DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

REPT.BK.NO. 831
BOOKARTOO OCHRE DEPOSIT -
SEC. 85, HD. PARACHILNA

GEOLOGICAL SURVEY

by

J.L. KEELING

MINERAL RESOURCES

NOVEMBER, 1984

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DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

Rept. Bk. No. 831
D.M.E. No. ~~36/61~~ 1502/63
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BOOKARTOO OCHRE DEPOSIT
SECTION 85 HUNDRED PARACHILNA

ABSTRACT

Bookartoo ochre mine, 19 km southeast of Parachilna, South Australia was a traditional source of ceremonial decoration for aborigines of central and eastern Australia.

The deposit is currently held by the Aboriginal Lands Trust and is excluded from operation of the Mining Act.

Red-brown ochre, primarily earthy hematite with minor calcite and silica infills joints and fractures in dolomite directly below the contact with overlying mottled limestone, both lower facies of Wilkawillina Limestone of Early Cambrian age.

Hematite and associated minor willemite mineralisation probably formed by arid weathering and redistribution of sulphide ore precipitated from mineralising fluids in karst-type cavities and collapsed breccia at the top of the dolomite unit.

The deposit is small and low grade but has large inferred reserves for traditional aboriginal uses.

INTRODUCTION

Bookartoo ochre deposit is one of the oldest mining sites in Australia being the focus in South Australia of an extensive trade network that existed in Aboriginal Australia.

Bookartoo was visited in October 1983 during regional mapping of the western face of Hysen Range in the Flinders Ranges National Park; part of Stage 1 of an exploration program for lead/zinc mineralisation.

On 28 October 1983, the area was mapped and workings stadia surveyed by P.P. Crettenden (Technical Assistant) assisted by R.L. Wildy (Chief Geologist, Mineral Development and Economics).

The ochre deposit is excluded from operation of the Mining Act and was mapped to record this site of historical and geological interest.

LOCATION AND ACCESS

Bookartoo is located on the western face of Heysen Range in section 85, hundred Parachilna, county Taunton, part of the Flinders Ranges Planning Area.

Workings are approximately 8 km north of Brachina Gorge and 19 km southeast of Parachilna and are accessed from Brachina Gorge road by taking a northerly heading track 9 km east of the junction with the main Hawker to Leigh Creek road (Figs 1 & 2). The track is followed for approximately 7 km where it intersects a four wheel drive track heading easterly to the foot of Heysen Range a distance of about 5 km. The final 1.1 km is made on foot climbing 200 m up into the fore-hills of Heysen Range.

HISTORICAL BACKGROUND

Reddish brown ochre from Bookartoo has a distinctive colour and shiny appearance when painted on the body and was highly prized by aborigines of central and eastern Australia who adopted it as traditional ceremonial decoration.

At the time of white occupation of Australia, trade in Bookartoo ochre was widespread and the origins of the deposit an integral part of aboriginal mythology.

Two versions of the myth outlined below have a common theme of Bookartoo ochre forming from blood spilt from a slain dog.

Marindi the big dog challenged the gecko lizard Adno-Artina which lived in the valley; the lizard killed the dog and his blood dyed the rocks on the bank of the creek and from this the red ochre is obtained to this day (McCarthy, 1939).

An old woman and her two dogs, one red and one black, came from the north-west and arrived at Mount Patawarta north of Blinman. As she travelled south the dogs killed any people encountered and the old woman assisted in eating the victims. The people, by smoke signals and messages, managed to keep out of the path of

the cannibal woman, but as she approached Karuma, one of the main camping areas near Blinman, the people decided to make a stand and attempt to kill the woman and her dogs rather than leave the favoured area of good water and much game. Two men, Kudna (bearded dragon) and Wulkinara took their boomerangs and went out to meet the savage trio. Kudna climbed a tree and made a noise to attract the dogs while Wulkinara hid behind a bush. As the red dog approached Kudna, Wulkinara stepped from his hiding place and threw a boomerang cutting the dog in half. The same tactic was employed to kill the black dog. Kunda and Wulkinara then killed and burnt the old woman.

At the place where the black dog's blood was spilt a deposit of black wad (manganese oxide) formed while the red dog's blood formed a deposit of red ochre. Both were used for decorating bodies for dancing and during initiation of young men (Tindale, 1937).

Bookartoo ochre deposit belonged to the Blinman aborigines, a subdivision of the Kooyiannie and presents were sent to them from other tribes in return for permission to mine.

Members of these tribes travelled many hundreds of kilometres from central Australia, northeastern South Australia, New South Wales and from as far away as Charleville in southwestern Queensland. The expeditions often travelled through hostile territory with whose owners they had to fight unless they followed the regular trade routes for barter.

The Dieri sent expeditions away in July or August of each year southwards to procure red ochre, a distance of 500 km. Seventy or eighty picked men were sent under a great leader. Ochre was dug from a big deposit (at Bookartoo) then kneaded into large cakes weighing when dry 30 to 35 kilograms which were carried on the head (McCarthy, 1939).

As white settlement spread through the Flinders Ranges and central Australia, confrontations with aboriginal tribes were numerous and expeditions for ochre dwindled and eventually ceased.

The first white men to visit the ochre mine were Kissane and Harding who negotiated with an aborigine from Queensland to lead them to the deposit (Masey, 1882). They subsequently employed

the services of Dr. George Ulrich (geologist) to sample and report on the deposit; he described the workings as follows:-

'There are four narrow openings or burrows made by the natives in extracting the stuff for painting their bodies and between these places the deposit is from eight to twelve feet thick. Judging from the native workings and its relation to the country rock - a brown sandstone - the deposit seems to me to have less the character of a lode than that of a layer, i.e. similar to a coal seam lying between the strata and dipping with them at a rather flat angle into the hill' (Masey, 1882).

Following examination of samples, Ulrich concluded that the friable ochre filled narrow seams traversing a hard band of almost pure hematite with minor calcite. Under the microscope, he detected small beads of mercury.

