

PROGRESS REPORT ON GEOLOGICAL
EXPLORATIONS

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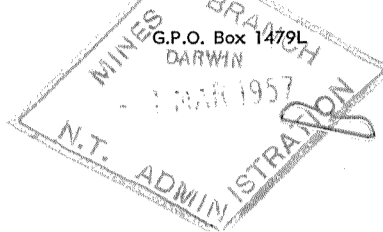
GEOSURVEYS OF AUSTRALIA LIMITED

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27-28 NATIONAL MUTUAL BUILDINGS
91 KING WILLIAM STREET
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SOUTH AUSTRALIA



AMMAROO BASIN

INTRODUCTION.

A preliminary geological reconnaissance survey has been made of the southern part of the Ammaroo Basin, around Mt. Ultim and Huchitta, in the Dulcie Range and along Arthur Creek north west of the Jervois Range. We were fortunate enough to borrow a photo mosaic of the Huchitta 4 mile military sheet from the Territories Administration and air photographs from the Mines Branch. To obtain a detailed knowledge of the stratigraphy and structure of the area detailed mapping was carried out of a number of air photos in selected areas.

PHYSIOGRAPHY.

In contrast to the Georgina Basin the topography of this region is in the moderate stage of erosional degradation. Outcrops are generally good and the structures are clearly delineated. Most of the formations show a characteristic erosion pattern on the air photos.

STRATIGRAPHY.

Tertiary Sandstone.

In a broad stream valley in the Dulcie Ranges (Huchitta 4 mile, run 10 Photo 5018; 1.3" E, 6 4" N of SW corner) there are several sharp hills about 100 feet high. These hills consist of white, fine to medium grained, poorly bedded, poorly sorted quartz sandstones. These sandstones contain considerable lenses of sandstone conglomerate. These hills are surrounded and underlain by "Dolomites" to which they bear an unconformable relationship. There is no disturbance of the attitude of these "Dolomites" in the vicinity of these inliers.

Except that they are younger than the ^{"Dolomites"} "Dolomites" there is no evidence regarding the age of these sandstones.

Ordovician Sandstone.

This formation forms a series of plateaux and mesa-like hills in the Mt. Ultim-Dulcie Range area.

This sandstone is fairly uniform and is white to grey, fine to medium grained, generally well sorted, quartzitic, usually thick bedded, often torrentially cross-bedded. It is a typical Orthoquartzite.

Measurements of the direction of the cross bedding currents were made at several points. This direction shows considerable variation but the average direction is approximately north east.

Fossils are not common and generally poorly preserved. However asaphid trilobites, raphistomenid gastropods and orthid brachiopods were observed.

The thickness exposed is variable, 300 feet at Mt. Ultim, about 800 feet near Huchitta and about 400 feet in the eastern part of the Dulcie Range. This variation is usually due to the varying depth of erosion.

In mapping on the photographic overlays the edge of the scarp has been taken as the base of the formation. The actual base is obscured by scree deposits.

PR56/007

Ordovician Limestone.

This formation underlies the Ordovician sandstone and is often obscured by the scree deposits on the lower part of the scarps.

The formation consists of thin beds and lenses of limestone and haematitic sandstones. This sandstone becomes an oolitic haematite in the eastern part of the Dulcie Range. Some of the limestones are conchoidal and contain rounded quartz grains similar to the Ordovician limestones of the Tarlton and Toko Ranges. Fossils are fairly common in all rock types with raphid gastropods, orthid brachiopods and rare nautiloids.

The thickness is approximately 100 feet. In the eastern part of the Dulcie Range (Huchitta 4 mile, run 10 photo 5018, 1.6" E and 8.1" N of SW corner) the oolitic haematite is about 10 feet thick and is highly fossiliferous.

The Ordovician sequence overlies upper Cambrian sandstones in some areas and "Dolomites" in others. This seems explainable by unconformable overlap or by faulting.

Upper Cambrian Sandstone.

This widespread formation usually outcrops as rounded hills and ridges flanking the Ordovician limestone scarp. Exposures are poor to fair.

Lithologically this sandstone is very similar to the Ordovician sandstone but is usually more strongly cemented and more thinly bedded. It is often micaceous.

The section usually contains interbedded dolomite beds which may form up to 20 percent of the formation. In some areas the formation appears to grade downwards into the "Dolomite" formation.

The thickness is of the order of 500 feet and considerable variation appears to occur.

