AUTHOR

Rept.Bk.No. 69/1
G.S. No. 4259

RIB 6911

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY

REGIONAL SURVEYS DIVISION

PRELIMINARY NOTES ON THE OAKVALE 1:63,360 SHEET

by

R.A. CALLEN
GEOLOGIST
REGIONAL MAPPING SECTION

DM.590/68

10th July, 1969

69/1

DEPARTMENT OF MINES
SOUTH AUSTRALIA

RIB 6911

PRELIMINARY NOTES ON THE OAKVALE 1:63,360 SHEET

by

R.A. CALLEN
GEOLOGIST
REGIONAL MAPPING SECTION

CONTENTS

FIGURES

No.	Description
1	Undulating Pleistocene surface
2	Pooraka Formation
3	Possible Loveday Soil
4	Tertiary Sandstone
5	Giant polygonal cracking
6	Giant polygonal cracking
7	Clay pan and sand dune

PLAN

No	Title	Scale
	Geological map OAKVALE	1:63,360

Rept.Bk.No. 69/1
G.S. No. 4259
D.M. No. 590/68

10th July, 1969.

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rpt.Bk.No. 69/1
G.S. No. 4259
D.M. No. 590/68

PRELIMINARY NOTES ON THE OAKVALE 1:63,360 SHEET

ABSTRACT

Flat-lying Tertiary sandstones crop out in the Southwestern corner of the Oakvale 1 mile sheet, the remaining area being almost entirely Pleistocene.

Definition of Quaternary units is difficult due to lack of outcrop, and possible variations in lithology as one moves inland from the Murray River Area. Auger holes are recommended in order to clarify this.

The stratigraphic sequence defined from surface outcrop is as follows:

Recent salt and gypsum crusts and minor alluvium in clay pans and waterways, together with low red-brown sand dunes and drift sand form a minor proportion of the cover, overlying the very extensive Pleistocene Pooraka Formation, in which the Loveday Soil (?) horizon is developed. Outcrops of Bakara calcrete occur, sometimes calcreting Tertiary ferricretes. Blanchetown clay is found in many of the dams, but is not of sufficient area to depict as outcrop. It can be seen to be underlain by an unusual variegated mottled silty clay with tubular structures at one locality.

The Tertiary is represented by brown and white micaceous clayey and ferruginous sandstones, having a silcreted upper surface, which is, in turn, often ferricreted.

INTRODUCTION

Mapping of the Oakvale 1:63,360 sheet took place in January - March 1969, involving 15 days of mapping time, and was undertaken as part of the Olary 1:250,000 project.

Station homesteads included within the area were: Most of the Oakvale station, the northwestern corner of Oakbank and a small southern portion of Mutooroo.

Procedure

Black and white colour aerial photographs were studied stereoscopically in the office. All features of geological interest were noted for checking in the field, without marking the photos.

The aeromagnetic map was examined, and location and shape of highs noted. In the southwestern corner, low confused anomalies suggested flat-dipping rocks. Bore records indicated Tertiary could be present. White areas between dunes were suspected to be outcrop. Dunes were restricted to the south-western corner of the sheet.

Two paper prints of base maps were used, one for marking planned routes to ensure the minimum of overlap in driving along tracks, the other for marking on the actual route taken. Additional information on tracks and bores obtained from local sources was put onto the first map for checking before transfer to air photos.

Procedure in the field involved driving along all tracks marked on the base-map or air photos, correcting routes, tanks, bores, etc. where necessary. Geology was marked in the usual manner.

Physiography

The area can be divided into three physiographic regions:

(1) Gently undulating plains with thick mulga and black oak, with an understorey of bluebush and needlebush. Areas of "swallow" holes occur into which surface water sinks, to reappear in the watercourses and depressions.

(2) Watercourses and depressions - The former are areas where surface runoff is concentrated, there being no well defined creek beds. Depressions or clay pans are mainly concentrated along the southern edge of

the sheet. These features are thought to be unchanged since Pleistocene times. Vegetation inlcudes "Water" bush (Hakea sp.), Myall (Acacia hoderi), Casurina, etc. (Fig. 7).