Ochre samples were analysed by James Cosmo Newbery (Technological Museum, Melbourne) who reportedly confirmed the presence of 0.5 per cent mercury in one sample and a much lesser amount in another (Masey, 1882).

Masey acquired an interest in the deposit and an account of his visit to Bookartoo ochre workings together with details of its past history were reported in the Adelaide Observer in June 1882 (Masey, 1882).

No further work appears to have been done prior to June 1904, when A. Raeck pegged and registered mineral claim (MC) 5562 of 40 acres covering the deposit.

This resulted in considerable unrest among the aboriginal community and prompted R. Matheson of Wilpena to write to E.L. Hamilton (Protector of Aborigines), on 8 August 1904 requesting that the area be reserved for exclusive use by aborigines.

F.R. George, (Assistant Government Geologist) was sent to inspect the site and reported in January 1905 that the claim appeared abandoned and recommended that it be revoked (O'Neil, 1982). Geological observations extracted from George's report appear in Jack (1928).

Following George's recommendation, the claim was cancelled and an area of approximately 8 ha (20 acres) was withdrawn from the operation of the Mining Act and reserved for aborigines.

Today, the deposit appears much as described by Masey in 1882. A crowbar and shovel with rotted wooden handle may well have been those used by Masey to collect samples.

The only recent geological work in the area was regional mapping, sampling and limited shallow diamond drilling by Electrolytic Zinc Co. of Australasia Ltd. in 1970 (Electrolytic Zinc Co., 1972).

MINERAL AND LAND TENURE

MC 5562 of 16.2 ha. (40 acres) was registered for A. Raeck of Waymouth Street, Adelaide on 7 June 1904.

Two claim pegs were located by George during his inspection in 1905 and the only workings other than that done by aborigines was a small vertical pit about 2 m deep (Jack, 1928).

The claim being abandoned, George recommended cancellation and on 26 January 1905 an area of 8 ha (20 acres) covering the ochre mine was withdrawn from operation of the Mining Act.

Three claim pegs located during recent mapping and shown on Figure 3 may be original corner posts of MC 5562 but any identifying marks have long since been obliterated.

On 14 April 1938, section 85, hundred Parachilna was proclaimed an Aboriginal Reserve and on 20 May 1976, the Aboriginal Lands Trust initiated action to transfer the reserve to the Trust.

In the process of examining the proposal, the ochre mine was discovered to be outside the reserve boundaries as shown on existing plans and in February 1977, the mine site was resurveyed and plans amended.

On 1 March 1979, section 85 covering 8.091 ha centred on the ochre mine was granted to the Aboriginal Lands Trust.

Section 85 is within the boundaries of the Flinders Ranges National Park but is excluded from the park.

REGIONAL GEOLOGY

The geological setting shown in Figure 2 was adapted from PARACHILNA (Dalgarno and Johnson, 1966) and Parachilna (Dalgarno and Johnson, 1965).

Bookartoo ochre deposit is located in lower Hawker Group carbonates of Early Cambrian age forming the front range of hills on the western face of Heysen Range.

The Hawker Group overlies Pound Subgroup, shallow water sandstone and quartzite of Adelaidean age, and represents a return to marine conditions in Cambrian times (Forbes, 1972). Basal member of the Hawker Group is Parachilna Formation, an argillaceous sandstone with minor oolitic and shaley lenses characterised by vertical worm burrows. This is overlain by Wilkawillina Limestone massive, clean limestone commonly dolomitic near the base and in part recrystallised to marble and containing fossil biohermal banks of archaeocyatha

Wilkawillina Limestone is in turn overlain by a thin basal limestone unit of Billy Creek Formation part of the predominantly sandy Lake Frome Group of Middle Cambrian age.

The rocks were deformed during Late Cambrian to Early Ordovician times into broad open folds about approximate north-south fold axes and Heysen Range, dipping westerly at 40 to 60 degrees, forms the eastern limb of a northerly plunging syncline.

SITE GEOLOGY

Geology of the mine area is shown on geological plans (Figs. 3 and 4) and sections (Fig. 5).

Wilkawillina Limestone comprises, from the base, light brown to light grey, flaggy-bedded, sandy dolomite overlain by pale brown to yellow brown dolomite showing algal laminations, thin calcrete horizons and discontinuous magnesite-chert beds 1 to 2 m thick.

The dolomitic units, equated with Woodendinna Dolomite facies (Haslett, 1975, Workum, 1981) are overlain by pale grey to dark grey nodular limestone in yellow-brown matrix interbedded with clean, partly recrystallised limestone with archaeocyatha.

The contact between dolomite and mottled, silty limestone appears to locally control hematite mineralisation recorded at several locations generally at or within 100 m of the contact (Fig. 3).

Mottled limestone grades upward into clean massive crystalline marble in turn overlain by massive recrystallised limestone with abundant archaeocyatha.

Bedding strikes from 140 to 010 degrees, dipping at 40 to 60 degrees west.

The ochre workings are located immediately below the dolomite/mottled limestone contact in an area of strong reddening caused by disseminated hematite mineralisation (Fig. 4, Plate 1). Principal excavations, covering approximately 80 m^2 are at one end of a 4 m thick quartzite lens in dolomite and comprise three or four burrows which have since collapsed into four shallow pits now less than 2 m deep (Plate 2).

Five metres south is the entrance to a small underground working 2.4 m deep by 1.2 m wide and 1.5 m high (Plate 3). Here, earthy hematite (ochre) mixed with red and white calcite was gouged from joints and fractures 0.2 to 0.6 m wide in pink dolomite.

A smaller burrowing in hematite stained dolomite was found 22 m east of the underground workings (Fig. 4).

South of the ochre workings is an extensive area of carbonate breccia 180 m long by up to 60 m wide elongated along strike. The breccia comprises subrounded to subangular limestone and marble clasts varying from a few centimetres to several metres diameter (Plate 4) in a red-brown matrix of crystalline calcite with minor hematite pigmentation.

The rounded nature of the clasts and the fact that they appear to be exclusively of overlying lithologies suggest that the breccia formed by collapse.

