rather than outcrop.

The Cobar region generally has low relief (Figures 1, 2, 3) and is semi-arid, with an average rainfall of about 400 mm. Red earth soils are typical of much of the area, and probably represent the influence of aeolian dust derived from areas to the west, which has mixed with bedrock-derived material, and has been reworked into colluvial and alluvial material. Watercourses are ephemeral, with flash flooding after rare periods of heavy rain. They are generally of low relief with poorly-defined channels, and an alluvial fill of red loamy detritus.

Although the region is mostly of low relief, there are more rugged areas. Low hills and hills (30-300 m relief) of resistant lithologies stand steeply from the lower relief areas. The general local base level rises to the south from the Darling River at a slope of about 50 m per 100 km (1:2000) to the low relief drainage divide between Lachlan River drainage in the south of the map area, and watercourses draining to the Darling River in the north and to sandplains on the Murray Basin in the west. The landsurface then falls to the south at a steeper slope (about 1:500) to the Lachlan River, just to the south of the map area (Figures 2, 3). The general relief of the landsurface, reflected by the distribution of low hills and hills (relief 30-300 m) on the map (units SSel1 & 2, or units 7 & 11 on earlier paper copies of the map), increases as this divide is approached from the north.

Various arguments have been put forward as to whether the low relief surface is a peneplain or pediplain (see for example Dury & Langford Smith, 1964). Such arguments are of dubious value, as these conceptual terms are from theoretical considerations based on observations outside Australia. It is more important to describe the area as it is, without the constraints of theoretical models.

Cretaceous rocks of the Eromanga Basin are present north of the Darling River. The general landsurface over the map area is interpreted to be a modified Cretaceous landsurface, exhumed by removal of Cretaceous rocks in the north, but probably never covered by anything more than thin regolith cover since the late Palaeozoic for much of the area (McQueen & Gibson, 1996). This landsurface has been eroded by post-Cretaceous drainage. The Darling River in the north, which is roughly at the level of the Cretaceous surface, the floodplain of the Bogan River to the east, and plains on the Murray Basin to the west, provide modern base levels to which north-, east- and west-flowing, streams have graded. Hence, much of the landsurface has not been substantially eroded in the north and central parts of the map area. Further south, it is interpreted that more material has been removed.

Here the catchment of the west-flowing Lachlan River, just to the south of the map area, has incised the Cretaceous landsurface.

Information from the Barnato 1:250 000 sheet area indicates that the gross landscape elements of the area 60 km west of Cobar were already in place by the Early Cretaceous. Here, Rayner (1969) described Early Cretaceous sediments (dated by forams) exposed in road cuttings. What is important to landscape history of the region is that although these sediments have been topographically inverted on a local scale, they occur at about 230m elevation, close to hills of Devonian Mulga Downs Group rocks with peaks up to 320 m. If there have been no post-Early Cretaceous differential movements, and there is no evidence for this, the modern peaks must be eroded remnants of more rugged Cretaceous landforms, and the local relief in the Cretaceous prior to deposition of the sediments must have been at least 90 m. Modern drainage in the area is at about 200 m, indicating that there has only been about 30 m of net incision since the Early Cretaceous, and that there has probably been little change to the landscape since that time. By extension of this concept to the east, the Cobar landscape is probably very old, at least in the western part of the map area, and the areas of higher relief may have been preserved from at least Cretaceous times. A corollary of this conclusion is that net erosion rates in the area must be very low.

Old inverted alluvial gravels are present as hill cappings at about 240 m elevation, in the northwest of the Cobar 1:250 000 sheet area. These contain boulder conglomerates, and Gibson (1998a) and Gibson & Chan (1998) have argued that they are probably of Early Cretaceous age. Local major watercourses in this area are now at about 190m, indicating about 50 m of net incision since the Early Cretaceous, a rate of 0.5m/Myr.

Low net incision rates have also been demonstrated in areas to the east of the map area. 20 km west of Parkes (ie about 80 km east of the southeastern corner of the map area), a probable Jurassic inverted palaeochannel is present at 300 m elevation (Krynen et al., 1990; Gibson & Chan, 1998), with local drainage now at about 260 m. This indicates a probable net incision of 40 m since the Jurassic.

In conclusion, the present day landforms and regolith distribution of the Cobar area result from deep weathering and erosion of a palaeoplain sloping gently to the north. Deep weathering has affected all the area for much of the time since withdrawal of the Cretaceous sea. Relatively high local base levels and low slopes have resulted in only minor removal of weathered material in the north, but increased amounts of erosion have occurred to the south, especially where incision of the Lachlan River has provided locally lower base levels. The aeolian/colluvial/residual regolith that occurs over most of the area is a result of deep weathering, low relief, tectonic stability, aridity, and inefficient removal of surficial materials.

2.3 Drainage and incised palaeochannels

Mount (1992) has shown that up to 130 m of Cainozoic sediment occurs along the Darling River, downstream of Bourke. He attributes the thickness of sediment in this area to Cainozoic structural movements, a graben-like feature resulting from postulated dextral strike-slip movement along a bedrock structures extending along the Darling River Lineament.

The sediment dates back to at least Early Miocene (microfossil determination of one sample by Martin, in Mount, 1992). Martin (1990) shows that all the major rivers of the Murray-Darling River system flow over now-aggraded, mostly steep-sided palaeovalleys, with the age of the valley fill sediments ranging from Late Eocene to Holocene, mostly Late Miocene and younger. This has led Gibson & Chan (1998) argue that the thickness of sediment beneath the Darling River downstream of Bourke represents the fill of an ancient incised valley rather than sediment in a subsiding graben.

The author considers that some streams tributary to the Darling managed to incise their courses as a result of past low base levels in the Darling valley. For example, a buried palaeovalley is present beneath Yanda Creek (Ford, 1996). Ford, however, attributes the incision of the palaeovalley to Late Pliocene uplift. The valley fill sediments contain detrital maghemite pisoliths, thus the palaeovalley is evident on magnetic images of the area as a narrow zone of high frequency anomalies. The modern Yanda Creek does not necessarily flow directly above the palaeovalley, and has a broader, less intense associated magnetic anomaly, due to thin sheets of maghemite-bearing sediments in broad zones of modern alluvium.

However, incision resulting from lowered base levels does not necessarily mean that all the Cobar area would be affected by increased erosion. Gorge formation would proceed along drainage lines by headward erosion (retreat of nickpoints in stream gradients), but patterns of erosion would remain unaffected in adjoining areas above knickpoints. Nott et al. (1996) have shown that gorge extension can occur at a far greater rate than escarpment retreat, summit lowering, and interfluve consumption. However, gorge formation (and thus increased landscape relief) may have lowered the watertable in the area. These may have been raised again when the gorges were filled, lifting local base level and cutting off potential groundwater discharge zones. However, drying of climate in the late Tertiary (e.g. Martin, 1991) may have resulted in the preservation of deep water table levels.

The buried palaeochannel in the Yanda Creek catchment north of Cobar, described by Ford (1996), contains up to 60 m of sediment. Sandy clay and gravels make up most of the sediment fill. Outcropping sediment thought to be part of the palaeodrainage fill is present in two gravel pits north of Cobar. The first, 11 km from Cobar on the Bourke road (grid reference 55J 392903 6525176), has about 2 m of poorly cemented conglomerate overlying weathered Palaeozoic rocks. The conglomerate contains detrital maghemite pisoliths, and quartz and rock fragment pebbles to 7 cm in a grey clay matrix. The second pit, 4 km along the Coolabah road near Cobb & Co. Tank (grid reference 55J 398787 6549619), is excavated entirely in conglomerate with a clay matrix, and clayey sandstone. The conglomerate clasts are mainly detrital maghemite pisoliths, and the clay is grey coloured. Weathering is evidenced by yellow and orange mottles.

These sediments are quite different from older topographically inverted sediments, in that they contain detrital maghemite, and have a grey clayey matrix. Although both localities are presently being eroded, they are low in the landscape, contrasting with the position of the older sediments, high in the landscape.

In the south of the map area, broad alluvial areas are underlain by thick valley fill sediments. Little information is available on these, but several water bores have intersected up to about 100 m of sediment (Schiebner, 1987). These sediments have also been mined for tin at Tallebung (Suppel & Gilligan, 1993), where excavation and exploratory drilling indicate palaeo-stream gradients of 30 m/km, far steeper than today. These palaeo-valley floors appear to be graded to the incised level of the Lachlan River, but instead of narrow gorges, broad valleys have been eroded, possibly in response to weathered and easily eroded bedrock.

The main period of alluviation in the Lachlan and Darling River systems is from Late Miocene to Recent (Martin, 1990), and it is probable that the palaeochannels in the Cobar area also filled over this time range in response to rising base levels. The presence of maghemite in the palaeochannel sediments indicates that generation of maghemite may have commenced in the Miocene/Pliocene. The maghemite pisoliths may in fact be 'fossil', having been generated under climatic conditions different from those of today. This is important, because it means that maghemite pisoliths, a potential geochemical sampling medium, may have been present in the near-surface environment for considerable time, allowing for transport over considerable distances.

2.4 Weathering and silcrete formation

The present climate is very different from climates earlier in the Cainozoic, so any attempt to explain regolith features in terms of present climate is pointless. It is postulated that the area has been undergoing deep weathering under a wet tropical climate for much of the Late Cretaceous and

Cainozoic (see Byrnes, 1993; Langford & others, 1995). Preservation of deep weathering profiles in the region has been accentuated by low rates of erosion

The hills of slightly weathered resistant lithologies are zones where weathering has not proceeded to any great depth, leaving the hills as residuals while softer weathered material has been eroded from around them. Some of the gold and copper mineralisation around Cobar was accompanied by silicification of the surrounding rock making it resistant to the deep weathering. The resistant areas now occur as hills.

Previous authors have recognised that the residual hills in the area have been present for some time. Dury (1966) pointed out that in at least some of the map area, silcrete is preserved not on the peaks, but near their bases, not far above present day local base level. The conclusion he draws, that the peaks were present at the time of silicification but were themselves only superficially silicified or unaffected, seems valid. However, Dury was more interested in the weathering profiles commonly associated with the silcrete, and where the mythical 'silcrete/ferricrete' line occurred. He did not seem to appreciate that the silcrete need not be genetically associated with weathering profiles, and can be superimposed on a pre-existing weathering profile which has been partially or even completely stripped. Nor did he appreciate that silcrete in the area is commonly formed in transported sediment, and it is possible that the distribution of silcrete relates to palaeogeography rather than weathering.

Silcrete in the area is viewed by the author as forming in localised areas at different times during the Cainozoic as a response to local groundwater and chemical conditions. It has formed mostly in host material of alluvial sediment, but also saprolite in certain areas. Using silcrete to reconstruct old 'surfaces' or for correlation is not considered a valid exercise. However, the sediments that have been cemented may possibly be correlated.

2.5 Landscape evolution model

A simple model for landscape evolution, based on models for eastern Australia presented by Ollier & Pain (1994), Chan (1998) and Gibson & Chan (1998) is as follows:

- A north-sloping surface with substantial local relief in some areas (controlled by bedrock type), but mostly of low relief was present prior to deposition of the Eromanga Basin in the Mesozoic. The origin of this landsurface is not known. Evidence for sea ice, and palaeo-pole positions (Frakes & Francis, 1988; Frakes et al., 1992; Frakes et al., 1995) indicate that winter freezing of rivers may have occurred in the Late Jurassic to Early Cretaceous.

- Deposition of Mesozoic sediments occurred along rivers draining north to the 'Eromanga Sea' in at least the northern part of the region. Sediment was introduced to the region from catchment areas to the south, as well as locally derived from local hills.

- The Lachlan and Darling Rivers were established in response to uplift of the eastern highlands at about 95 Ma prior to continental rifting and subsequent Tasman Sea continental extension in the Late Cretaceous.

- Erosion of the Lachlan valley into the Mesozoic surface occurred in the south, and in the north there was erosion of Eromanga Basin sediments in the vicinity of the Darling River and exhumation of the Mesozoic surface (Early Tertiary).

- Low base levels in the subsiding Murray Basin in the Early Tertiary lead to incision of the Lachlan and Darling Rivers into their valleys, and local dissection of the landscape in response to the local low base levels in the Lachlan and Darling valleys. There was continued slow erosion of the Mesozoic surface north of the Lachlan /Darling divide away from dissected areas, and more rapid erosion of the steeper landscape in the Lachlan catchment.

- Drying of the climate, vegetation change, and raised base levels due to sedimentation in the no longer subsiding Murray Basin in the Late Tertiary, resulted in infilling of the landscape to pre-incision levels. Aeolian sand and dust were deposited. Low slopes in the north ensured slow erosion and preservation of weathered profiles, but erosion rates were faster in the south where slopes are steeper.