(3) Slightly more undulating country with up to 30 feet of relief and a cover of reddish sand drift and low, distinct dunes. Occasional areas of sandstone outcrop and float material occur. Mallee and spinifex are dominant in the sandy areas, otherwise vegetation is similar to (1) above. (Photo - fig. 1.).

(4) Erosion is very slight, due to lack of well defined watercourses, flat terrain, and presence of dense scrub. Water sinks through the surface soil, and comes to rest on the top of the Blanchetown Clay, eventually finding its way into the clay pans and watercourses.

STRATIGRAPHY

1. Recent Qra: Thin veneer of salty and gypseous material, with minor locally derived alluvium (Fig. 7 - see earlier references under physiography).
2. Recent Qrd: Dunes and sand drift derived from Qpp. Reddish-brown, with north face steeper than south face. Some dunes appear to contain calcrete, and may be older, or perhaps are Bakara calcrete ridges overlain by sand veneer (Fig. 7).
3. Pleistocene Qpp: Pooraka Formation (Fig. 2) - red-brown clayey sand to grit. Possibly confused in some small areas with Recent outwash derived from basement areas to north and west. e.g.James Dam section -

    0 - 1 or 2 feet. Red-brown sandy soil.

    2 - 3 ft. Calcareous soil with kunkar nodules and rounded quartz and ironstone gravel (¼ - ½ inch grain size).

Recent outwash or Pooraka Formation?	3-10 ft.	Red-brown slightly indurated angular grit, mainly quartz fragments, sub-rounded to angular 0.1-0.5 inches, poorly sorted with mica and feldspar (?) fragments common (mica less than 1%).
Blanchetown Clay	10-18 ft.+	Red clay with greenish streaks and sub-rounded quartz grit (5%) up to one inch diameter.

The Loveday Soil, represented by calcareous or ropy mottling (not hard calcrete), occurs in gypsiferous yellow-brown soil on some dams in the northeastern section. The calcreted gravelly horizon may also belong to this soil.

4. Calcrete of the Bakara Soil - QCa: Nodular calcrete forming well developed spheres, cemented into larger blocks. Sometimes nodules have quartz-ironstone gravel in their centres (possibly Telford Gravel). Developed in sandy yellow-brown soil, on ferricrete or on silcreted bedrock. The sequence at Corner Dam Dugout follows:

0 - 1 ft. Porous yellow-brown sand with clay. Calcrete nodules becoming common near base.

1-2ft.8ins. Blocky calcrete - nodular calcrete spheres with sandy centres cemented into sheet in top 10", but becoming ropy towards base, with 50% sandy yellow-brown soil.

2ft.8ins.-3ft.8ins + Yellow-brown sand with 25% ropy calcrete (vertically arranged).

5. Blanchetown Clay Qph: Reddish clay often mottled blue. Sandy and gritty in places. Occurs in several dams (e.g. Mulga Dam).

6. Qp? Mottled red-brown, white and yellow sandy clay with tubular structures and pellets. The sequence in Mulga Dam (east) is as follows:

Pooraka Formation	0-2½ ft.	Hard red-brown clay with patches of quartz sand to grit (well rounded).
Blanchetown Clay	2½-13 ft.	Mottled bright red-brown and white clay. Breaks with shiny fracture. Indurated.
Qp?	13-16ft.+	Mottled moderately indurated bright red-brown and yellow to white sandy and silty clay. Red Clay fills cracks. Numerous tubular and peletel structures with no obvious orientation are filled with yellowish silty clay. Sand and silt are of rounded quartz grains.

7. Ferricrete Tfe: Nodular ferricrete containing sand grains; found coated with calcrete in one locality, showing calcrete was later development.

8. Yellow nodular silcrete Tsi_1: Yellow nodular cavernous silcrete pieces intermingled with Pooraka sand and silcreted ferruginous sandstones. Not found outcropping. Older than dunes, yellow colour suggests Tertiary. Restricted in area.

9. "Duricrust" silcrete Tsi_2: White and reddish silcrete, very hard, developed on sandstones. Sometimes with ferricreted upper surface.