Two pods of willemite (zinc silicate) mineralisation crop out on the eastern margin of the breccia, the larger being 15 m long by 3 m wide and the smaller, associated with calcite veins is 1 m long by 0.5 m wide (Fig. 3). Other willemite occurrences were recorded in mottled limestone north and west of the ochre workings (Fig. 3).

DISTRIBUTION AND NATURE OF IRON MINERALISATION

Areas of strong and moderate reddening were delineated within the area of the ochre mine (Fig. 4). Weaker iron mineralisation, primarily as a coating on joints, extends for approximately 100 m north and 300 m south along strike outside the area mapped and is present throughout the matrix of the carbonate breccia.

Iron mineralisation was identified by X-ray diffraction to be hematite in all samples collected from the area of workings (Table 1).

Within zones of strong reddening, hematite is found:

- ... impregnating and partly replacing host dolomite, limestone and sandstone .
- ... as earthy deposits (ochre) associated with calcite veins, infilling joints and fractures
- ... as botryoidal masses in vugs and fractures.

In areas of moderate reddening, hematite is generally restricted to joint and fracture filling, commonly associated with calcite veins.

Ochre workings appear to be concentrated in an area of strong fracturing where earthy hematite is found in joints and fractures up to 0.6 m wide.

Ochre varies from moderate reddish brown (Munsell colour - 10R4/6) to dark reddish brown (10R3/4), powders easily and is dispersed readily in water. Coating properties appear to be good although total iron content (Table 1) is low compared with commercial ochres (Fe_2O_3 > 60 per cent, Anon, 1971) and reflects the relatively high carbonate content. Bookartoo ochre produces a characteristic shiny appearance when painted on the body which suggest that some hematite is present as crystalline flakes.

TABLE 1

Silicate analyses and mineralogy of ferruginous rocks.

Sample No.	A5172/83	A5173/83	A5174/83
Rock description	red calcite vein	earthy hematite (ochre)	hard siliceous iron ore
SiO_2	1.80	13.5	38.0
TiO_2	0.04	0.07	0.01
Al_2O_3	0.59	1.34	0.23
Total iron as Fe_2O_3	11.5	45.1	61.0
MnO	0.68	0.13	<0.01
MgO	0.47	7.10	0.10
CaO	47.0	13.5	0.46
Na_2O	0.12	0.13	0.09
K_2O	0.15	0.20	0.12
P_2O_5	0.03	0.07	<0.01
LOI	37.0	18.9	0.52
Total	99.4	100.0	100.5
Mineralogy by XRD	Calcite D Hematite A Quartz Tr	Hematite D Dolomite SD Calcite A Quartz A	Hematite CD Quartz CD Calcite Tr

SEMIQUANTITATIVE ABBREVIATIONS:

D = Dominant. Used for the component apparently most abundant, regardless of its probable percentage level.

CD = Co-dominant. Used for two (or more) predominating components, both or all of which are judged to be present in roughly equal amounts.

SD = Sub-dominant. The next most abundant component(s) providing its percentage level is judged above about 20%.

A = Accessory. Components judged to be present between the levels of roughly 5 and 20%.

Tr = Trace. Components judged to be below about 5%.

ORE FORMATION

Concentration of hematite at several locations at or near the dolomite/mottled limestone contact suggests that this stratigraphic horizon had relatively high porosity providing a suitable site for mineral deposition.

Pre-mineralisation porosity may be the result of:

... volume changes in the sediment during post depositional dolomitisation, assuming the lower unit was originally deposited as limestone

... development of karst near the top of the dolomite unit

... dissolution of evaporite deposits within the upper dolomite sequence.

The area of breccia immediately south of the ochre workings appears to be large cavity collapse, either a karstic feature or the result of dissolution of evaporite deposits following emergence and flushing of the compacted sequence by relatively fresh meteoric water.

Petrographic examination of limestone breccia and quartzite (See Appendix) shows trails of hematite inclusions which rim breccia fragments and outline quartz grains and have been enveloped subsequently by crystalline calcite or authigenic quartz overgrowths.

It is therefore suggested that primary mineralisation predates low grade metamorphism associated with the Delamerian orogeny of Late Cambrian to Early Ordovician age.

Primary ore was most likely sulphide mineralisation, pyrite and minor sphalerite with siderite formed by reaction of mineralisation fluids with host dolomite and limestone.

Subsequent oxidation and redistribution of iron is the result of weathering since formation of the sulphide ore. Muller (1972) postulated a model for willemite formation at Beltana where prolonged weathering under arid climatic conditions produced intensely acid solutions that decomposed sphalerite and mobilised zinc to produce secondary willemite deposits on the margin of the orebody and precipitated hematite in open joints and fractures above the water table.

A similar weathering history in a predominantly pyrite rich orebody is envisaged at Bookartoo with fractures in and adjacent to the quartzite lens acting as a more permeable zone for deposition of hematite.

SUMMARY AND CONCLUSIONS

Bookartoo ochre deposit was a significant source of pigment used for ceremonial decoration by Australian aborigines throughout central and eastern Australia.

The importance of the deposit to aboriginals was recognised in 1905 when approximately 8 ha of land centred on the ochre workings was excluded from operation of the Mining Act and subsequently transferred to the Aboriginal Lands Trust in 1979.

The deposit, on the western face of Heysen Range is 19 km southeast of Parachilna in Wilkawillina Limestone of Early Cambrian age sited in possible Woodendinna Dolomite facies a few metres below the contact with overlying mottled limestone.

The ochre is earthy hematite with minor silica and carbonate, infilling joints and fractures in iron-rich quartzite, dolomite and limestone. Workings comprise a number of shallow underground burrows now mostly collapsed.

Ore formation is postulated as initial deposition of pyrite and minor sphalerite in karstic cavities in dolomite followed by prolonged oxidation under arid conditions resulting in formation and redistribution of hematite and minor willemite above the water table.

The deposit is too small and low grade to be ranked as a commercial source of pigment but has large inferred reserves for its traditional use.