3. NOTES ON THE REGOLITH LANDFORM UNITS ON THE COBAR 1:500 000 REGOLITH LANDFORMS MAP

These notes are arranged roughly in the order of presentation on the hardcopy versions of the map. All units have two associated symbols. A simple numerical polygon identification system was used on the original paper copy of the map, but a combination of upper and lower case letters and a numeral has been used on the digital form and revised paper copies. In the compound symbols, the upper case letters identify the most important type of regolith present within the unit, the lower case letters correspond to the landform present, and the digit distinguishes between areas with similar gross regolith and landform features, but different detail. The following letters have been used:

Regolith components

A alluvium

I aeolian sediments (undifferentiated grain size)

IS aeolian sand

L lacustrine sediments

C colluvium (undifferentiated), mostly talus deposits

CH colluvium (sheet flow deposits)

R residual deposits

S saprolite (undifferentiated degree of weathering). Note that saprolite is used as a general term for rock weathered to any degree

SS saprolite (with slight degree of weathering)

Landforms

af flood plain

ap alluvial plain

ul longitudinal dunefield

u lunette

pp playa plain

pd depositional plain (undifferentiated)

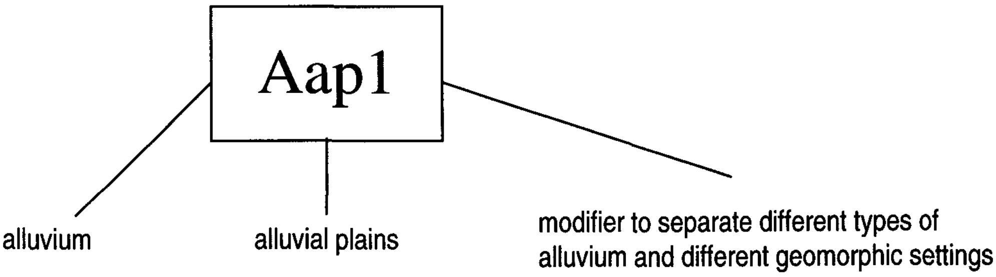
fc colluvial fan

ep erosional plain (0-9 m relief)

er erosional rises (9-30 m relief)

el erosional low hills (30-90 m relief).

These letter symbols have been combined as shown below.



A general division has been made into units dominated by transported and *in situ* regolith. These divisions also approximate to depositional and erosional landscape regimes, although some depositional regolith is now being eroded. Units classified as having transported regolith will most probably have *in situ* regolith at depth, and those classified as *in situ* will have a surface veneer of transported to residual regolith. At the scale of the map, residual regolith is regarded as being *in situ*.

3.1 Units dominated by transported regolith

Alluvial Sediments

Aaf1; 1 This unit comprises the lower-lying parts of the floodplain of the Darling/Bogan River System. It is dominated by overbank flood deposits of grey, pink and black clayey silt and mud, with minor loamy sand. Byrnes (1993) states that the floodplain deposits are about 10 m thick in the vicinity of Bourke and that the colour of the sediment is mostly grey, and becomes paler with depth. Using several sources, he concludes that the Darling/Bogan system is far less active now than it has been in the past. Mount (1992) states that grey silty clay of the modern Darling floodplain is approximately 7 to 10 m thick, and has in places been cut through by river erosion; the clays are probably equivalent to the Shepparton Formation of the Murray Basin (see Brown & Stephenson, 1991). Walker (1991) has divided this unit into several landsystems. Most of the alluvium in the floodplain has been brought into the area from upstream catchment areas outside the map area.

Mount (1992) describes alluvium dating back to at least the Early Miocene, up to 140 m thick beneath part of the Darling floodplain. Gamma log signatures indicate stacked channel and crevasse splay deposits, intercalated with abandonment-fill muds and floodplain clays. Mount attributes this thick alluvial sequence to downwarping and transtensional extension along a complex series of intersecting fractures he recognised from analysis of Landsat data. He also suggests that the proto Darling River may have incised a narrow gorges between structural depocentres, indicating regional base levels below present day river level at some time in the Late Tertiary. The implication of this interpretation is that the actual level of the Darling River was never as deep as the present-day level of the base of the sediments, these being structurally depressed.

Gibson & Chan (1998) conclude that the rivers of the Murray-Darling River system and many of their major tributaries eroded an integrated system of gorges up to 140 m deep mostly in the Early Tertiary, and that these were filled with alluvial sediment, commencing in the Late Eocene in areas proximal to the Murray basin, but at later times upstream. Under this scenario the palaeo-Darling River eroded to about 140 m below the present day landsurface without the need for structural downwarping.

Aaf2; 23 Older riverine alluvium of the Darling and Bogan Rivers makes up this unit. Byrnes (1993) describes the area as consisting of sandy alluvial tracts with infilled meander channels which have different wavelength and amplitude to those of present day drainage. Walker (1991) has describes this unit as a single landsystem. He states that it is slightly elevated with respect to the remainder of the floodplain, and that the topsoils of the texture contrast soils, which are dominant in the unit have been extensively eroded.

The thick sequence of alluvium described above may partly underlie this unit.

Aaf3; 6 This unit comprises narrow floodplains of active major stream channels flowing northwest and north to the Darling River. Bedload consists of sand and gravel, with overbank deposits of finer sediments. This unit was mapped separately from the Darling River floodplain because of the sandy bedload, and from other watercourses in the area because of the presence of active channels, which are strongly meandering in part. Walker (1991) states that the channels are stable, and about 20 m wide and 3 m deep. Soils are mainly red earths with a hardpan.

Aap1; 17 This unit covers alluvium of minor watercourses and valley plains. Most of the drainage lines in the area have an alluvial fill that is probably in part reworked aeolian dust. Relief across most of the drainage lines is very low, and in many cases there is no definite channel. The alluvium reaches a considerable thickness, up to 100 m in broad areas of alluvium in the south of the map area (see bore logs from the Mount Allen 1:100 000 sheet in Appendix II). Detailed drilling and geophysics around the Tallebung alluvial tin field in the southeast of the map area show that palaeo-stream gradients on the now-buried topography beneath the alluvium were as high as 30 m per km (Suppel & Gilligan, 1993). Alluvium may also be quite thick in the central part of the map area (eg 60 m in a palaeochannel in the Yanda Creek area north of Cobar; Ford, 1996). However, presence of bleached saprolitic clay in spoil from farm tanks over much of the area away from the major rivers indicates that despite the low relief of valley floors, alluvium is only a few metres thick. Detrital maghemite pisoliths are commonly present in the alluvium, especially over the Darling Basin area. Thus the alluvium may show short wavelength anomalies on magnetometer surveys (Gidley, 1980; Ford, 1996).

Aap2; 16 Broad slightly undulating sand plains with local relief of up to 3 m are present in the northwest of the map area, south of the Darling River, at an elevation of 100-150 m. Walker (1991) describes the surface regolith as alluvium, but the author has observed few signs of channels, normally associated with alluvial deposition, on airphotos. There are numerous rounded depressions, giving rise to an airphoto texture described as 'rice-bubble texture' by Mount (1992). Mount states that the top 0.5-1 m of sediment is 'red-orange part sandy clay soil', with sparse sand drifts, to several metres thick, scattered across the area. Beneath this is a 2-3 m thick layer of pale green to light grey plastic clay of either lacustrine or floodplain origin. Beneath this, deep farm dams have intersected a layer of grey clay containing concretionary gypsum (selenite) nodules to 10 cm diameter. Byrnes (1993) describes the area as having deep red loamy soils with abundant small internal drainage areas and vegetated hummocks. There are no traces of longitudinal dunes on this sandplain, but Walker (1991) reports numerous lunettes on the eastern side of depressions.

Probable Cainozoic sediments have been intersected by bores in the area beneath the sediments described above; 'sand drift' from 21.3 to 61 m in bore # 4638, reported by Mount (1992), is the thickest known occurrence.

Aap3; 20 This unit comprises areas of valley floor sediments in the central west of the map area, which the author photo-interpreted to be alluvial sediments partly reworked by wind, on the basis of arcuate vegetation zones. Walker (1991) shows the area to be alluvium with calcareous red earth and texture contrast soils, without aeolian reworking, and it is possible that the photointerpretation of reworking is incorrect.

Eroded Alluvial Sediments

Aer1; 15 Outcrops of poorly consolidated fluvial sediments have been described by previous workers from many parts of the map area. These have generally been assigned a Tertiary age, and most are topographically inverted, forming cappings to erosional rises. Many of the occurrences are capped by silcreted or partly silicified zones developed in the sediment; this hardening has enhanced their preservation. Virtually all of the occurrences shown on the map are taken from published 1:100 000 and 1:250 000 geological and metallogenic maps. However, it should be noted that since compilation of the map, it has been found that there are deposits that have not been previously mapped, and are thus not shown, for example exposed in a gravel pit on the Nymagee road 14 km south of Canbelego. In addition, some of the previously mapped deposits are mis-identified or misleading. A deposit 40 km south of Cobar has been examined by the author since publication of the map, and found to comprise steeply-dipping poorly-bedded conglomerate which is most probably Devonian; deposits shown in the far northwest of the Cobar 1:100 000 geological sheet (Glen, 1994), mapped as part of unit Ser5 (14) are in fact thin reworked gravel lag deposits derived from in situ bodies of partly silcreted fluvial or fluvio/glacial gravels outcropping in the vicinity of Tyncin Trig, mapped as silcrete by Glen.

At Coolibah on the Mitchell Highway, sandstone and conglomerate are exposed in old railway cuttings, and in a gravel pit north of the village. There are also excellent exposures of white, cross-bedded, poorly consolidated clayey sandstone and conglomerate in gullies on the north face of Belah Hill, just west of the map area on the Barrier Highway. Here, the author has measured a thickness of 18 m of fluvial sediment unconformably overlying steeply dipping bleached Devonian siltstone. Pebbles in conglomerates in the sediment are well rounded, and include a variety of resistant lithologies, as well as clasts of Devonian saprolite. Further west, sediments which include sandstone with matrix supported boulders to 1 m are well exposed in cuttings on the old alignment of the Barrier Highway. These have been dated by forams as Early Cretaceous (Ludbrook, in Rayner, 1969). Although only one outcrop of this material has been recorded on the Barnato 1:250 000 geological map, work by M. Spry (University of Canberra) indicates that many of the surrounding mapped silcrete bodies have formed in similar sediments. Boulder conglomerates are also present west of Tyncin Trig in the far northwest of the Cobar 1:250 000 Sheet area. The largest area of probable Tertiary sediment in the map area is in the southwest, west of ranges of Mulga Downs Group.

Some of the mapped occurrences, and occurrences of silcrete, which more often than not forms in transported material rather than bedrock, are in near-linear strings, probably indicating the location of a former stream channel.

In places, rounded pebbles and quartz granules are present as part of the lag on the surface of units Ser2 (10), Ser3 (19) and Ser4 (22), for example in the McKinnons Mine area 25 km south of Cobar, and the area northwest of Elura mine. These are probably lag clasts from old inverted fluvial deposits, the *in situ* bodies of which have now been completely eroded.

Aer2; 13 Silcrete deposits as shown on published geological and metallogenic maps make up this unit. The 1:100 000 geological and 1:250 000 metallogenic sheets produced by the NSW Geological Survey show the distribution of most of the known silcrete occurrences in the area. However, Baker (1978) shows further occurrences in a crude map illustration; because this is a sketch map at small scale, no attempt has been made to show these further occurrences on the regolith landforms map. The occurrences shown on the map include silcrete in the strict sense (a very hard rock with microcrystalline quartz cement filling all void spaces, not easily broken with a hammer), and also porous partly silicified rock. It is not known whether the latter represents partially cemented material, or silcrete which has been degraded by removal of part of the cement.

Fieldwork carried out since compilation of the map shows that some of the mapped occurrences of silcrete are in fact areas with lag of silcrete clasts overlying soil on weathered bedrock, rather than in situ silcrete bodies (Gibson, 1998a).

Some of the silcrete bodies, eg. near Mount Oxley (about 30 km ESE of Bourke), exposures described by Dury (1966) near Mt Buckambool (about 50 km SSW of Cobar), Mt Boppy (about 45 km east of Cobar on the Barrier Highway), and silcreted talus at the foot of Mt Gunderbooka (about 55 km SSW of Bourke; Mount, 1991), occur at low elevations close to high peaks which apparently show no sign of silcreted material. The most reasonable explanation is that the silcrete formed in areas low in the landscape, which has been little modified since that time.

Glen & Hutton (1983) provide details of several silcrete samples from the area, including chemistry. Wasson & others (1979) argue that some of the rocks described as silcrete by Dury (1966) are in fact siliceous bedrock that has not acquired any silica since Palaeozoic deformation.

It appears that most of the bodies shown as silcrete on the map have formed in transported sediment, rather than weathered bedrock. Hence, any attempt to relate silcrete to the underlying rock type, (eg Glen & Hutton, 1983), is considered spurious. In addition, the concept embraced by many previous authors, that silcrete relates to a discrete weathering or duricrusting event, and can be used as a datum, is considered by the author to be in error.