10. Tertiary Sandstone (See AMDEL Report MP.3092-69 Spec. (P.19, 20, 21/69): White kaolinitic fine-grained sandstone, and reddish ferruginous micaceous laminated medium-grained sandstone. (Fig. 4). The relationship between these

sandstones could not be observed, although the presence of red sandstone on the Mulga Well dump in an area of white sandstone outcrop suggests the red sandstone is lower in the sequence.

Red sandstone outcropping near Dinnertime Plain was removed for use in building the old Oakvale Homestead. The outcrop appears to have a dip slope on its southern side, indicating an attitude of 2-5° to the south.

DISCUSSION

1. Dunes: It is not certain whether the dunes have a calcrete layer within them. The sand they consist of is not calcareous in the upper part, but a pit or auger hole is required to define internal structure and test for calcite.

2. Limestone (Specimen 152/5/7663/3) - A pink sandy limestone occurs in lenticular blocks in what has been assumed to be Pooraka Formation. It occurs in the same horizon as a quartz-ironstone gravel with nodular calcrete, as follows:

   0 - 2½ ft. Red-brown soil with scattered calcreted quartz pebbles, contains 50% or more of sub-rounded quartz grit.

   2½ - 3 ft. Calcreted quartz and ironstone gravel, angular to sub-rounded fragments, often in two layers - stream gravel? Patches of pink blocky calcrete.

   3 - 4 ft.+ Bright, red-brown clay, fractures to give shiny lustre. Contains angular quartz grit and sand, but not as common as 0 - 2½ ft.

   The limestone also occurs on walls of Pigeon Dam, suggesting it is fairly widespread.

   The age is thought to be about that of the Ripon Calcrete, or else a calcrete within the Blanchetown Clay. This would make the red clay horizon beneath it equivalent to the Blanchetown or Hindmarsh Clay, and the overlying 2-3 ft. of material the Pooraka Formation.

However, it is possible that the whole sequence is a new unit, or that the calcrete is derived.

The calcreted gravels (Figs. 2 and 3) in the same horizon as the limestone have been recorded elsewhere, but do not have mappable boundaries. They can be confused with weathered Telford Gravel on the surface, and are possibly Loveday Soil or have been recently calcreted. See top P. 8

3. Telford Gravel: Patches of calcreted quartz gravel and cobbles occur, in which the calcrete is of a solid blocky nature. Also cobbles and pebbles of schist, dolomite, quartzite, quartz and gneiss are strewn over the Oakvale depression and in the dumps of many of the dams.

These deposits may be Telford Gravel, but their stratigraphic context is difficult to interpret due to poor outcrop.

4. Areas of "swallow holes": occurring on slight rises in areas of Pooraka Clay in many places. Some of these areas can be outlined on the air-photo (e.g. on 152/5/7663) and appear to be a somewhat different soil type - often greyish in colour.

In one place very large polygonal cracks (Figs. 5 and 6)
8 are developed, 2 - 300 ft. in diameter and 1½ - 2 ft. wide by 1 - 2 ft. deep. Tree roots and infilling on tracks indicate recent enlargement. These cracks provide a soil section which exhibits a calcreted gravel horizon, sometimes developed into solid nodular blocky calcrete masses similar to Bakara Soil calcrete found at the Corner Dam Dugout, but generally very thin.

The size of the polygonal cracks suggests a deep-seated shrinkage phenomenon resulting from alternate water-logging and drying of underlying soil. The presence of mallee suggests that, at depth, a soil different from that on the surface occurs. The mallee is a different species to that occurring in the southeastern corner of the sheet.

The impression is that Pooraka Formation forms a thin veneer over the Bakara surface, beneath which occurs a sandy upper member of the Blanchetown Clay; or else the calcrete is a new calcrete horizon developed within Pooraka Clay. The former hypothesis would account for the development of pink limestone in this horizon as described under 3 above, but the horizon is too thin and sporadic to be called Bakara Calcrete. Another possibility is that the blocky calcrete is derived material, and that the horizon is simply a limy Recent development caused by calcium carbonate bearing groundwater passing through porous gravel, or else it is the Loveday Soil horizon.

Insert before 3. on p. 7.