JLK:DP

J.L. KEELING
SENIOR GEOLOGIST
MINERAL RESOURCES SECTION

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APPENDIX

Petrographic descriptions

(extracted from AMDEL report GS 6247/84 by D. McColl)

Sample 6635 RS 286; TSC 45201

Rock Name:
Hematite marble breccia

Hand Specimen:
A massive coarse grained rock in which large angular to subangular light coloured to white rock fragments are set in a dark red-brown matrix with abudant finer fragments.

Thin Section:
A visual estimate of the constituents is as follows:

Calcite	>90%
Hematite	3-5%

This rock consists almost entirely of granuloblastic calcite having a wide range of grain sizes and a variety of textures. The outlines of former limestone rock fragments are indicated by circumferential trains of granular hematite which is now enveloped in a matrix of further carbonate. The rock fragments vary greatly in size, the coarsest pieces being several centimetres in diameter, but are set in a rather abundant ($\sim$ 50%) matrix of extenisly cominuted hematitic carbonate.

Although the rock framgents are all limestones, they do vary considerably in texture. Several fragments consist of regular granoblastic marble formed from a mosaic of equidimensional polygonal crystals up to a maximum diameter of 1 mm. Other fragments consist of finer inequigranular mosaics in which alternating bands consist of coarser and finer grain sizes, which may be relicts of sedimentary stratification. Other fragments show parallel elongation of the carbonate crystals which are often quite heavily strained and may indicate that they have been subjected to shearing stresses and a degree of recrystallisation.

The matrix consists of an irregular assortment of grain sizes of calcite, which in places has clearly developed from partial recrystallisation of smaller limestone fragments, and now has the appearance of a fine irregular metamorphic marble. Apart from the rims of granular to ochreous hematite which surround the coarser and more prominent rock fragments, there is a diffuse dissemination of hematite throughout the matrix. The actual proportion is however much less than the appearance of the hand specimen suggests, and is more in the nature of a pigmentation.

Although the limestone fragments comprising this sample area slightly rounded on the sharper corners, this may be more due to metamorphic recrystallisation than attrition during transport. There is sufficient angularity however, to suggest that the rock is more properly classified as a breccia than a conglomerate. The reaction of the carbonate with the alizarin red-S reagent, as well as with 2 M hydrochloric acid indicates that it is compositionally calcite, so that the rock is appropriately classified as a partially recrystallised tectonic limestone breccia with minor hematitic pigmentation.

Sample 6635 RS 287; TSC 45202

Rock Name:
Quartzite

Hand Specimen:
A medium to fine grained massive unstratified siliceous sediment coloured a strong reddish-brown by what is presumably finely dispersed iron oxides. It is strongly cemented with a quartzitic fracture.

Thin Section:
A visual estimate of the constituents is as follows:

Quartz	>90%
Felspars (argillaceous in part)	1-2%
Carbonate (calcite)	<1%
Tourmaline	Trace
Voids	2%
Goethite	2-3%

Well rounded quartz grains, generally in the size interval 0.5 to 1.0 mm diameter, comprise almost the entire aggregate of this rock. The former outlines of the grains are however virtually all indicated only by trails of inclusions and fine goethitic opaques, which have been enveloped within subsequent authigenic overgrowths. The whole rock is now a granuloblastic mosaic of polygonal quartz crystals which are tightly interlocked in a typical quartzitic texture.

A small proportion of detrital felspars is also present throughout the quartz sandy aggregate. Some of these still show traces of polysynthetic twinning while others are turbid with varying degrees of argillisation. These are of similar dimensions and form to the quartz grains, and in many cases are of such similar appearance that their exact proportion is uncertain. Equally well rounded but generally smaller detrital well rounded grains of yellowish-green tourmaline are also scattered randomly among the quartz, with the coarsest grains only up to 0.3 mm.

A few irregular but generally rounded voids are still present as remnants of the former intergranular interstices which were not closed with authigenic quartz. A few of these are still empty, but others contain small clusters of microgranular carbonate, traces of clay mineral or minor fillings of ochreous geothite. The rock is a very well sorted and mechanically abraded sediment, principally a quartz sand, which was probably deposited fairly rapidly in a moderately shallow basin. Consolidation and induration were accompanied by authigenic silicification which may have been a consequence of mild metamorphism.