Since publication of the map, Ford (1996) has described silcretes in buried alluvial deposits that appear distinctly younger than the silcreted sediments shown on the map. The authors consider that silcrete has formed as a result of local groundwater conditions at varying times rather than as a result of widespread weathering or planation events.

Aeolian Sediments

ISul1; 5 This is an aeolian sand plain, characterised by longitudinal dunes of reddish sand and silt. Wasson & others (1988) class these as narrow crested linear dunes, and also show the presence of irregular dunes in this area. The dunes are currently being degraded by action of wind and water, and in places grade into small areas of low relief sandplain. Local relief is about 4 m. Low mounds of aeolian sand are apparently being buried by alluvium, leaving 'islands' of sand on the Darling River floodplain in the Bourke area.

Iul1; 3 This unit comprises lunettes of sand, aeolian dust and gypsum bordering the eastern margins of claypans. The lunette associated with the claypan in the far southeast of the map occurs its southeast margin, indicating deposition by winds from a direction more to the northwest than is normal for lunettes in the north of the map. Many lunettes adjacent to small claypans present in unit Aap2 (16) have not been shown on the map.

Lacustrine Sediments

Lpp1; 2 Lacustrine clay and silt in claypans and swamps makes up this unit. Only the larger claypans are shown on the map. Numerous small unmapped claypans are present in unit Aap2 (16), and several large basins adjacent to the Darling River floodplain have been shown as part of the floodplain rather than part of this unit. One of the claypans in the far northwest of the map is largely infilled with gypsum, and is bordered by a gypsum bearing lunette. More than 277 000 t of gypsum has been mined at this locality (Byrnes, 1993).

Colluvial Sediments

Cfc1; 8. This unit comprises talus slopes, mostly abutting unit SSel1 (7). Colluvium of sand and gravel has been derived from steep outcrops of Devonian rocks. Both mass movement and sheet flow sediments are probably present. Red earth soils generally occur in this material. The underlying bedrock is probably only slightly weathered.

CHpd1; 12 This unit comprises gently sloping plains low in the landscape, with little organised drainage and low slopes. The unit was described as erosional plains with thick colluvium on earlier paper copies of the map, but information from Walker (1991) indicates that it is better classed as colluvial plains. Walker indicates that bedrock may be present at about 6 m depth in the north of the area. Degree of weathering of the bedrock is not known. The colluvium most probably comprises sheet flow deposits derived from higher relief areas upslope; alluvium may also be present.

3.2 Units dominated by *in situ* regolith

Residual

Rer1; 21 The various geological and metallogenic maps of the area show numerous small areas of 'laterite', 'ferricrete' and 'ironstone', which have been combined to form this unit. It is probable that many of the areas shown on the map are in fact only areas with gravel lags of ferruginised rock fragments, derived from erosion of iron rich mottles or ferruginised zones in bedrock. A possible chemically precipitated oolitic ferricrete is present near Buckeroo woolshed (Byrnes, 1993). Maghemite pisoliths are present as a lag component across some of the area, especially the Darling Basin, but these areas have not been differentiated on the published maps, and are not shown on the Cobar regolith landforms map.

Weathered Bedrock

Sep1; 4 This unit comprises low, rounded erosional areas underlain by rocks of the Eromanga Basin at an elevation of 105 to 115 m, present in the northwest of the map area. Local relief is about 5 m. Byrnes (1993) describes the Cretaceous rocks as being weathered mudstones, but the degree of weathering is not stated. Walker (1991) states that 'silicified sandstone and conglomerate (mainly as talus material)' obscures the Cretaceous. He also mentions 'isolated Tertiary sediments'. The author has not examined this unit in the field, so the exact nature of the silicified and 'Tertiary' material is not known. Transported regolith probably forms a veneer over most of this unit, probably consisting of sheetwash colluvium, lag, areas of aeolian sand, alluvium along watercourses and lacustrine sediment in claypans.

Sep2; 9 Plains and occasional rises, commonly forming low relief headwater catchment basins, make up this unit. Minor erosional scarps typically bound the unit where more active drainage of surrounding catchments is consuming it through headward erosion. Drainage lines are very poorly defined in many areas, occupying zones up to one km wide. A mobile veneer of soil formed in colluvium (sheetwash deposits), aeolian dust, residual deposits and alluvium overlies weathered bedrock. Degree of weathering is probably variable, with Darling Basin rocks highly weathered to a considerable depth, but Girilambone Group rocks probably only slightly weathered, and to shallow depths only. Soils are mainly deep red earths. Silcrete (both silcreted sediments and bedrock) is locally present, eg. along the Louth road northwest of Cobar. A lag composed of one or more of the following components may be present: rock fragments (some variously ferruginised), maghemite pisoliths, silcrete clasts, and rounded clasts reworked from old eroded alluvial deposits. This unit occurs at a variety of elevations from about 180 m to 260 m. It represents areas where erosion is proceeding very slowly, due to high local base levels.

Ser1; 18 This unit comprises areas of Tertiary lavas and intrusives. Tertiary leucitite lava flows at Byrock and El Capitan were well known by the late 19th Century (Curran, 1887; Judd, 1887; Anderson, 1888; David & Anderson, 1889). The areas shown on the map include all areas of Tertiary igneous rocks shown on the Bourke and Cobar 1:250 000 Metallogenic maps. Some of these deposits are known only from exploration drilling, and are probably intrusive. Age is reported as 11.9 million years (K-Ar; Wellman et al., 1970).

The main flows occur as hills to 40 m high. Cundari & Ollier (1970) describe one of the remnants. The leucitite has a maximum observed thickness of 25 m, and overlies old river sediments. They cite this flow as an example of inverted relief, the lava having flowed down an old river valley. Cundari & Ollier interpret promontories and divisions in the present plan shape of the flow to reflect tributaries in the pre-volcanic river system. If this is the case, a **SSE** flow direction is indicated. This is opposite to the present general landsurface slope towards the Darling River, and the general palaeodrainage direction for southeast Australia described by Ollier (1995) and Ollier & Pain (1994).

Gilligan & Byrnes (1995) state that scoriaceous flow bottoms present at El Capitan may mark encounters of the lava with larger pools of water. They also report that silcrete and silicified conglomerate occurs around the base of leucitite remnants, which 'may suggest a pre-Tertiary age, at least for some bodies' of silcrete. Byrnes (1993) also gives this view, and gives NSW Geological Survey file GS 1983/541 as a source of information. Byrnes also considers that the steep sides of the El Capitan leucitite can be interpreted as due to the removal of soft weathered material from the flanks of a former valley infill. This implies a rate of erosion of about 3 m/Myr, which the author considers very high, given the apparent antiquity of the landscape as an interpreted little-modified Cretaceous surface.

An alternative explanation (pers comm K. McQueen, University of Canberra) is that the lavas were self inflating, forming mounded bodies with a congealed skin, and not requiring confining valley walls.

The author has briefly examined several of the flows on the property 'Kergunyah' northeast of Cobar. Conglomerate (in places silcreted) of angular milky quartz clasts (mostly <3 cm) in a sandy matrix, and fine to medium grained sandstone is locally present beneath the leucitite. Outcrop is poor, but there is commonly abundant scree of fragments of these rocks. They appear to be at most only a few metres thick. They are underlain by moderately weathered bedrock exposed in rare natural outcrops, and in a prospecting shaft at about grid reference 55J 0418707 6549951. Depth of weathering is unknown, and degree of weathering may be variable, given the variety of lithologies present in the area.

As well as in situ weathered rock material and old alluvial sediments, regolith in this unit includes talus and sheetwash colluvium, and lag fragments of leucitite. Stony lithosols are present. The leucitites are mostly slightly weathered at the surface.

Ser2; 10 This unit consists of undulating rises, with saprolite at shallow depth overlain by a layer of transported and residual regolith. The unit was mapped across the entire map area; however, in the south and west, where Geological Survey of New South Wales 1:100 000 geological maps are available, it has been subdivided into two complementary units, Ser3 (22) and Ser4 (19) on the basis of whether the geological maps show outcropping Palaeozoic rocks or cover. The assumption is that where areas of bedrock are shown on the maps, the transported and residual regolith cover is thinner. The Canbelego 1:100 000 map (Felton et al., 1985) does not distinguish areas with thin cover from outcrop, and hence the subdivision was not possible over that map area. The transported regolith for unit Ser2 mostly consists of a mobile zone with a multicomponent lag (eg Cohen et al., 1996). Where relief is higher and there is bedrock outcrop, lithosols formed in colluvial (sheetwash) deposits predominate. Downslope, red earth soils are predominant. These have formed in what is probably a mixture of aeolian dust and bedrock-derived detritus (both residual and transported), subjected to varying amounts of movement by sheetwash, bioturbation and soil creep. The soil-saprolite boundary is abrupt. The lag generally reflects the underlying rock type, so small distances of transport may be implied. Thin alluvium is present along watercourses. Many clast types are present in alluvium, especially detrital maghemite pisoliths, indicating longer transport distances down slopes and into drainage lines. Regolith carbonate is present as skins and veins on and in saprolite, and some soils are calcareous.

Ser3; 22 This unit has been mapped in the east and south of the map where 1:100 000 geological maps show Palaeozoic rocks without cover, in areas of erosional rises. It is considered that there is likely to be at least a thin veneer (< 1m) of mobile zone materials (colluvium, residual material, alluvium and lag) over saprolite in these areas. Aeolian dust may be present as a soil component, and calcrete skins and veins on and in saprolite are present. This unit and unit Ser4 (19) are complementary.

Ser4; 19 This unit has been mapped over erosional rises where the 1:100 000 geological maps show 'residual and colluvial' cover, but where it is considered likely that saprolite will still be present at relatively shallow depth. These areas have mobile zone regolith thicker than for unit Ser3 (22), probably > 1m, with less influence from the underlying saprolite. The transported regolith probably consists mainly of sheetwash colluvium, with local bedrock-derived lag, aeolian dust as a soil component, and alluvium along watercourses. Regolith carbonate is present as skins over and veins in saprolite.

Ser5; 14 This is a complex mosaic area of rises of numerous small outcrops of topographically inverted fluvial sediments which have been silcreted in part, reworked rounded gravel deposits, ferruginous lags, calcrete skins over highly to slightly weathered and in places ferruginised or silicified Palaeozoic bedrock, in an area to the northwest of Cobar. The transported regolith also includes sheetwash colluvium, and alluvium along watercourses. Partially silicified (but not silcreted) bedrock forms low scarps bordering low relief elevated areas, and in some places is present immediately below silcreted fluvial sediments. In the latter situation, the partly silicified saprolite displays prominent vertical columnar and nodular structures, as well as bedding.

SSel1; 7 Steep low hills and hills (90-300 m relief) of resistant sandstone and conglomerate of the Devonian Mulga Downs Group make up this unit. Elevation ranges from about 110 to 510 m, with local relief up to 300 m. Rocks are generally slightly weathered to unweathered. Transported regolith is probably restricted to talus, creep and sheetflow colluvium with shallow stony soils becoming deeper and better developed downslope, and alluvium with red earth soils along watercourses. The Mulga Downs Group is differentiated from areas of older Palaeozoic rocks, as it is considered to be unprospective for base metals, but unlike the latter, may contain large quantities of groundwater.

SSel2; 11 This unit comprises low hills and hills of Palaeozoic bedrock older than Mulga Downs Group. Elevation ranges between about 150 and 574 m, with local relief up to 270 m. Slightly weathered to unweathered bedrock occurs over most of this unit. Transported regolith consists mainly of talus, creep and sheetflow colluvium on slopes, and alluvium with red earth soils along watercourses. Elevation and relief of the unit tends to increase to the south.

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APPENDIX I
OLD AND NEW MAP SYMBOLS

In order of appearance on original hardcopy map:

1	becomes	Aaf1.
23		Aaf2.
6		Aaf3.
17		Aap1.
15		Aer1.
13		Aer2.
5		ISul1.
3		Iu1.
16		Aap2.
20		Aap3.
2		Lpp1.
8		Cfc1.
12		CHpd1.
9		Sep2.
10		Ser2.
22		Ser3.
19		Ser4.
21		Rer1.
4		Sep1.
14		Ser5.
18		Ser1.
7		SSel1.
11		SSel2.

In numeric order

1	becomes	Aaf1.
2		Lpp1.
3		Iu1.
4		Sep1.
5		ISul1.
6		Aaf3.
7		SSel1.
8		Cfc1.
9		Sep2.
10		Ser2.
11		SSel2.
12		CHpd1.
13		Aer2.
14		Ser5.
15		Aer1.
16		Aap2.
17		Aap1.
18		Ser1.
19		Ser4.
20		Aap3.
21		Rer1.
22		Ser3.
23		Aaf2.