5. Bore logs: The location of bores and wells is shown on the map. Mulga Bore, Mulga Well and Brook Bore were visited, the latter being the only one in use. A water sample was taken from here and has been analysed.

According to numbers on the bore index cards, 106 (Mulga Bore) and 108 (Mulga Well) are wrongly positioned on the Mines Department bore locality map.

Number 109 was not visited, but is recorded as a bore, not a well, by the Manager of Oakvale Station. It is thought that 109 applies to Oakvale Well at Oakvale Station. Billings Bore (105) is therefore also wrongly located, and should be in the position of 109.

The log of Mulga Bore (106) indicates the Pooraka Formation (?) is 15 feet thick, and the ferruginous sandstone 75 feet thick (with possibly 50 feet of overlying white sandstone). The sequence then passes into black bituminous (?) sands and glauconitic (?) clay with shelly fossils.

Mowpa - Mannum L/S. = See Murray Lindsay - River Valley Chaundle & Mutaroo

Mulga Well log records the same thickness of Pooraka Formation and sandstone, and encounters black sands at the same depth. O'Driscoll (1960) places the black sand in the Knight Formation, which would put the green clays in the Lower Cretaceous. The overlying sandstone could

Not T + this old up here

Otway Basin.

be either Loxton Sand or Nelson Sandstone equivalent. This suggests foraminifera could be present in the outcropping sandstones. However, leaching and ferruginisation of the outcrop has probably destroyed them, and the nature of the sediment is such that only non-diagnostic foraminifera are likely to be present.

The sequence at Brook's Bore is very similar.

O'Driscoll records:

0-110 ft.	Recent and Pleistocene.
110-360 ft.	Pata Limestone Equivalent.
360-406 ft.	Ettrick Marl Equivalent.
406-420 ft.	Knight Group.

The upper 110 feet would now be recorded as :-

0-10 ft.	Pooraka Clay.
10-35 ft.	Blanchetown Clay ?
35-110 ft.	Tertiary sandstone.

Well No. 109 records :-

0-10ft.6ins.	Clay (Blanchetown Clay?)
10'6"-13 ft.	Ironstone conglomerate (Ferricrete?)
13-20 ft.	Bright yellow clay (?)
20-40 ft.	White sand (Tertiary sandstone?)

The depths of the various recognisable horizons indicate the regional dip is very slight.

Projecting Pledges (1965) sections across the Chowilla 1:250,000 sheet into Oakvale indicates that he would consider the sandstones as part of the Recent. This is unlikely since silcretes of probable Tertiary age are developed on the sandstone surface and overlain by Blanchetown Clay.

CONCLUSIONS

In order to differentiate between the various Quaternary units and resolve some of the problems outlined above, it is suggested that five mechanical auger holes be drilled

through the Quaternary cover. They could be placed as follows:-

1. On top of one of the well-developed sand dunes near the N.S.W. Border.
2. In the vicinity of Mulga Dam.
3. Adjacent to the location of specimen 152/5/7663/3 on the higher ground.
4. As for 3, in the depression.
5. In the area of polygonal cracking.

These would test the stratigraphic relationship of the Quaternary sandstone containing animal burrows, depth to Tertiary near Mulga Dam, position of the calcrete-limestone horizon in the sequence, and differences between rises and depressions.

REFERENCES

O'DRISCOLL, E.P.D., 1960. The hydrology of the Murray Basin Province in South Australia. Bull. geol. Surv. S.Aust., 35.

PLEDGE, N.S., 1965. Chowilla 4-mile sheet - preliminary report. Geol. surv. S.Aust., unpub. Rept. 60/10.

R.A. CALLEN
GEOLOGIST
REGIONAL MAPPING SECTION

RAC:JMM
10.7.69

Figure 1.

photo 20408
slide 8736

Undulating Pleistocene surface, southwest corner of Oakvale Sheet. Dune in foreground is superimposed on the Pleistocene surface. Border fence with N.S.W. on right, actual border is 200 feet to left of road. Looking north.

Figure 2.

photo 20397 Slide 8726

Pooraka Formation outcropping in bank of channel. Scale 6" long. Note gravel layer near base, pebbles coated with calcite.