Well preserved fossils are rare but brachiopods and trilobites were found. The upper Cambrian age of these sandstones has been determined by the Bureau of Mineral Resources.

Sandstone occurs conformably overlying middle Cambrian limestone west of the Jervois Range (Huchitta 4 mile, run 8, photo 5089, 6.5"E, 0.5"N of SW corner). This section is unfossiliferous but is possibly upper Cambrian.

Middle Cambrian Limestone.

This formation was studied in the Arthur River area.

Lithologically it consists of platy blue-grey finely crystalline limestones with rare fine sandstone beds.

Fossils are common, generally fragmentary, orboid brachiopods and ²⁰aqueid trilobites are the commonest types. In some sections thin dark laminae of abundantly fossiliferous bituminous limestone were noted. Some of these gave off a distinct odour of hydrogen sulphide when broken.

The thickness of this formation is unknown but it is probably of the order of 500 feet.

The relationship of this formation to the other formations in the area could not be determined during the period spent in the area. However it is possible that these limestones occupy basins in the Dolomites and quartzites and that they are conformably overlain by a possible upper Cambrian sandstone.

"Dolomite" Formation.

This formation consists of crystalline dolomites which may be yellow, brown, white, or purple. Occasionally they are brecciated, oolitic or algal.

No fossils other than algal (Collenia) were discovered.

Measurement of thickness is complicated by folding but in the eastern part

227	235	Calcareous shale.
235	240	Shaly limestone.
240	250	Calcareous shale with some dark limestone.
250	255	Dark limestone and calcareous shale.
255	260	Calcareous shale.
260	275	Dark shaly limestone.
275	290	Dark shale.
290	320	Dark calcareous shale with thin bands of shaly limestone.
320	325	Dark calcareous shale with phosphatic shell debris.
325	340	Dark shaly limestone, some pyrite.
340	345	Dark calcareous shale.
345	350	Dark blue grey limestone.
350	360	Dark calcareous shale.
360	375	Dark shaly limestone with paler bands and richly fossiliferous lenses (fossils all fragmentary).
375	402	Dark calcareous shale.
402	410	Pale gray crystalline limestone with galena & pyrite.
410	415	Principally gray and light gray limestone, finely crystalline some black shale.
415	420	Principally light to dark grey limestone.
420	425	Grey to dark grey finely crystalline limestone with fossil fragments (suspended 4/12/56).

R.C. SPRIGG

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COMPOSITE STRATIGRAPHIC LOG OF NOS. 1, 1A, & 2 BORES.

AMMAROO.

This log has been prepared from all available sources of information. Interval 0-99 feet (No.2 bore) has been logged by Mr. R.L. Chase of Geosurveys, 150-410 feet (No. 1 bore) by B.M.R. geologists, and 410 to 425 feet (No.1 bore) by Mr. R.C. Sprigg.

General.

The uppermost 15 feet penetrated are loose unconsolidated (?) aluvial deposits, which are underlain by 19 feet of weathered limestone possibly interbedded with micaceous shale. From 41 to 99 feet, an interval of 58 feet, the samples consisted of angular flakes of finely crystalline grey limestone, containing abundant organic remains, including definite trilobite fossils, and possible echinozoans. The sample taken from 91-94 feet has a strong smell due either to the tobacco tin in which the sample was contained or to a petroliferous fraction in the chips themselves.

A detailed description of the samples follows. (The remarks in inverted commas were scratched on the tobacco tins containing the samples).

Ammaroo Bore 2.

Interval (feet) From to	<u>Description.</u>
1 5	Red brown <u>Sandy Clay</u> .
5 10	" " <u>Gravel</u> - white 1st chips or nodules in red brown <u>Sandy Clay</u> matrix.
10 15	Light red brown <u>Sandy Clay</u> with Limestone nodules or pebbles.
15 22	Chips of white weathered <u>limestone</u> finely crystalline, hard to semi-friable, stained black on some surfaces "mixed with clay".
22 29	<u>Limestone</u> chips, yellow white, hard, fx-dense, pellets of <u>calcareous Clay</u> , and pebbles of weathered yellow-white micaceous <u>Shale</u> . "Mixed with clay".
29 32	<u>Limestone</u> chips, gray, finely crystalline, most are massive, but some show Shaly laminations.
32 37	Chips of gray <u>Limestone</u> and Micaceous calcareous <u>Shale</u> with <u>Trilobite</u> remains "hard and soft layers".
37 41	"Hard and soft layers". Chips of finely crystalline gray <u>limestone</u> and minor amounts of micaceous <u>shale</u> .