PLATES

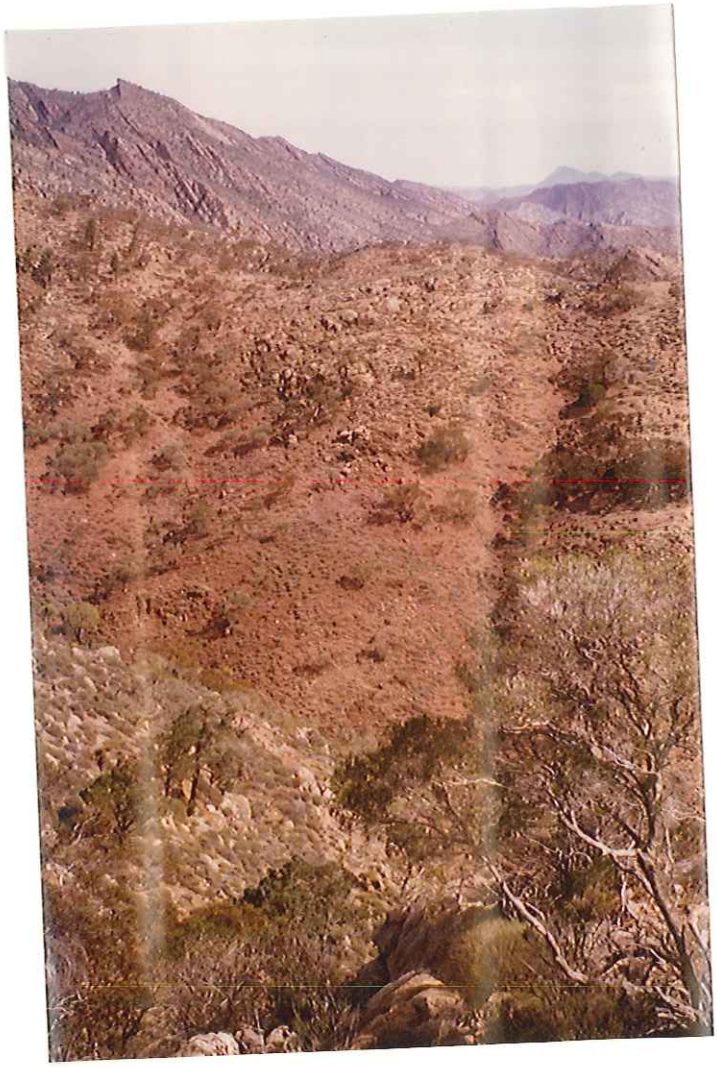

PLATE 1. Bookartoo ochre deposit. General view southerly of ochre workings (centre). Note pale outcrop of massive breccia directly above workings and widespread reddening caused by hematite mineralisation. November, 1983.

Slide No. 24685

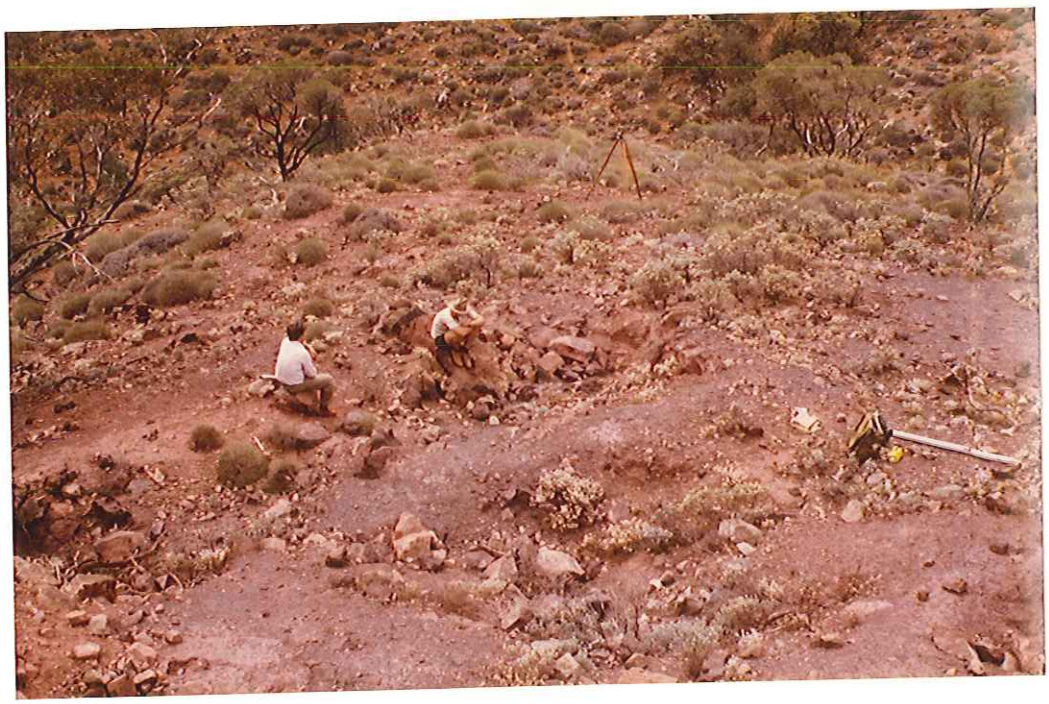

PLATE 2. Bookartoo ochre deposit. Collapsed ochre workings, view northerly. Theodolite on STA A. November, 1983.

Slide No. 24686

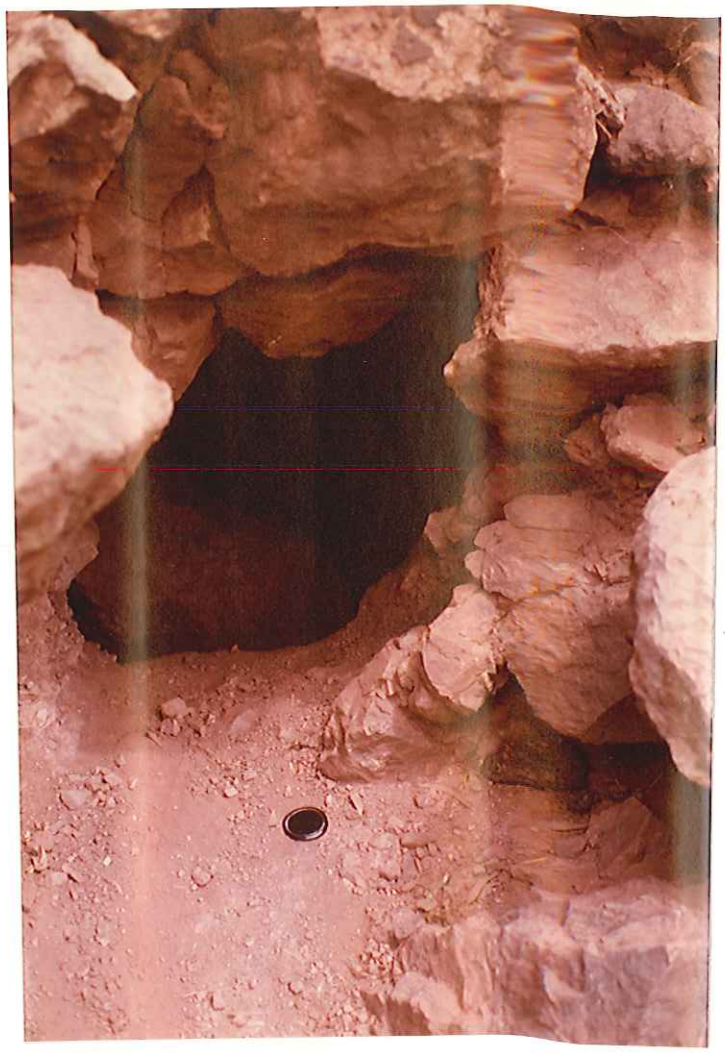

PLATE 3. Bookartoo ochre deposit. Entrance to shallow underground workings, 5 m south of collapsed pits. Earthy hematite gouged from fractures in dolomites, is seen on the floor at the entrance. November, 1983.