Figure 3.

photo 20398
slide 8727

Highly calcreted gravel horizon developed near Canegrass Dam. Bank about 2'6" high. Possibly Loveday Soil.

Figure 4.

photo 20403
slide 8732

Tertiary ferruginous, porous sandstone. Outcrop in centre. Pile to left has been quarried for use in old Oakvale Homestead.

photo 20402
slide 8731

Figure 5.

Giant polygonal cracking in Mallee area 5 miles north of Oakvale Homestead, looking east. Note join between two crack systems. Pooraka Clay Formation on surface.

photo 20401
slide 8730

Giant polygonal cracking. Note tree roots and mallee growing from crack, indicating recent shrinkage, or else doming caused by swelling of underlying clays.

photo 20404
slide 8733

Figure 7.

Typical mulga, myall and black-oak vegetation - dune in background, clay pan in foreground.

Gilgai Soils commerce

APPENDIX

AMDEL REPORT MP.3092-69

Sample: P19/69: TS.22779 RC.152/4/7673/1

Location:

Olary four-mile Oakvale one-mile, 182 chains on 322°T from Lubra Dam.

Rock Name:

Ferruginous sandstone

Hand Specimen:

Friable, brown sandstone.

Thin Section:

An optical estimate of the constituents gives the following:-

	%
Detrital quartz	70-80
Detrital mica	Trace
Detrital lithic grains	Trace
Detrital feldspar	2-3
Tourmaline	Trace
Opaque grains	1-2
Zircon	Minute trace
Iron oxide	5-10
Interstitial clay	5-10

The rock is composed mainly of angular to subangular quartz grains (0.05-0.2mm) which have been moderately well sorted and loosely packed. There are a few flakes of partly altered muscovite, lithic grains (mainly quartzite) and cloud feldspar grains.

Opaque grains have been largely replaced by leucoxene and iron oxide. Rare tourmaline grains are angular. Very fine grained iron oxide surrounds many detrital grains. Interstices are not completely filled with clay. There has been little, if any, compaction and no inter-penetration of grains. There is no evidence of metamorphism.

Sample: P20/69: TS.22780: RC.152/5/7669/3

Location:

Olary four-mile, Oakvale one-mile, 202 chains on 18° from Brook Bore.

Rock Name:

Sandstone

Hand Specimen:

Porous brown sandstone.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	70-80
Goethite	5-10
Sericite or hydromica	1-2
Cavities	10-15
Zircon	Minute trace
Opaque grains	Minute trace

Detrital quartz and rare, meta-quartzite grains (0.1-08 mm) are sub-rounded to subangular and generally surrounded by a thin (0.01 mm) layer of goethite which is continuous between grains and which lines most interstices.

In general the quartz grains are separated by the layer of goethite and are not closely packed. There has been no interpretation of welding of grains.

Traces of sericite or hydromica form thin layers on goethite lining some interstices and fill others. In hand specimen, many interstices do not contain minerals, and the rock is therefore porous. There is no evidence of metamorphism.

Sample: P21/69: TS.22781: RC.152/15/7670/2

Location:

Olary four-mile, Oakvale one-mile, 66 chains on 148° from Purple Catch.

Rock Name:

Ferruginous argillaceous sandstone

Hand Specimen:

Pale-grey, gritty clay, stained yellow to brown with iron oxide in places.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	40-50
Clay and sericite	50-60
Zircon	Trace
Sphene	Trace
Opaque grains and leucoxene	Trace
Goethite	1-2

Detrital quartz grains 0.1-0.3 mm are subangular to sub-rounded and are very loosely packed in a matrix consisting mainly of cloudy, pale buff-coloured clay which has partly recrystallised to very fine grained sericite or hydromica, particularly in zones of stress between some detrital grains

There are rare, subrounded and fractured zircons, opaque grains and very rare detrital grains of sphene. Leucoxene has replaced a few opaque grains. Most of the quartz grains are surrounded by a film of red iron oxide and this also occurs along irregular joints.

Goethite has filled a few small cavities and open fractures.

In parts of the rock the clay matrix has been heavily stained by iron oxide.

There has been no interpenetration or welding of quartz grains and no evidence of metamorphism.

Sedimentary rock.