APPENDIX II

DESCRIPTIONS OF REGOLITH MATERIALS IN AND AROUND THE COBAR REGOLITH LANDFORMS MAP AREA

The following descriptions of regolith from in an around the map area are mostly summarised or transcribed from published explanatory notes and papers available to the author at the time of map compilation. Other publications and unpublished reports on the area may have further useful information. However, the listed localities give a guide to regolith, especially depositional materials. In some instances, the author has visited the published localities, and comments are appended.

The descriptions are arranged by 1:250 000 and 1:100 000 sheet areas. Metric grid references (AMGs) are given where possible - these are to the AGD 66 datum.

BOURKE 1:250 000 SHEET AREA

Buckeroo Woolshed 55J 479400 6574100

Oolitic ironstone here is probably lacustrine chemical sediment (Byrnes, 1993, p123).

Clifton bore to near Bourke.

Langford Smith and Dury (1965) mention that numerous exposures of 'bouldery silcrete' are present at the surface; these are folded in places. Clifton Bore is on the Tibooburra - Bourke road near the Bulloo River Overflow, well to the west of the area. The author has not visited this area, but consider the description of 'folded silcretes' to indicate that the materials are probably not in fact silcretes.

Darling River

Tertiary sediments are present below the Darling River floodplain. At Bourke weir, immediately downstream of the town, 3.6 m of bleached, well consolidated argillaceous sandstone is exposed. This dips gently to the south, and has broad crossbed sets dipping to the southwest. Between Bourke and Yanda, drilling supported by palynology suggests an early Miocene age for a thick Tertiary sequence (Byrnes, 1993, referring to Mount, 1992).

Langford smith & Dury (1965) report they found no traces of duricrust on the '(?) Silurian rocks exposed.... at Bourke Weir'.

Mount (1992) describes a 140 m thick alluvial sequence dating back to at least the Early Miocene beneath the Darling River in the Yanda Creek area.

El Capitan (Cobar and Bourke 1:250 000 Sheet Areas)

There are minor exposures of quartz gravel beneath the leucitite on the Cobar and Bourke 1:250 000 sheet areas. The loosely cemented gravels have been found to be slightly auriferous in places (Byrnes, 1993, referring to Curran, 1887; Anderson, 1888).

Byrnes (1993, p68) states that the leucitite was extruded after deep weathering in the Bourke Sheet area.

Galambo Depression

Considerable thickness of Tertiary granule sand is suspected in the Galambo Depression. One bore in this area (Dept of Water Resources 36853) passed through 76 m of light grey clean quartz coarse sand and fine gravel, overlying unbleached Cretaceous strata of medium to dark grey colour (Byrnes, 1993).

Gongolgon (White Tank), 55J 478600 6640600

A kaolinitic sequence up to 14 m thick is sparsely known over an area of about 5 km. The beds are exposed at White Tank and dip gently to the northwest and continue possibly as far as Keerugulla Lake.

Hard pure kaolin is interbedded with softer sandy kaolin, and kaolinitic sandstone; likely to have been derived from the weathering of a nearby granite (Byrnes, 1993).

Gunderbooka Range

Silcreted scree occurs on the flanks of the Gunderbooka Range (Byrnes, 1993). These possible piedmont silcretes are now at a high level, suggesting general erosional lowering since the time of silicification. This material is also mentioned by Mount (1992).

Keerugulla

Water bores east of Keerugulla (eg WRC 6304 and 6336) reveal up to 66 m of micaceous sediment overlying granite (Byrnes, 1993).

Lafoes Tank, 55J 460800 6612800

An extensive deposit of gravel-rich alluvium occurs in this area. The gravels locally contain boulders of such great size and high polish that the former passage of a significant river or vigorous stream is indicated. Some clasts have crescentic percussion marks. Exploration shafts to 12 m were already present in 1887. An extensive area is strewn with quartz pebbles from the gravel, and a tract with large boulders trends northerly. The boulders consist of vein quartz, quartzite, sandstone etc. The deposit may reach 30 m thickness (Byrnes, 1993).

Langford Smith & Dury (1965) report that 'the outcrop marked as Tertiary on the geological map, 54 miles southeast of Bourke and 10 miles east of Byrock, appears to constitute an error; a surface litter of grey fragments and quartz gravel appears to have been taken for bouldery silcrete and to have been assigned to the Tertiary'.

Medway Well, 1.6 Km South of Byrock Hill

Byrnes (1993) reports from David (1886) that the Medway well was sunk to 33.2 m in granite so weathered that it could be cut all the way by spade.

Mount Oxley

There is silcreted scree on the flanks of Mount Oxley (Byrnes, 1993). These possible piedmont silcretes are now at a high level, suggesting general erosional lowering since time of silicification.

Langford smith and Dury (1965) report that they found no traces of duricrust on or near Mt Oxley.

Paka Gypsum Deposit, 55J 371200 6678250

Byrnes (1993 p 96) describes this deposit in an old claypan or lake.

COBAR 1:250 000 SHEET AREA

Coolibah.

The Coolibah Grit of probable Tertiary age overlies Ordovician rocks (Rayner, 1969). Grit, mudstone, quartz conglomerate shown in stratigraphic table.

Poorly consolidated gravel with pebbles of quartz, quartzite, and chert is interbedded with claystone, and friable sandstone. The unconformable contact with the Girilambone Group is exposed in the railway cutting south of Coolabah (Byrnes, 1993).

Langford Smith and Dury (1965) record that the Tertiary materials here include 'ferricrete, a mottled zone, and a pallid zone which extends into the underlying shales'.

The author has observed good outcrop of poorly cemented conglomerate and sandstone in a gravel pit on the SW corner of the intersection of the Bourke and Cobar roads, just north of the village.

El Capitan (Cobar and Bourke 1:250 000 Sheet Areas)

There are minor exposures of quartz gravel beneath the leucitite on the Cobar and Bourke 1:250 000 sheet areas. The loosely cemented gravels have been found to be slightly auriferous in places (Byrnes, 1993; referring to Curran, 1887 and Anderson, 1888). See also notes for Bourke 1:250 000 Sheet area.

Girilambone

Dury (1966) reports that: 'The hill immediately west of the settlement, cut in Ordovician schist, is somewhat silicified at the summit which carries occasional silcrete boulders. Rounded billy fragments occur amid angular fragments of schists all down the hillside. A low plinth at the hillfoot, about 300 ft (90 m) lower than the summit but rising distinctly above the lowest and latest pediment....is capped with silcrete blocks; it displays mottled and pallid zones on its fore-edge'.

However, Wasson & others (1979) found no silcrete at this locality, only Palaeozoic foliated quartz arenites.

Rileys Mount

Minor gold-bearing placer deposits in Cainozoic drainage systems occur at Rileys Mount in the northeast of the Sheet area (Gilligan & Byrnes, 1995, p23). On p. 99 they further describe the deposit. 11m of weakly cemented Tertiary conglomerate is present on a small hill crest. Clasts in the conglomerate are mostly quartz of pebble size, with exceptional clasts to 70 cm. Boulder clasts of Girilambone Group are also present. Shallow alluvial workings also occur downslope where the gold has been eroded from the conglomerate and concentrated in more recent times.

55J 397600 6507800

Gilligan & Byrnes (1995) report shallow fireclay pits. Fireclay was mined from 1910. The fireclay is presumed by Gilligan and Byrnes to be Tertiary sub-duricrust pallid zone.

40 Km West of Nyngan on Cobar Road

Dury (1966) shows in a sketch map an occurrence of silcrete, but does not describe it. Note that Wasson & others (1979) are highly critical of Dury's identification of silcrete.

Yanda Creek

Ongley (1970) p 26 reports an occurrence of 'silcretic bedrock ..... about one quarter mile 'upstream' of the point known as the 'Four Corners' on 'The Lease' property on Yanda Creek. The author cannot identify this locality, but it is almost certainly near the Barrier highway.

COBAR 1:100 000 SHEET AREA

Buckwaroon Trig, 55J 363300 6531600

Silcrete is present over weathered sandstone (Glen, 1994).

Cobar Watertower Workings, 55J 387350 6515600

Gilligan & Byrnes (1995) report old workings for magnesite and possibly fireclay. They refer to Mulholland (1940), who described a fireclay belt 160 m east of the water tower.

Cougar Trig, 55J 390000 6539700

Cobbles derived from the Drysdale Conglomerate Member are very resistant to weathering and are spread widely from their original outcrops as colluvial deposits. A surface litter of these cobbles can give a misleading impression of the underlying rocks (Baker, 1978).

Louth Road

Baker (1978) reports that 10 t of ironstone ore from the Louth Road Workings yielded 24 g/t Au (after Andrews, 1913, p185). In all, shafts were sunk in ferricrete caps in seven areas on the Cobar 1:100 000 Sheet area. Most of these mines were thought to be unproductive.

The locality is further discussed by Gilligan & Byrnes (1995, p101), who state that some confusion surrounds the exact position. See next entry.

55J 380126 6523521

The author visited this location in December 1996. It may be the locality described above. An area of several hectares has been costeaned and worked. Massive ironstone is present, grading to ferruginous Devonian sedimentary rock.

Louth Road North of Poon Boon Turnoff

Silcrete boulders are partly obscured by and buried in recent eluvium (Glen, 1994).

Mooka Trig

Baker (1978) draws attention to localised silcrete occurrences in this area in his fig 4. Glen (1994) refers to this source.

Mount Drysdale

The lower slopes are mantled with a thick layer of rounded pebbles derived from the underlying Drysdale Conglomerate Member, outcrop being obscured in all but deep gullies (Baker, 1978).

Baker (1978) draws attention to localised silcrete occurrences in this area in his fig. 4. Glen (1994) refers to this source.

Gilligan & Byrnes (1995) refer briefly to minor gold bearing placer deposits in Cainozoic drainage systems at Mt Drysdale (p23).

In Northwest of Cobar 1:100 000 Sheet Area

Prominent Cainozoic gravel deposits mantle low hills. Clasts are almost wholly composed of vein quartz (Glen, 1994).

The author has found that many of the areas of Czg shown in the NW of the Cobar 1:100 000 geological sheet are gravels from older Mesozoic or Cainozoic deposits reworked downslope. Clasts include many lithologies. Boulder clasts of sandstone and quartzite (probably derived from outcrop of Mulga Downs Group to the west) up to 1 m in size are present in the in situ deposits.

Old Reservoir Magnesite Pits, 55J 391200 6517000

Gilligan & Byrnes (1995) describe magnesite occurring in veins and fractures in Devonian shales.

Tinderra Tank, 55J 396600 6565400

A small flat-topped hill of sandstone occurs above the Cobar Group (Rayner, 1969). Sandstone and grit are shown in a stratigraphic table.

Silcrete occurs as a solid capping up to 4 m thick. A pallid soil horizon is present under the silcrete (Baker, 1978; Glen, 1994; Glen & Hutton, 1983).

Gilligan & Byrnes (1995) list a fireclay deposit at 55J 397000 6565400, presumably a clay rich variant of the sandstone. Carne (1908) and Andrews (1913) refer to firebricks for the Cobar smelters probably made from this material.

The author visited this locality with K McQueen and K P Tan (University of Canberra) in 1995. The silcrete has formed in a kaolinitic sandstone (?weathered arkose), which is exposed in a breakaway beneath the silcrete. The silcrete is not completely cemented. The sandstone is not present in gravel pits at a higher elevation nearby to the north, indicating the sediment was probably deposited in a valley-fill situation.

Tyncin Trig., 55J 359100 6566700

Silcrete occurs as a solid capping up to 4 m thick (Baker, 1978)

Note that Auslig give the location of the Trig as 55J 359070 6566730, but that the pattern of outcrop shown on the Cobar 1:100 000 geological sheet suggests a location of about 358800 6566900. There is therefore a spatial error of at least 300 m on the 1:100 000 map in this area.

The author visited this locality on several occasions. The near flat-topped hill, with the trig near the eastern end, slopes down to the west, possibly dropping 8-10 m in about 800 m. The top surface of the hill is littered with fragments of massive silcrete, formed in sandstone and conglomerate, and rounded clasts weathered from conglomerate. Grainsize of the silcreted sediment increases from sandstone with only rare granules and pebbles in the east, to conglomerate with boulders to 1m in the west. The conglomerate clasts consist of milky quartz, orthoquartzite, metaquartzite, and grey quartz. The silcreted sediment appears to be rarely more than 2 m thick. One outcrop of unsilcreted sediment was noted about halfway along the northern rim of the hill. Beneath the sediment is almost continuous outcrop of hardened (?partly silicified) Devonian saprolite. This is off-white colour, still has visible bedding (dip is to the south at about 40 degrees), and on weathered surfaces, displays columnar (vertical) and nodular textures, reminiscent of textures in pedogenic silcretes (Thiry & Milnes, 1991), but without the strong cementation. The hardened saprolite is characterised by cavernous weathering.