Slide No. 24687

PLATE 4. Bookartoo ochre deposit. Limestone breccia resulting from probable cavity collapse. Calcite matrix carries minor hematite pigmentation. November, 1983.

Slide No. 24688

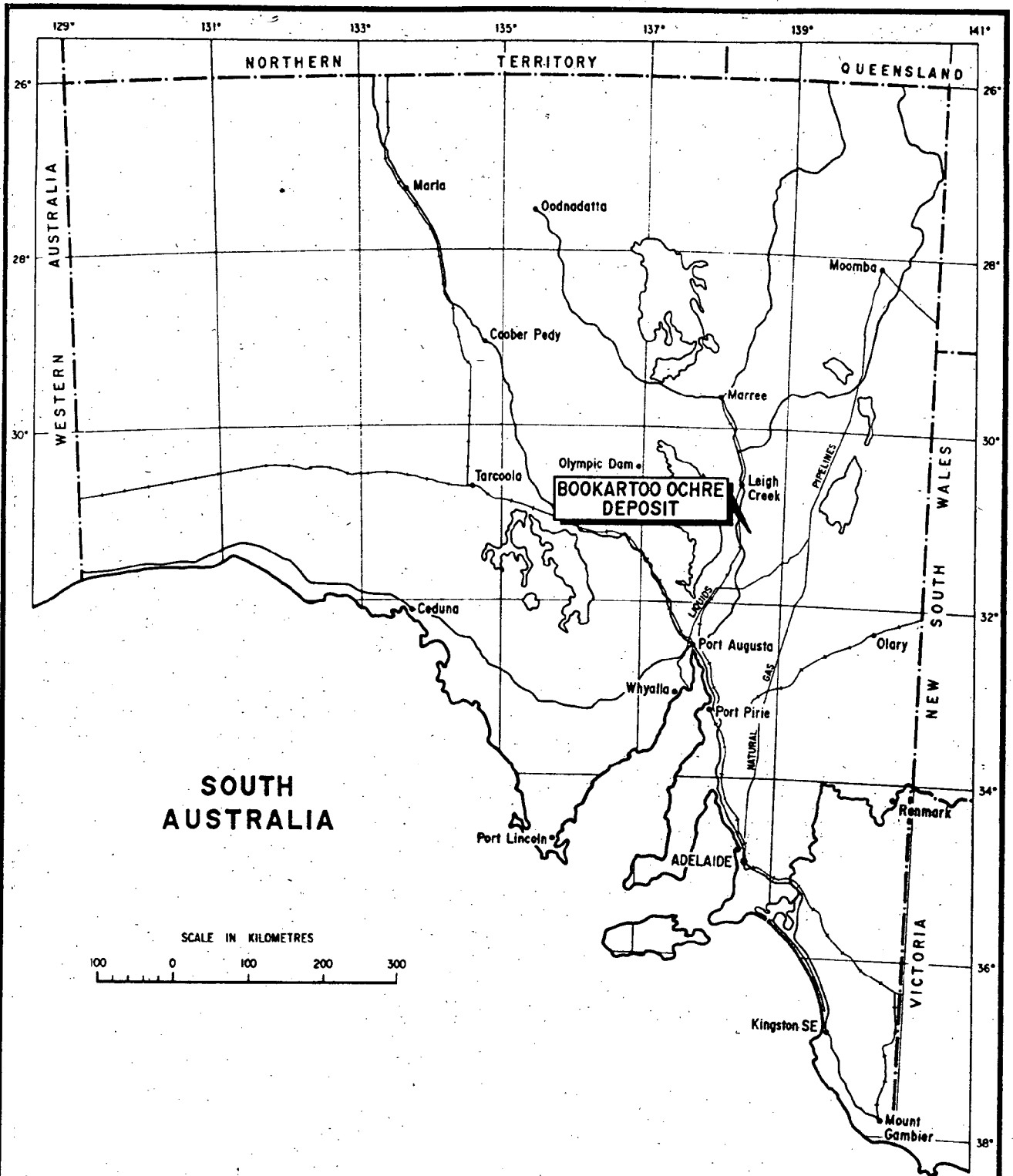

FIG. 1

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BOOKARTOO OCHRE DEPOSIT

SECTION 85 HUNDRED OF PARACHILNA

LOCALITY MAP

COMPILED J.K.	C.D.O. DATE
DRAWN A.F.	SCALE 1:7500000
DATE 29-8-84	PLAN NUMBER S 17540
CHECKED	

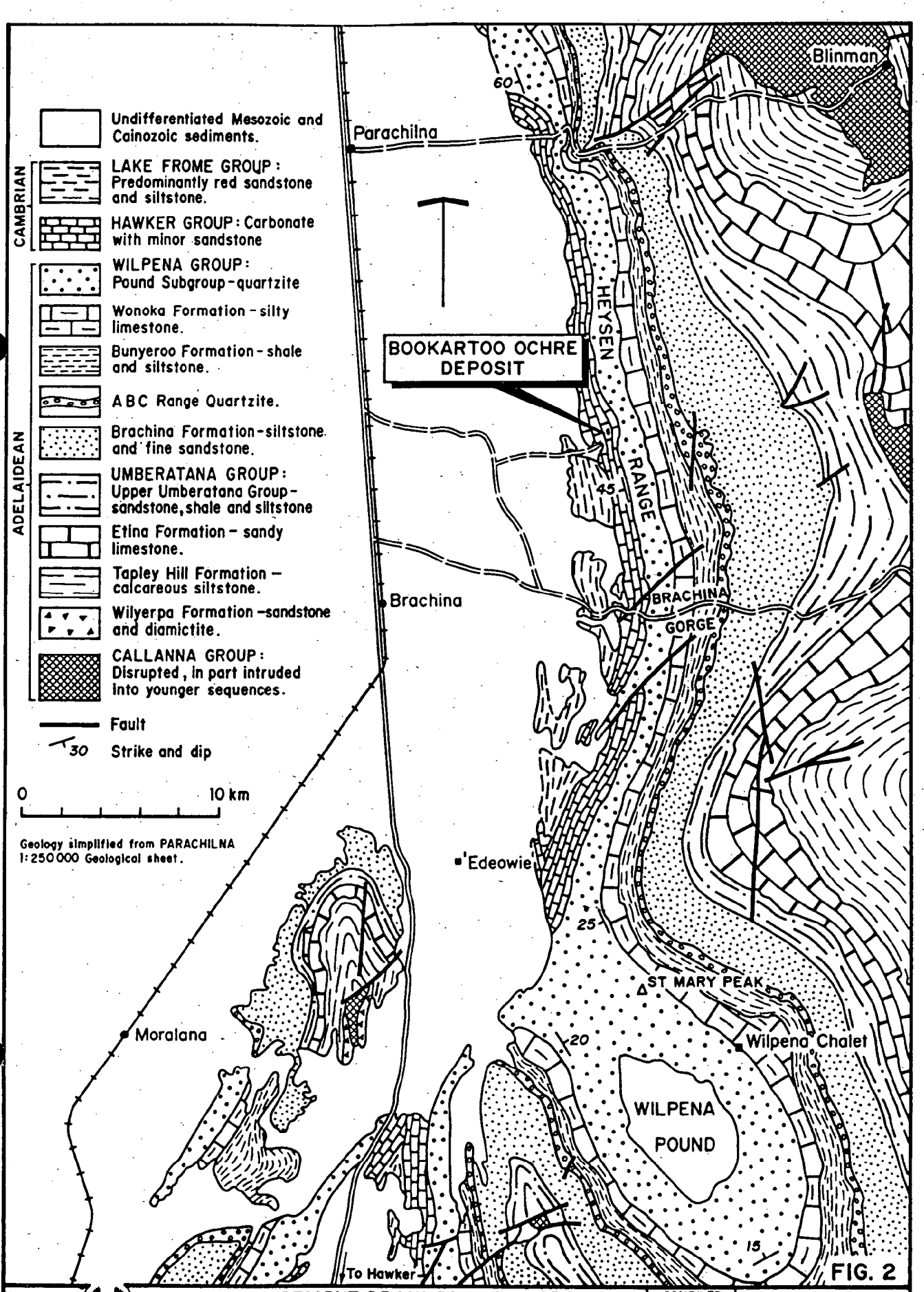

FIG. 2

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BOOKARTOO OCHRE DEPOSIT
SECTION 85 HUNDRED OF PARACHILNA
LOCATION AND REGIONAL GEOLOGY

COMPILED J.K.	C.D.O. DATE
DRAWN A.F.	SCALE 1:250000
DATE 29-8-84	PLAN NUMBER S17541
CHECKED	

NATIONAL PARK BOUNDARY

FLINDERS RANGES NATIONAL PARK

EMU ROCK

ABORIGINAL RESERVE (SECTION 85)

Bookartoo ochre workings (see plan 84-349)

Bundulla Creek

WILKAWILLINA LIMESTONE

EARLY CAMBRIAN

Limestone – white to pale grey, recrystallised and massive at base, abundant archaeocyatha in upper part.

Limestone – mottled yellow-brown to grey with interbedded pale grey crystalline limestone.

Dolomite – pale yellow to pale brown with thin magnesite beds.

Dolomite – sandy, grey to brown, algal laminations.

Breccia

Hematite rich zone

Fault

Strike and dip of bedding

xMg Magnesite

xZn Zinc

xCu Copper

xPb Lead

Claim peg

SCALE IN METRES

0 1000

FIG. 3

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BOOKARTOO OCHRE DEPOSIT

SECTION 85 HUNDRED OF PARACHILNA

DETAILED GEOLOGICAL SETTING

COMPILED J.K.	C.D.O. 13.3.86 DATE
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DATE 17-9-84	PLAN NUMBER 84-348
CHECKED	

3633

555
560
565
570
575
580
585
590
595
600
605
610
615

STN A
580·0

RS 287

A 5174/83

A 5173/83

A 5172/83

RS 286

40
85
53

A
A'
B
B'

EARLY CAMBRIAN

WILKAWILLINA LIMESTONE

- Breccia
- Limestone
- Mottled limestone
- Quartzite
- Dolomite
- Zone of moderate reddening
- Zone of strong reddening
- 40 — Strike and dip of bedding
- 85 — Strike and dip of jointing
- Pit
- Minor excavation showing extent of underground workings
- x A5172/73 — Sample location
- Section, see plan 84-350, Fig. 5
- Creek
- △STN A — Survey station
- 605 — Topographic contour, interval 5m. Datum - arbitrary