55J 358000 6519400

Boulders of clean, quartz rich sandstone up to 40 cm are derived from the Mulga Downs Group (fishplates in one boulder, crossbedding in another, and quartz pebbles in a third). Time of deposition may be either Cainozoic or Cretaceous (Glen, 1994)

55J 358600 6560600

Silcrete occurs on weathered Palaeozoic sandstone (Glen, 1994)

55J 358800 6560600

Silicified Cainozoic conglomerate (Glen, 1994)

55J 360700 6516300

Massive ironstones developed from the ferruginisation of sedimentary rocks (Glen, 1994)

55J 362900 6528700, South of Buckwaroon Trig.

Ferricrete pebble float is derived from outcrops of highly leached sediments containing ferricrete nodules (Baker, 1978).

55J 367400 6560100

Massive ferricrete outcrop with many of the bedding features of the original rock preserved (Baker, 1978).

55J 368000 6525400

Example of strongly silicified Palaeozoic sediments with cleavage and/or bedding preserved (Baker, 1978).

55J 368000 6525800

Massive boulder outcrops of silcrete and ferricrete less than 2 m apart occur on a low rise west of Cobar (Baker, 1978)

55J 368200 6557500

Massive ferricrete outcrop with many of the bedding features of the original rock preserved (Baker, 1978).

55J 373800 6519900

Pit or shaft sunk in ferricrete outcrop mistakenly identified as a gossan (Baker, 1978).

Referred to as ironstone by Glen (1994).

55J 380000 6523500

Massive ironstone accumulation developed from ferruginisation of sedimentary rock (Glen, 1994).

55J 380000 6551000

Massive ironstone accumulation developed from ferruginisation of sedimentary rock (Glen, 1994).

55J 392900 6525200, beside Bourke road, 11 km n of Cobar.

Conglomerate unconformably overlies vertical Chesney Formation, and includes pebbles of mudstone, as well as the dominant ironstone pebbles and minor vein quartz. The sequence is about 2 m thick (Baker, 1978).

See also entry for 55J 398600 6549500.

The author visited this locality in December 1996. The conglomerate occurs in the NW face of the gravel pit. It has numerous maghemite pisolith clasts, and very high magnetic susceptibility. Other clasts include quartz and rock fragments to 7 cm in grey clayey sand matrix. Overlies bleached and stained Devonian saprolite. Overlain by red soils with maghemite pisolith lag. The conglomerate is now being eroded.

55J 394400 6563100

Silcrete occurs as a solid capping up to 4 m thick (Baker, 1978)

55J 398600 6549500, Coolibah Road

Over 6 m of Cainozoic sediment crops out in a gravel pit beside the Coolibah road. The conglomerate has well-rounded pebbles of maghemite, averaging about 0.5 cm in diameter, with scattered pebbles of vein quartz in a groundmass of sand sized quartz grains. Pale grey mudstones are interbedded with conglomerates and sandstones in lenticular beds up to about 20 cm thick (Baker, 1978)

Glen (1994) quotes this occurrence, but gives the 55J 392900 6525200

The author visited this locality in December 1996. The conglomerate is mottled. Most clasts are maghemite pisoliths, matrix is clayey sand. Pebble bands show bedding. Cross bedding is visible. There is also some sandstone. Across the road, at Cobb & Co Tank, there is no sign of the sediment, only white clay in the tank excavation spoil.

One and a half miles from Cobar on the Louth road.

Ongley (1970) reports that 'massive kaolin is found in a quarry on the Louth road about one and a half miles from Cobar. An artificially modified creek bed ... found at the base of the hill .... containing the quarry, truncates the steeply-dipping and alternately kaolinised and relatively unweathered bedrock existing at the base of the deep weathering zone.

30 km west of Cobar.

Shallow gravel deposits containing pebbles of vein quartz, quartzite, and maghemite form a capping on hills (Baker, 1978).

Glen (1994) states that unconsolidated ?Cainozoic gravels are common in the southwestern corner of the Cobar 1:100 000 Sheet area, where they mantle low hills, probably as relics of an earlier land surface. Clasts are generally found strewn loosely on the ground surface. They consist mainly of white vein quartz (>90%) with some grey pebbles (hornfels?) and were probably derived mainly from the Mulga Downs Group 25 km west of the Sheet edge. Other clasts consist of rounded ironstones or ferruginised sandstones and silicified or partly silicified sedimentary rocks.

Dam on Mema Station (55J 401000 6524000)

Ongley (1970) reports that a dam on Mema property (grid reference calculated by the present author from a sketch map) is 'anchored at either end on two low rises of silcrete which are themselves only a few feet above the surface of the valley alluvium. Directly from these silcrete mounds rise valley side slopes comprised of only slightly weathered, red and yellow sandstone, siltstone and phyllites. Immediately under the bouldery silcrete, which appears at most to be only two or three feet thick, lies kaolinised bedrock in which is preserved an inherited inclined bedding. Two large drains, one at either end of the dam, skirt the edge of the silcrete and expose pallid material in their floors. There is only a suggestion of mottled bedrock in the two drains. ... Two tanks, one on either side of the dam, are cut into kaolinitic material to a level well below that of the present valley floor- -at least twenty feet according to the property owner. Unidentified but apparently ferruginous material was excavated out of the pallid material during the sinking of the tanks. This material is said to have been soft during the excavation but has set in air to a hard, slag-like rock.'

WRIGHTVILLE 1:100 000 SHEET AREA

Bidabirra Hill, 16 Km W of Cobar

Dury (1966) reports 'very steeply dipping sandstones exposed in summits have been in part converted to silcrete of the bouldery grey-billy type, while the kaolinized pallid zone beneath is exposed to a depth of about 20 ft (6 m) in a large roadside borrow pit two miles (3.2 km) to the east'.

However, Wasson & others (1979) recognise Dury's silcrete as Palaeozoic fine grained quartz arenite.

Glen (1987) reports that Dury (1966) noted the presence of a kaolinised pallid zone below sandstones partly converted to silcrete.

Glen states that the pallid zone really consists of finely interbedded mudstone, siltstone and sandstone of the Biddabirra Formation.

Ongley (1970) describes a 'full profile ... in the flank of a low residual eight miles west of Cobar .... over which the Barrier Highway rises. Here, the pallid and mottled zones are displayed in a borrow pit, while the summit is capped with bouldery silcrete'. This is probably the same occurrence as described above, and is described as being 8 miles west of Cobar.

Mount Buckambool

Glen (1987) reports that Dury (1966) noted a pallid weathering zone below sandstones partly altered to silcrete. In particular he noted thin siliceous skins on fracture faces. Glen states that the pallid zone may be mudrock rich, although he reports that Wasson et al. (1979) reported the presence of carbonate nodules and cement.

Dury (1966) actually states: '..sandstone and conglomerate with vertical dip at Buckambool Homestead have been converted in part to bouldery grey billy; the pallid zone shows on the sides of lower rises nearby. Between the Homestead and the foot of Mount Buckambool (1325 ft) (404 m), bouldery silcrete of the common type is well in evidence on the top of a small cuesta, where gently dipping sandstones rise some 50 ft (15 m) above the surrounding pediments...The constant slope on this side of Mt Buckambool, cut in flat-lying sandstone, exhibits signs of silicification throughout the upper 250 ft (76 m) of its vertical extent. Joint blocks in this range are typically clad with thin siliceous skins, 5 to 25 mm through; the process of silicification appears to have worked inwards from the surfaces'.

From his illustrations, it appears that the silcrete at the homestead overlies deformed early Devonian rocks, whereas the cuesta and slope of Mt Buckambool are cut in relatively undeformed late Devonian rocks. The silcrete at the Homestead and on the cuesta lie at about 1000 feet (305 m). The author has not visited the site, but considers it could well be that the siliceous skins on the late Devonian rocks are not silcrete, but case hardening, due to movement of ions from the interior of the rocks to the surface.

Wasson & others (1979) observed no silcretes here, and attributed the siliceous skins as due to removal of iron near the rock surface.

55J 369100 6459500

The only mapped sand dune on the Wrightville 1:100 000 Sheet area occurs here (Glen, 1987).

55J 371300 6483000

True silcretes occur around this locality (Glen, 1987).

55J 379500 6470600

Glen (1987) reports a low 'outcrop' of rounded siliceous rocks overlying the Thule Granite at its eastern margin at this locality.

55J 382500 6468500

Glen (1987) reports a low 'outcrop' of rounded siliceous rocks overlying the Thule Granite at its eastern margin at this locality.

55J 384300 6469300

A low outcrop of Cainozoic conglomerate with siliceous clasts in a fine-grained sandstone/mudstone matrix is noted by Glen (1987).

The author visited this locality in August 1997 with K. McQueen and M. Spry (University of Canberra), C. Pain (AGSO) and K. Scott (CSIRO). Burdekin Resources have a gold prospect in the vicinity, with numerous drillholes and costeans on a rise to the east of the access track. To the west of the track is a rise with some outcrops of a dipping Palaeozoic conglomerate with quartzite clasts, similar to outcrops described at the locality below. Glen's (1978) outcrop is probably similar or may be the same locality, and is thus not Cainozoic.

55J 384500 6475500

Cainozoic conglomerate with siliceous clasts in a fine grained sandstone/mudstone matrix occurs on hills around this locality (Glen, 1987).

The author visited this locality in August 1997 with K. McQueen and M. Spry (University of Canberra), C. Pain (AGSO) and K. Scott (CSIRO). Two areas of 'Czg' are shown on the Wrightville 100 000 geology sheet. The more southern coincides with a low relief area with scattered lag of rounded to subangular quartzite pebbles. The more northern is a rise with outcrops of slightly ferruginised conglomerate near the crest. These have rounded to subangular quartzite pebbles, some with quartz veins in the pebbles. The matrix is well compacted and cemented sand. There are no clear bedding planes, but lines of pebbles indicating bedding are uniformly orientated with a steep dip (not measured). We were of the unanimous opinion that the rock is Palaeozoic. The only material which could be conceivably mapped as 'Czg' is the pebble lag derived from the Palaeozoic conglomerate.

55J 397600 6498900

Scree at this locality is from Cainozoic conglomerate with siliceous clasts in a fine grained sandstone/mudstone matrix (Glen, 1987).

55J 398500 6500500

Scree at this locality is from Cainozoic conglomerate with siliceous clasts in a fine grained sandstone/mudstone matrix (Glen, 1987).

CANBELEGO 1:100 000 SHEET AREA

Hermitage to Florida Railway Station

Felton (1981) reports a line of small silcrete residuals from 55J 440000 6503500 to 437300 6511700. In these, the quartz grains are derived from the underlying Florida Volcanics.

Gilligan & Byrnes (1995) report a shaft mapped as 'old fireclay shaft' by Andrews (1915) at 55J 437800 6511900. The locality was not visited by Gilligan & Byrnes, but was considered to be a Tertiary sediment, with sub-duricrust pallid zone.

Dury (1966) reports that there is no sign of duricrusting on Mt Boppy. However, 'bouldery silcrete is present almost at the foot of Mt Boppy, in the angle of the two road turn offs to Canbelego. It caps a low rise above the bordering pediments, not less than 200 ft (60 m) and probably at least 300 ft (90 m) lower than the summit of Mt Boppy. The associated mottled zone is strongly suggested by spoil thrown up during road work, while the pallid zone is well displayed in a shallow natural wash. At this site....the silcrete horizon stands perceptibly above, and must accordingly be earlier than, the lowest and latest pediments, while the principal and highest residual rises well above the silcrete'.

Kopyje

East of Kopyje (55J 442900 6486300) are remnants of an extensive sheet of silcrete (Felton, 1981).

East of Mafeesh

Gravels are exposed on low rises. These deposits do not crop out in a consolidated state, and consist of well rounded loose boulders, cobbles and pebbles of quartzite and minor chert (Brown, 1976).

Meryula Tank

Ongley (1970) reports that 'Meryula Tank ... is excavated in gypsiferous kaolin. Several hundred yards distant, kaolinitic and mottled material outcrops in midslope of a low ridge at the Meryula shearing shed'.

One and a Half Miles North of Meryula Homestead

Ongley (1970) reports that highly mottled bedrock outcrops on a low rise on the western side of the access track. A higher ridge immediately to the NW has siliceous bedrock which is apparently not related to the deep weathering profile.

Four Tenths of a Mile West of the Meryula Turnoff

Ongley (1970) reports that on a west facing slope on the Barrier highway, 'siliceous though non duricrusted bedrock caps a prominent ridge; downslope, one passes over mottled bedrock, thence over pallid tank debris around a tank at the slope foot.

Near Entrance to Mema Station

Ongley (1970) p 26 reports an occurrence of silcreted bedrock 'near the entrance to Mema property'.

Barrier Highway Crossing of Yanda Creek

Ongley (1970) reports that 'pallid material is found about a tank immediately east of Yanda Creek crossing of the Barrier highway.'

The Rookery

North of The Rookery (55J 412500 6489700) are remnants of an extensive sheet of silcrete (Felton, 1981).

Brown (1976) states that extensive silcrete deposits crop out prominently to the north and west of The Rookery homestead, attaining a probable maximum of 3 m, and overlying bleached clayey material. The rock consists of white, grey, and rare black silicified gravel and sandy detritus, and crops out on topographic highs as distinct beds.

Gilligan & Byrnes (1995) list a fireclay deposit at 55J 412485 6490895. A well developed pallid zone appears to be present below silcrete. There is a 6m pallid thickness, beneath which white clay discolours and becomes light brown by 12 m. Estimated deposit size is 10 m t of medium quality kaolin. This deposit was also mentioned by Andrews (1913), and clay from here was probably used in the manufacture of refractory bricks for the Great Cobar Smelter in the 1880s.

Ongley (1970) notes that Andrews (1913) ' has specifically noted the occurrence of siliceous duricrust underlain by 'fireclay' in association with Silurian limestone in the area between 'The Rookery' and a point eleven miles southeast of Cobar. He also referred to occurrences of ironstone capping over fireclay. Analysis of the fireclay indicated it to be 86% silica with the next largest fraction (9%) of alumina.

The author visited a quarry at 412782 6490639 in August 1997, with K. McQueen and M. Spry (University of Canberra), K. Scott (CSIRO) and C. Pain and (AGSO). The silcrete, formed in transported sediment, outcrops on a hilltop, and is well exposed in a quarry face. Rather than a flat top, in situ silcrete is present down part of the slope of the hill, thinning downslope. Clay, mostly bleached but with mottled zones, is present beneath the silcrete The quarry shows the silcrete occurs as 'jigsaw' blocks to about a metre in size. Limestone is present beneath the clay.

55J 419300 6468700

Unconsolidated gravel deposits, consisting of boulders, cobbles, and pebbles of quartzite and minor chert occur on low rises in this vicinity. These may be remnants of a more extensive sheet of consolidated ?Tertiary conglomerate or silcrete (Felton, 1981).

55J 409286 6487144

Low rise with outcrop of ferruginised saprolite, or 'ironstone'. Several shafts show ironstone thickness of 1-6 m over Palaeozoic saprolite. This is not considered to be a 'laterite' developed from weathering, rather a zone where iron has precipitated from groundwater. From the author's notes.

16 Km East of Mt Boppy

Dury (1966) describes a quarry which cuts into a low subdued hill at about this distance (according to his sketch map) from Mt Boppy along the Nyngan road: 'Rocks at the summit are here highly silicified to a depth of six to ten feet (2-3 m). Although they weather into mainly angular fragments, and fracture into irregular or cuboidal pieces with sharp edges, they would appear to correspond to the bouldery silcrete elsewhere on the pediplain; for below them, a mottled zone extends in places down to the quarry floor, about 25 feet (8 m) below the hilltop, and the pallid zone next below is also partly exposed. The total depth of the weathering-profile could be well in excess of 30 ft (9 m), if the pallid zone is as thick below the quarry floor as it is where exposed on portions of the face'.

Wasson & others (1979) visited this quarry (the Ballast Quarry), and were not able to observe any section displaying Dury's sequence, and conclude that: 'Differences in induration and the presence of pallid and mottled material...is readily explicable in terms of bedrock variation'.

The author visited this locality in August 1997. Folded, well bedded cherts and fine clastic sediments are exposed. Although there is some colouration of the rocks, none are more than slightly weathered. The very top (<1m) of the exposure is slightly hardened, presumably by silica.

55J 438200 6494200, On Canbelego-Nymagee Road

The author visited this site in August 1997. A gravel pit by the road exposes Palaeozoic saprolite overlain in the northern part of the pit by post-Palaeozoic conglomerate. The unconformity dips to the north. The slightly higher ground to the east of the road has no outcrop of the conglomerate, but is clad in scree of rounded quartz pebbles. There is probably 3 m thickness of conglomerate preserved in the pit.

NYMAGEE 1:250 000 SHEET AREA

Mount Hope - Gilgunnia Area.

Tertiary drifts and leads occur under Recent alluvium (Rayner, 1969).

LACHLAN DOWNS 1:100 000 SHEET AREA

Western Flank Mulga Downs Group Ranges

Low rises are capped with Tertiary ferruginous sandstone and greybilly (siliceous duricrust) over flat lying white sandstone (Rayner, 1969).

Poorly consolidated coarse granule sandstone and coarse conglomerate with a white clay matrix and pebbles of quartz and chert predominating, may represent a marginal facies of the terrestrial Knights Group (Sprigg & Boukatoff, 1952) of the Murray Basin. Provenance of these sediments is local, mainly the Upper Devonian sediments to the east (Brunker, 1973).

55H 370700 6412800

Poorly consolidated conglomerate occurs to the west and southwest of this point. The rock is poorly sorted with clasts of vein quartz and sandstone set in a sandy matrix. Clasts are 0.5 to 15 cm, average 4-5 cm (MacRae, 1989)

55H 388800 6439400

Poorly consolidated arkosic conglomerate occurs around this location. Clasts of granite, quartzite, and minor vein quartz are up to 10 cm, and are set in a sandstone to granule conglomerate matrix dominated by angular sandstone and quartz (MacRae, 1989).

Western Third of Lachlan Downs 1:100 000 Sheet Area

Outcrops of silicified sandstone and conglomerate occur in the western third of the sheet area, and overlying the Thule Granite. Only a few small outcrops occur in the east of the sheet on Cobar Supergroup rocks.

The rock is generally pale grey and comprises angular quartz grains (80%) 6.4 - 15 mm set in a siliceous matrix (20%) (MacRae, 1989).

NYMAGEE 1:100 000 SHEET AREA

55H 406700 6414300

Silicified Cainozoic sandstone and conglomerate. The rocks are typically pale grey and comprise angular quartz grains set in a siliceous matrix. The rock is poorly sorted, with quartz grains 0.5 to 12 mm comprising 80% of the rock, the remainder being matrix (MacRae, 1987)

55H 407600 6429200

Silicified Cainozoic sandstone and conglomerate. The rocks are typically pale grey and comprise angular quartz grains set in a siliceous matrix. The rock is poorly sorted, with quartz grains 0.5 to 12 mm comprising 80% of the rock, the remainder being matrix (MacRae, 1987)

55H 409900 6448700

Gravel deposits were observed in tank walls. Quartz and lithic clasts ranging from coarse sand to cobbles. The lithic material is generally locally derived (MacRae, 1987). The gravels are crossbedded (planar 10-15 cm sets), and indicate transport in a southwesterly direction.

55H 421300 6441100

Gravel deposits were observed in tank walls. Quartz and lithic clasts range from coarse sand to cobbles. The lithic material is generally locally derived (MacRae, 1987).

55H 449400 6437200

Silicified Cainozoic sandstone and conglomerate. The rocks are typically pale grey and comprise angular quartz grains set in a siliceous matrix. The rock is poorly sorted, with quartz grains 0.5 to 12 mm comprising 80% of the rock, the remainder being matrix (MacRae, 1987)

55H 450500 6408700 to 451600 6404600

Silicified sandstone and conglomerate outcrops probably represent the remnants of an extensive sheet, as strongly quartzose alluvium occurs between the outcrops. The rocks are typically pale grey and comprise angular quartz grains set in a siliceous matrix. The rock is poorly sorted, with quartz grains 0.5 to 12 mm comprising 80% of the rock, the remainder being matrix (MacRae, 1987)

BOBADAH 1:100 000 SHEET AREA

Erimeran Granite

This is deeply weathered in part (Pogson, 1991)

55H 490100 6413150

A few metres of poorly consolidated granule and pebble conglomerate cap a low rise. Pebbles are well rounded and mainly comprise quartzite and vein quartz. The conglomerate is poorly exposed but appears to be flat lying (Pogson, 1991).

55H 464500 6404300 to 4539000 6404600

Scattered outcrops of silicified sandstone and arkosic conglomerate form thin cappings on low rises. Outcrops are typically low and rubbly. The rocks are grey, poorly sorted, and comprise angular quartz grains and granitic detritus set in a siliceous matrix. The framework grains and fragments are all derived from the underlying Erimeran Granite. The outcrops are thought to represent remnants of an originally more extensive silicified surface developed during a period of 'duricrust' formation in the Cainozoic (Pogson, 1991).

Nangerybone Creek at Bobadah-Nymagee Road Crossing

The author visited this site in August 1997. Several metres of off white, well bedded, poorly to moderately cemented cross-bedded medium to very coarse grained poorly sorted sandstone, and grey/red mottled clay, is present. Calcrete occurs in joints and as tubular structures (?precipitated around roots). Topmost 125 cm is mostly clay, and has pedal structure. Detritus appears to be granite-derived.

West of Yellow Mountain

See notes for Gindoonoo 1:100 000 sheet.

MOUNT ALLEN 1:100 000 SHEET AREA

Keginni Creek

Alluvial fluviatile sediments in the form of high terraces or fans occur along Keginni Creek which flowed more northwesterly in earlier times (Scheibner, 1987). These consist of poorly consolidated friable gritty sandstone and conglomerate with white clayey matrix. Most of the pebbles are white quartz (to 10 cm) and grey chert, but an assemblage of polymict clasts identical to those in the Keginni Conglomerate Member was probably derived from that unit.

The sediments appear to form two terraces on outwash fans of Keginni Creek, the lower at about 220 m asl. The thickness of the higher terrace is about 5 m, but locally may be more, and the sediments are more cemented than the lower terrace.

55H 400500 6399500

Water Resources Commission bore No 17789 (Scheibner, 1987).

0-3.04m	soil
3.04-69.49	clay with sprinkle of sandstone. Granitic at base.

55H 401800 6370300

Three small shafts were sunk to a depth of 18-20 m at Bundure homestead for extraction of clay for refractory firebricks at Mount Hope and Great Central smelters. The clay contains sand and grit, plus subangular small quartz pebbles, and refractory bricks were produced after the crushing of small quartz pebbles, which made up roughly 69% of the rock. Carne (1908, p 400), reported in Scheibner (1987).

Suppel & Gilligan (1993, p156) record a fireclay deposit, with a Quaternary age attributed.

55H 4045500 6381800

Water Resources Commission bore No 17606 (Scheibner, 1987).

0-0.91m	red loam
0.91-28.64	soft white siltstone
28.64-43.25	yellow and brown siltstone

55H 405000 6401450

Water Resources Commission bore No 18098 (Scheibner, 1987).

0-0.91m	soil
0.91-5.51	coarse gravel and clay
5.51-6.40 TD	not stated in reference

55H 405050 6392600

Water Resources Commission bore No 17786 (Scheibner, 1987).

0-0.91m	loam
0.91-7.31	clay and gravel
7.31-9.46	green white clay and gravel
9.46-95.09TD	brown and yellow slate, with minor grey siltstone and sandstone

55H 405300 6399800

Water Resources Commission bore No 18099 (Scheibner, 1987).

0-1.52m	clay and quartz gravel
1.52-12.18	yellow clay and gravel
12.18-15.23TD	yellow and white clay with fine quartz and gravel

55H 369100 6354800

Water Resources Commission bore No 14077 (Scheibner, 1987)

0-7.01m	clay
7.01-9.44	boulders
9.44-22.48	clay
22.48-27.66	boulders
27.66-29.18	clay
29.18-33.14	bedded sandstone
33.14-35.27	clay
35.27-40.14	dry sand
40.14-40.44	sandy clay
40.44-63.60	dry sand
63.60-64.81	yellow clay
64.81-71.51	grey clay
71.51-72.42	water bearing fine sand
72.42-74.55	clay
74.55-94.36	water bearing sand
94.36-94.66	clay

55H 370100 6367100

Water Resources Commission bore No 13767 (Scheibner, 1987).

0-1.82m	red clay
1.82-8.52	red clay and gravel
8.52-15.83	sticky grey clay
15.83-19.48	soft sandstone and sandstone boulders
19.48-67.05 TD	White and yellow sandstone and siltstone

55H 381800 6380800

Water Resources Commission bore No 18675 (Scheibner, 1987).

0-1.21m	topsoil
1.21-31.38	clay and gravel
31.38-74.35	clay and quartz gravel

74.35-105.15TD slate and sandstone

55H 390000 6358900

Water Resources Commission bore No 18222 (Scheibner, 1987)

0-0.91m	soil
0.91-21.33	clay and gravel

21.33-35.35 TD 'decomposed granite'

The 'decomposed granite' is likely to be porphyry or volcanics rather than granite (Scheibner, 1987).

55H 391300 6364900

Water Resources Commission bore No 44444 (Scheibner, 1987).

0-6.10	red loam
6.10-12.10	clay and rock fragments
12.10-12.11	loam
12.11-54.71	yellow siltstone
54.71-82.11	grey siltstone

55H 395400 6392800

An isolated outcrop of bedded to thickly bedded (>50 cm) coarse, gritty, partly arkosic sandstone with pebbles and large clasts and a clayey siliceous matrix (Scheibner, 1987). Sorting is very poor. Some beds have low angle planar crossbeds. The thickness of these beds is about 3-4 m, and they dip at 10-15° to the northwest.