METRES
0 40

Stadia survey by P.P.Crettenden, SFB 690

FIG. 4

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

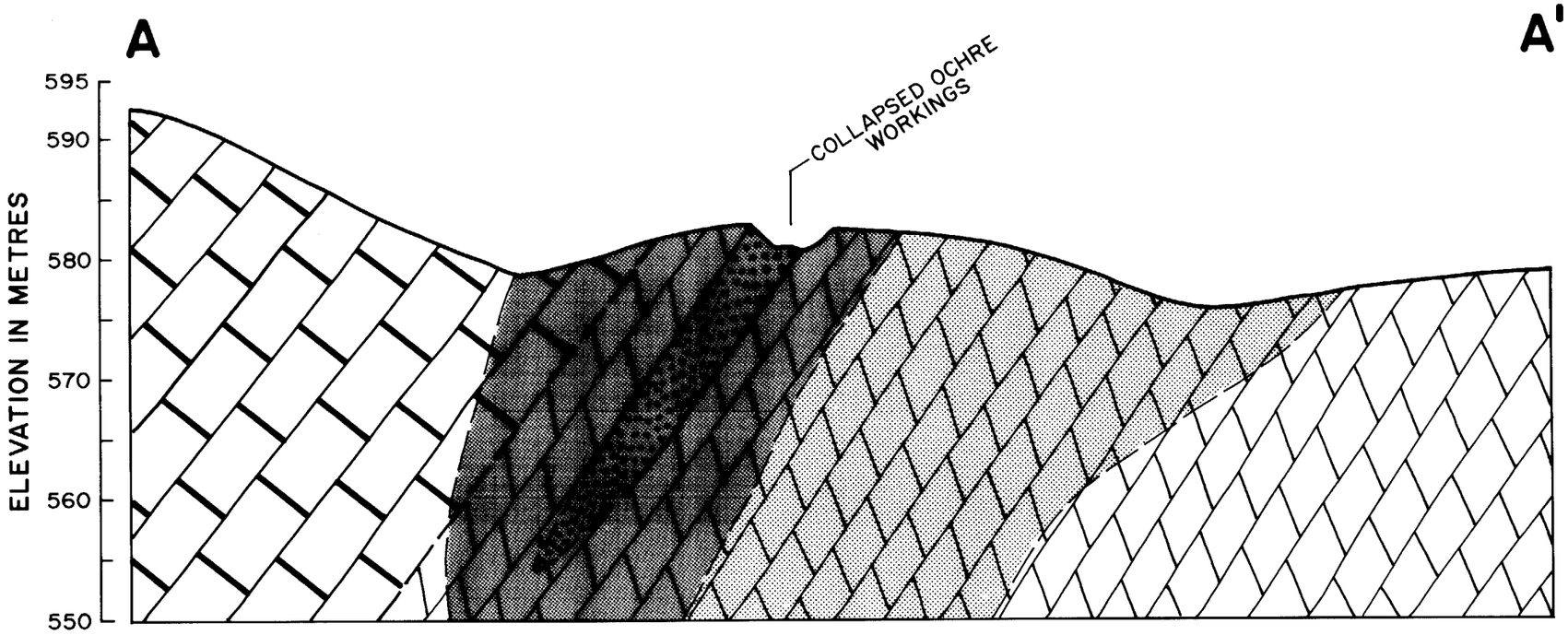
BOOKARTOO OCHRE DEPOSIT

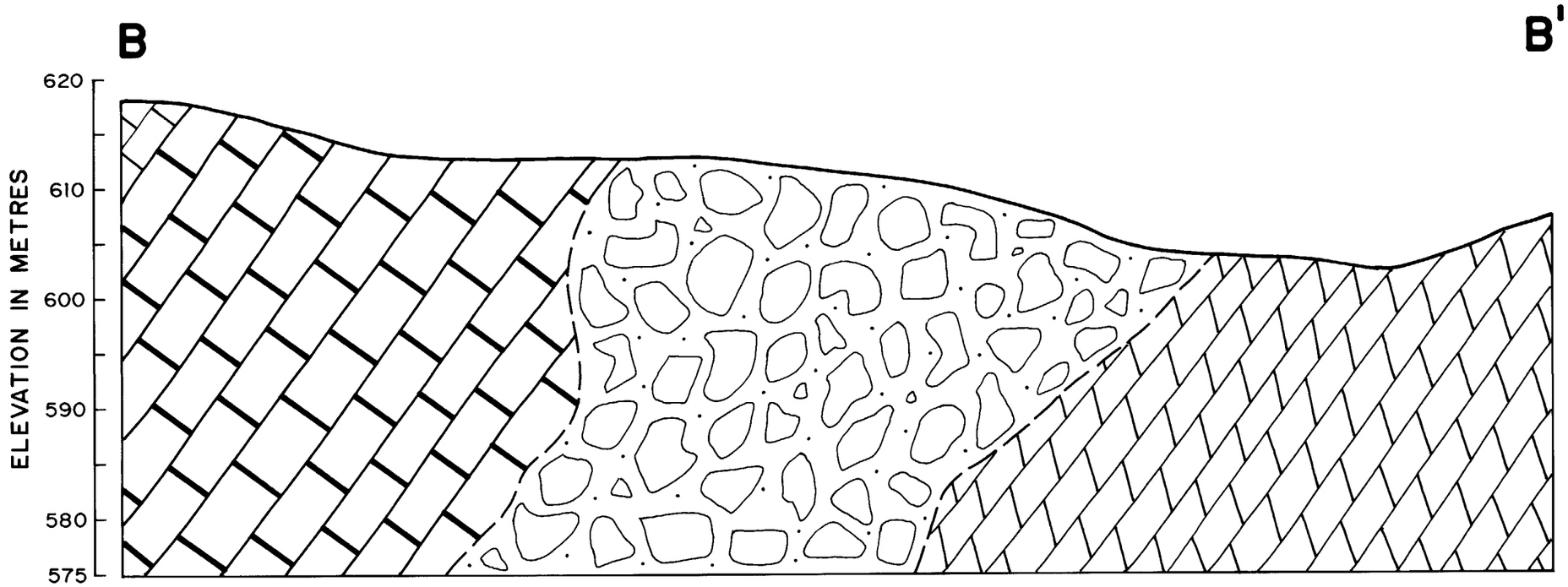
SECTION 85 HUNDRED OF PARACHILNA

GEOLOGICAL PLAN

COMPILED J.K.	C.D.O. 13·3·86 DATE
DRAWN A.F.	SCALE 1:500
DATE 17-9-84	PLAN NUMBER 84-349
CHECKED	

3G33





For legend and location of sections see plan 84-349, Fig. 4

SCALE IN METRES

0 50

FIG. 5

DEPARTMENT OF MINES AND ENERGY
SOUTH AUSTRALIA

BOOKARTOO OCHRE DEPOSIT

SECTION 85 HUNDRED OF PARACHILNA

GEOLOGICAL SECTIONS

COMPILED J.K.	C.D.O. 13·3·86 DATE
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