55H 398500 6390450

Water Resources Commission bore No 13734 (Scheibner, 1987).

0-4.87	soil and clay
4.87 -94.18	yellow siltstone and shale
94.18-95.09TD	black shale

Gr 3560 9335 (Yard Grid, Nymagee 1:250 000 Geol Sheet)

Water Resources Commission bore No 27506 (Scheibner, 1987).

0-0.91m	sandy soil
0.91-3.34	clay
3.34-8.21	boulder
8.21-19.94	clay
19.94-62.08TD	red sandstone, quartzite and slate.

Southwestern Part of the Mount Allen 1:100 000 Sheet

Intercalations of red and grey to white clay occur in unconsolidated Tertiary deposits underlying sandy flats covered with mallees in the southwestern part of the Mount Allen sheet (Scheibner, 1987).

Southern Part of the Mount Allen 1:100 000 Sheet

Tertiary sediments are concealed beneath mallee-covered flats. During geochemical bedrock sampling west of Matakana Siding (55H 397500 6349050), more than 30 m of unconsolidated sediment were discovered on the edge of sandy flats. They consist of alternating horizons of red and grey clays, and very fine, well sorted, probably aeolian sand, and some grit. These sediments were probably deposited in a lacustrine to fluvial environment, with some aeolian input. Scheibner (1987), states that the erosional surface beneath these sediments is well below the base of present erosion, indicating subsidence since the Tertiary.

Given the presence of a much lower base level along the Lachlan River during the Tertiary, the author considers subsidence is not necessary to explain the presence of this sediment.

55H 392600 6382400

Suppel & Gilligan (1993, p 126) record placer gold in alluvium at least 5 m thick.

KILPARNEY 1:100 000 SHEET AREA

Marobee Range

A strongly silicified, iron stained breccia occurs in creeks around the northern part of the Marobee Range, near 55H 445400 6394300. It comprises angular poorly sorted clasts of quartzite and siltstone in a matrix of unsorted quartz rich sandstone. The rock is strongly iron stained, giving it a deep red colour. The sediment is derived from the Tallebung Group which forms the Marobee Range. The breccia may be cemented stream material, or more extensive cemented talus slope material which has been exposed by the present streams (Trigg, 1987).

Walters Range

A hard siliceous-ferruginous rock caps some of the Devonian Lumga Siltstone along the eastern side of the Walters Range (Trigg, 1987).

Western Side of The Erimeran Granite

A number of small outcrops of silcrete and silica cemented rocks occur on the western side of the Erimeran Granite. The silcrete consists of a framework of granule conglomerate and sand sized angular quartz grains strongly cemented in a siliceous matrix. The framework grains are probably derived from the underlying rock (Trigg, 1987).

55H 406500 6356100

Trigg (1987) reports a sand dune, which is an extension of the considerable system developed to the west.

55H 411000 6391500

55 m of unconsolidated sediment in drill hole recorded by Freytag (1980).

Trigg (1987) considers this is mainly fluvial material.

55H 417700 6375400

Small outcrops of silcrete and silica cemented rocks. The silcrete consists of a framework of granule conglomerate and sand sized angular quartz grains strongly cemented in a siliceous matrix. The framework grains are probably derived from the underlying rock (Trigg, 1987).

55H 424500 6365000

Shafts of considerable but uncertain depth have been sunk in unconsolidated sediment consisting of rounded quartz cobbles and 'dirty' sand. This sediment appears to be outwash material derived from the Boothumble Formation which forms the range of hills to the east (Trigg, 1987).

Suppel & Gilligan (1993, p 157) record placer gold in Quaternary alluvium 30 m thick. The alluvium is characterised at the surface by rounded quartz cobbles and dirty sand. This appears to be outwash material from the Boothumble Formation outcropping to the east.

55H 450250 6399750

Suppel & Gilligan (1993, p130) record placer tin in Quaternary alluvium up to 6.7 m thick.

GINDOONO 1:100 000 SHEET AREA

Tallebung

Tertiary drifts and leads occur under Recent alluvium (Rayner, 1969)

Suppel & Gilligan (1993, p131,133-134) give more details. The depth of alluvial sediment averages up to 23 m, in two joining stream branches.

West of Yellow Mountain – Gindoonoo and Bobadah Sheets

The author visited this area in August 1997. Alluvium in creeks draining west from the mountain consists of angular rock fragments in a sandy matrix. There are numerous exposures of yellowish cemented 'creek rock' conglomerate, both directly overlying Palaeozoic saprolite, and within the alluvial sequence. At one location, 2 m of red alluvium overlying grey ?swamp deposits is exposed. At this locality also, the top 50 cm of exposed alluvium is red grey, with partly hardened pisoliths with granular interiors and goethite skins. Company information indicates that the alluvium thickens to around 50 m beneath the shallow valley west of the mountain.

On the west side of the valley, low bedrock outcrops are surrounded by pediments with a veneer of locally derived sheetwash colluvium, which merges eastwards with alluvium/colluvium of the main valley fill. Several dams in the valley fill on the west side of the drainage axis were dug through calcrete (eg dam at 55H 483675 6398750).

At 55H 482750 6398400 several well rounded quartz granules and pebbles were noted in a shallow drainage depression. The Gindoonoo 1:100 000 geology sheet shows outcrops of silcrete upstream, and it is presumed that this is the source of the pebbles.

AREAS ADJACENT TO COBAR REGOLITH LANDFORMS MAP AREA

BARNATO 1:250 000 SHEET AREA

Belah Trig.

Rayner (1969) reports Tertiary grits capping a hill above Amphitheatre Group, 34 km west of Cobar. Grit and sandstone in stratigraphic table.

Glen (1994) reports partly consolidated bedded and crossbedded Cainozoic sediments at 354000 6510500.

The author has located outcrop of the base of the sediments, in a bulldozer scrape on the north side of the Barrier Highway at about 55J 354656 6510478. The elevation difference between here and the top of the hill was measured (by incremental body height steps using a clinometer set to horizontal) at 18 m, with a probable error of $\pm$ 2 m. The sediments consist of crossbedded white clayey sandstone and conglomerate. Some of the conglomerate, especially towards the base, has numerous rounded 2-7 cm clasts of bleached Devonian saprolite, similar to that exposed *in situ* in gullies on the north side of the highway. The topmost preserved few metres of the sediment is of sandstone only. A NW-sloping cap of porous, moderately hard silcrete is present.

Wilcannia Road.

Rayner (1969) reports thin flat capping of white sandstone above Devonian beds 64 km west of Cobar. The sandstone contains Early Cretaceous foraminifera, determined by Ludbrook.

Glen (1994) reports quartz rich sandstone, boulder and cobble conglomerates found on The Meadows 1:100 000 Sheet area (eg 55H 330400 6507500, dated as Cretaceous by Ludbrook in Rayner, 1969).

The author has found that the grid reference given by Glen is for a large gravel pit excavated in Devonian saprolite, mostly bleached, but with some mottling. However, a few hundred metres west of here, on the old alignment of the highway (south of the gravel pit), a road cutting exposes the unconformity between Devonian saprolite and near-flat-lying sandstone and conglomerate, with pebble to boulder clasts. The rocks have been heavily invaded by calcrete along joints and bedding planes. Another couple of hundred metres west, and **downslope** of the first cutting, is a further cutting with exposure of similar rocks, with no base exposed. Boulders of sandstone (most probably from the Devonian Mulga Downs Group) reaching 1 m size are present as clasts in the sandstone. These are in most cases lone clasts, indicating ice transport. The rocks appear to be fluvial, making the presence of determinable forams a problem. The rocks appear to be too weathered for the preservation of microfossils, but it is probably 40 years since the sample Ludbrook dated was collected. There appears to be considerable relief on the unconformity at the base of the sediments.

55H 290806 6504730

The author visited this site in April 1997. A low relief surface at the top of a breakaway slope is covered with a lag of rounded pebbles, cobbles and boulders to 50 cm, and fragments of silcrete formed in poorly sorted sandstone and conglomerate. Weathered basement rocks are exposed in the breakaway.

55H 291982 6503956

Lag includes rounded pebbles. Author's observation.

55H 322418 6504574

Silcrete clasts to 30 cm are present at crest of rise. Some clasts have dimpled surface with red and yellow patches. There appears to be both silcreted Palaeozoic rock and post Palaeozoic sediment in this area. Author's hurried observation.

55H 336779 6565404

A treeless inclined planar surface cut on dipping Devonian rocks forms the sloping top to a low 'mesa'. Outcrop on the sides of the 'mesa' is reasonably well cemented sandstone, but the inclined top has numerous outcrops of extremely well cemented quartzite, which has the rounded low outcrop pattern of 'groundwater' silcrete. Rare vugs in the quartzite are half filled (geopetally) with ?chalcedony. The 'mesa' top appears to be a planar surface which has undergone silicification similar to silcreting of younger sediments in the area. From the author's notes.

55H 335890 6509578

Low rise, with slopes and top littered with clasts of silcrete formed in poorly sorted sandstone. Silcrete is partly nodular and columnar. Lag only, no in situ silcrete. From author's notes.

55H 334641 6509281.

Low ridge top, with outcrop of hardened sandstone grading to silcrete at the crest, and rare outcrops of poorly sorted (post Devonian) sandstone on the flanks. Lag of silcrete fragments, pebbles of quartz and quartzite, and cobbles and boulders of sandstone originally probably from the Mulga Downs Group, but most probably clasts exhumed from the sediment. This locality is close to the Cretaceous dated outcrop on the Barrier Highway (see above), and is most probably more of the Cretaceous sediment. The Barnato 1:250 000 geological sheet shows areas such as these as silcrete, ignoring the underlying Cretaceous sediment. From the author's notes.

55H 317290 6535810, Mt Gap Station.

Bevelled hill crest, with outcrops of dipping silicified Devonian sandstone, as well as unsilicified sandstone. Silicification has affected areas of rock up to 10 m across, mostly roughly elongated along strike direction. The silicified rock has a light surface colour, and shows in places irregular concentric banding. It has a rounded outcrop pattern, as opposed to the flaggy outcrop of unsilicified rock, which also has a ferruginous patina. From the author's notes.

OTHER AREAS

Tarringo (location not known)

Mention of 'Tarringo Sandstone' in Tertiary section of stratigraphic table in Rayner (1969). No further details known.

Louth

White sandstone under a greybilly capping, and unconformably overlying slate, is regarded as Cretaceous (Rayner, 1969).

APPENDIX III

OXIDATION OF OREBODIES

The following information on oxidation and secondary enrichment in mines in the Cobar area is summarised from Rayner (1969), with additional information from Shields (1996) on Girilambone.

GREAT COBAR

Oxidised to 61 m. Rich copper carbonate and oxide ore down to 85 m, with gold and bismuth minerals. Water level 85 m variable. Secondary enrichment between 61 and 152 m, especially 85 - 122 m; abundant chalcocite with chalcopyrite.

CSA

Oxidised zone to 140 m near main shaft, mainly leached and barren to 122 m. Water levels 131-139 m. Secondary enrichment zone between 128 and 146 m. Deeper oxidation and greater enrichment over CSA and Tinto ore shoots. Greatest copper secondary enrichment at 140 - 147 m. Main development of lead carbonate ore with some chalcocite at 137 - 140 m, in vicinity of water table.

GLADSTONE

Oxidation to over 61 m. Water level between 61 and 79 m. Secondary enrichment, chalcocite with chalcopyrite, between these depths.

NEW COBAR

Water level 99 m and higher.

CHESNEY

Water level 112 m and higher. Oxidised zone barren except for gold to 46 m. Copper carbonates 46 - 76 m. Secondary enrichment at 76 m, chalcopyrite coated with chalcocite and melaconite.

NEW OCCIDENTAL

Water level 98 m.

PEAK

Water level 82 m, most gold from enriched zone of oxidation above this.

QUEEN BEE

Oxidised zone to 76 m, mainly leached limonitic gossan to 27 m, copper carbonates 27 - 46 m. Secondary enrichment 46 - 76 m, copper carbonates and chalcocite. Water level at 76 m, some enrichment below this.

NYMAGEE

Oxidised and lean to 15 m, then secondary enrichment to below 37 m.

SHUTTLETON

Water levels in Shuttleton and Crowl Creek mines 136 -110 m and 101 - 91 m respectively. Oxidation in drill holes to 50 m. Some enrichment to 61 m.

MOUNT HOPE

Oxidised to 82 m. Complete oxidation to 55 m, copper carbonates with kaolin and sericite; partial oxidation and secondary enrichment with some chalcocite 55 - 82 m. Water level 82 m. Minor enrichment to 104 m.

MOUNT BOPPY GOLD MINE

Water level 69 m.

MOUNT BOPPY COPPER MINE

Water level 61 m.

CANBELEGO COPPER MINE

Water level 47 m, secondary enrichment to 61 m.

BUDGERY

Water level 85 m.

BUDGERIGAR

Water level 107 m.

BONNIE DUNDEE

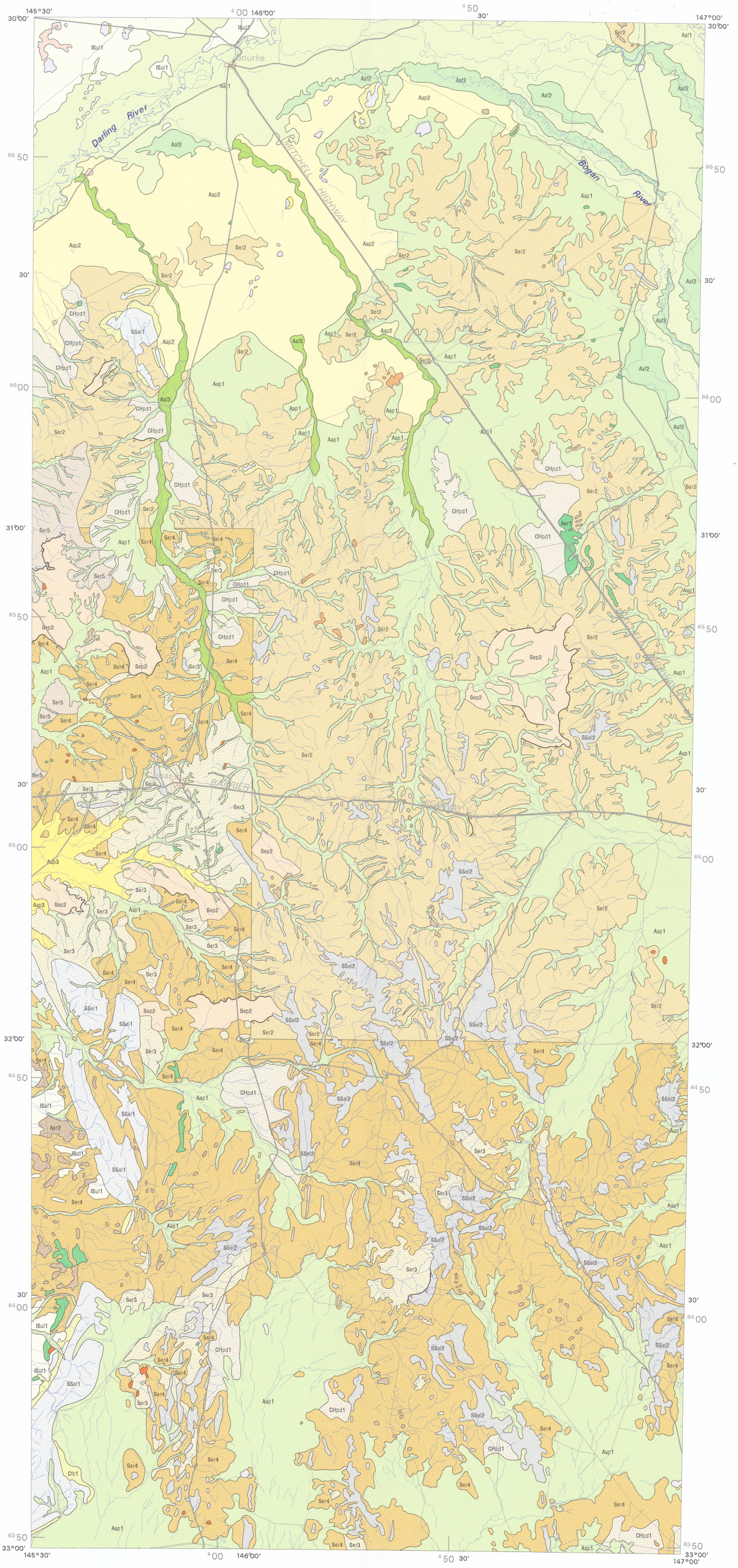
Water level 98 m.

GIRILAMBONE

Oxidation to 61 m. Note, however, that Shields (1996) states that there is a 20-30 m leached zone, and an enriched chalcocite 'blanket' beneath the modern water table at 80-100 m depth.

SECONDARY ENRICHMENT

Secondary enrichment of copper ores is prominent for the Cobar mining field and at Girilambone (Shields, 1996), but less important in the eastern belts of Canbelego, Hermidale and Tottenham. The principal zones of secondary enrichment are at or near water table. The chief copper mineral is chalcocite, formed by the action of descending copper bearing solutions.



COBAR REGOLITH LANDFORMS

TRANSPORTED REGOLITH

Alluvial sediments

Aaf1 — *Floodplain deposits of the Darling/Bogan River system. Grey, pink and black clayey silt and mud, minor loamy sand, up to 10 m thick. Overlies up to 130 m of older Cainozoic alluvial sand, gravel, silt and clay.*

Aaf2 — *Older tracts of alluvium of the Darling/Bogan River system characterised by abandoned meander belts. Reddish brown sandy alluvium. Overlies up to 130 m of older Cainozoic alluvial sand, gravel, silt and clay.*

Aaf3 — *Alluvium of active major stream channels. Bedload of sand and gravel, overbank deposits of sand, silt and clay.*

Aap1 — *Alluvium of minor watercourses and alluvial valley plains. Few active channels; deposition largely from sheet flow during periods of heavy rain. Sand, silt and clay, minor gravel. Gravel component includes detrital maghemite pisoliths. May include some aeolian, colluvial, and residual materials. Thickness varies from less than 1 m in minor watercourses to around 100 m in broad alluvial areas in the south.*

Aap2 — *Slightly undulating plains with 0.5-1 m of possible alluvial red-brown sandy clay and thicker sand drifts, overlying 2-3 m of green/grey plastic clay with gypsum nodules. Abundant small internal drainage areas with lunettes on their eastern sides. Cainozoic and possibly Mesozoic sediments present at depths up to 60 m.*

Aap3 — *Alluvial sediments probably partly reworked by wind, with arcuate vegetation zones.*

Eroded alluvial sediments

Aer1 — *Poorly consolidated alluvial sediments of Tertiary and possibly Cretaceous age, forming cappings on erosional rises. Poorly consolidated sandstone, conglomerate, siltstone and clays.*

Aer2 — *Silcrete and siliceous hardpan cappings on rises. Mostly formed in old alluvial sediments, but also in weathered Palaeozoic bedrock.*

Aeolian sediments

ISul1 — *Aeolian sandplain, characterised by longitudinal dunes. Reddish aeolian sand and silt.*

Iu1 — *Lunettes, consisting of sand and parna on eastern rims of claypans. Locally gypsiferous.*

Lacustrine sediments

Lpp1 — *Lacustine clay, silt and fine sand in claypans. May include an aeolian derived sand component. Locally gypsiferous.*

Colluvial and residual sediments

Cfc1 — *Talus slopes, forming especially around steep hills of Palaeozoic sandstone and conglomerate. Colluvial sand and gravel overlying mostly slightly weathered bedrock.*

CHpd1 — *Gently sloping colluvial plains low in the landscape, with sheet flow colluvial sediments and possibly alluvium to about 6 m thick, overlying slightly to highly weathered bedrock.*

IN SITU REGOLITH

Residual

Rer1 — *Ferruginous gravel lag and ferruginised saprolite. Includes minor areas of possible lacustrine chemically precipitated ironstone.*

Weathered bedrock

Sep1 — *Erosional plains on weathered Mesozoic rocks of Eromanga Basin with surface veneer of residual, colluvial and aeolian sediments. Alluvial and lacustrine sediments locally present.*

Sep2 — *Erosional plains forming drainage headwater areas high in the local landscape. Typically bounded by minor erosional scarps where more active drainage is consuming the plains by headward erosion. Mobile zone around 1 m thick (residual, colluvial and ?aeolian fine sediments, and lag) overlies slightly to highly weathered bedrock. Local alluvium.*

Ser1 — *Rises, low hills and plains of Tertiary lavas, mainly olivine leucitite. Generally slightly weathered. Lavas overlie variably weathered bedrock, and locally, old alluvial sediments.*

Ser2 — *Undulating rises of highly to slightly weathered Palaeozoic rocks overlain by a mobile veneer of residual, colluvial and fine aeolian sediments, and lag. Regolith carbonate and alluvium locally present.*

Ser3 — *Undulating rises of highly to slightly weathered Palaeozoic rocks overlain by a thin (mostly < 1 m) mobile veneer of residual, colluvial and fine aeolian sediments, and lag. Regolith carbonate and alluvium locally present.*

Ser4 — *Undulating rises of highly to slightly weathered Palaeozoic rocks overlain by a thick (mostly > 1 m) mobile veneer of residual, colluvial and fine aeolian sediments, and lag. Regolith carbonate and alluvium locally present.*

Ser5 — *Rises of highly weathered bedrock with mobile veneer of residual, colluvial and aeolian sediments. Numerous small areas of ferruginised saprolite, cappings of silcreted old alluvial sediments and bedrock, and dispersed clasts from old alluvial sediments. Regolith carbonate locally present.*

SSel1 — *Steep low hills and hills of slightly weathered Devonian Mulga Downs Group. Transported regolith veneer of colluvium and local alluvium.*

SSel2 — *Low hills and hills of slightly weathered Palaeozoic bedrock older than Mulga Downs Group. Transported regolith veneer of colluvium and local alluvium. Elevation and relief increases to the south.*

Regolith-landform unit boundary
Erosional scarp
Watercourse
Highway
Major road
Secondary road
Railway
Abandoned railway
Cobar *Town*

LANDFORMS

DEPOSITIONAL LANDFORMS

af *Alluvial flood plain*
ap *Alluvial plain*
ul *Aeolian sand plain*
u *Lunette*
pp *Lacustrine plain*
fc *Colluvial fan*
pd *Depositional plain*

EROSIONAL LANDFORMS

ep *Erosional plain (< 9 m relief)*
er *Erosional rise (9-30 m relief)*
el *Low hill (30-90 m relief)*

SCALE 1:500 000

10 0 10 20 30 40 50 Kilometres

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
LATITUDE OF ORIGIN: 0°. LONGITUDE OF ORIGIN: 147°

AMG grid ticks and values are shown in grey at 50 kilometre interval

Compiled by D.L. Gibson (CRC LEME/AGSO) 1995
Revised by D.L. Gibson (CRC LEME/AGSO) 1998
Cartography I.B. Hartig (AGSO), 1995, and L.M. Highet (AGSO), 1998

It is recommended that this map be referred to as:

D.L. Gibson, 1998 - Cobar Regolith Landforms (1:500 000 map scale). Cooperative Research Centre for Landscape Evolution and Mineral Exploration, (CRC LEME) Perth/Canberra

The author acknowledges the assistance of Dr K. McQueen (CRC LEME/University of Canberra) in the compilation of this map

Regolith landform polygons based on interpretation of 1:80 000 panchromatic aerial photographs and published geological data, with limited field checking. This map provides a broad overview of regolith landforms around the Broken Hill area. Boundaries and polygon descriptions are generalised to show the main regolith type and physical processes

Copies of this map may be obtained from:

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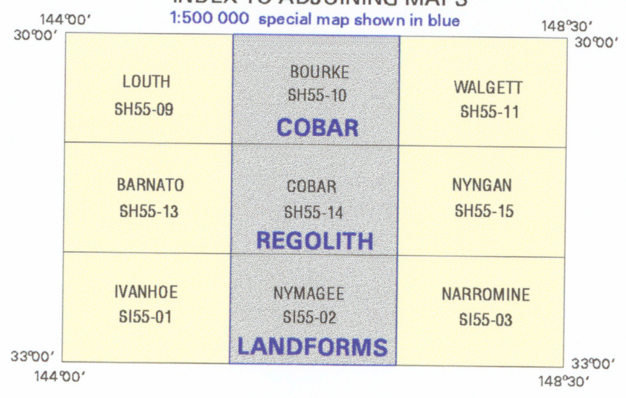

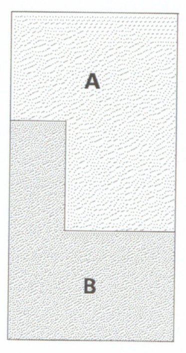

RELIABILITY DIAGRAM

A : *Airphoto interpretation, 1:250 000 metallogenic and geological sheets Limited field checking*

B : *Airphoto interpretation 1:250 000 metallogenic sheets, 1:250 000 and 1:100 000 geological sheets. Limited field checking*

MAP LOCALITY

WARNING: Colour may deteriorate with prolonged exposure to light and moisture

CRCLEME

MINERAL RESOURCES

AGSO AUSTRALIAN GEOLOGICAL SURVEY ORGANISATION

COBAR
REGOLITH-LANDFORMS
1:500 000 SPECIAL
REVISED MAP SEPTEMBER 1998
SUBJECT TO AMENDMENT