41	45	"Very hard layers" Fine (1-3 mm) chips of gray <u>limestone</u> , hard, fx, containing possible <u>trilobite</u> remains, <u>crystalline Calcite</u> , white, up to 3 mm across (indicates vugs or veins in the limestone).
45	50	"Very hard layers: fossil?". Fine chips of gray <u>Limestone</u> , hard, fx., No fossil seen.
50	54	"Hard layers: possible fossil" <u>Limestone</u> chips, gray hard, fx, some white crystalline calcite embedded in the gray matrix. No fossil seen.
54	58	"Hard layers: fossils" <u>Limestone</u> as above. One chip contained possible shelly fossil with (?) striae on one surface.
58	63	"Very hard seams about 6" through: highly fossiliferous". <u>Limestone</u> ; as above. Laminations evident, and abrupt changes of colour (from light to dark gray) suggesting intraformational breccia.
63	68	<u>Limestone</u> dark gray hard fx; occasional white calcite veins penetrate it. "very hard layers".
68	73	"Very hard to 71" <u>Limestone</u> light - dark grey hard, fx.,? slightly marly, contains possible <u>Shelly remains</u> , having shiny surfaces and ? striae.
73	78	<u>Limestone</u> gray, hard, with small knobby organic remains. "Slightly easier; very soft from 73'6" - 73'10" possibly clay".
78	83	"18" - very hard, then slightly softer". <u>Limestone</u> , gray, hard, fx, with blue shelly remains.
83	86	"Oil Slicks ? fairly soft, as if broken layer with clay at 83'9" - 84' ". <u>Limestone</u> , as above; silicified (chert) chips present many small black organic remains (1-2 mm) in the lst.
86	91	"First sign of petroliferous odour at 88 feet". <u>Limestone</u> as above. <u>Chert</u> fragments also present in minor quantities. One fragment was reddish, and was in the shape of a cylinder 4 mm long x 2.5 mm in diameter (Part of a blastoid ?) It was completely silicified.
91	94	"Hard and soft layers: first explosion at 91 feet this morning 17/11/56. Stronger smell". <u>Limestone</u> very dark gray, hard, chips fine (3mm-6mm). An associated odour may have been due to the tobacco formerly kept in the sample tin or to a petroliferous fraction in the chips.
94	99	"Hard with soft loose layers". <u>Limestone</u> , hard gray, fx-dense, contains many small (1-2 mm) organic remains, which appear to be thin shells made up of overlapping laminae.

Sludges not available between 99 and 178.

Ammaroo Bore 1.

178	194	<u>Limestone</u> with thin beds and laminae of calcareous shales with calcite veins in the limestone; Brachiopods.
194	205	Dark calcareous shale with thin lenses of limestone containing pyrites.
205	215	Grey limestone. Fossils near base.
215	221	Calcareous shale.
221	227	Shaly limestone. Fossiliferous.

of the Dulcie Range a section of 1000 + feet was measured.

In the eastern part of the Dulcie Range this formation underlies the Upper Cambrian sandstone with apparent conformity. Here the contact appears gradational. Further east the "Dolomites" are overlain by Ordovician limestone and sandstone with what may be a slight unconformity.

In the Arthur Creek area structural differences in the Dolomite and the middle Cambrian limestones suggest that there may be an unconformity relation between these two formations. The relative ages of these formations could not be determined at this stage.

Quartzite Formation.

This appears to be the oldest formation in the area and consists of white and purple siliceous sandstones and quartzites. The upper part of the formation is frequently feldspathic. Some sections are strongly cross bedded.

This formation outcrops in the Mopunga and Jervois Ranges and is at least 1000 feet thick. At the northern end of the Jervois Range the quartzites are overlain, by 50 feet of soft white argillaceous sandstone, then 15 feet of chert and quartz conglomerate and then 70 feet of white siliceous shale, ferruginous claystone and siliceous and argillaceous ironstone.

Structure.

The structural pattern of the area is rather complex and at this stage detailed stratigraphic studies are not possible despite good exposures. Folding, faulting, unconformity, overlap and possibly facies changes have had their effect in producing the present pattern.

Folding is widespread throughout the area and dips up to 45 degrees are common. Some sections are overturned.

Domal and basinal folds are common. These were studied in detail in the middle Cambrian limestones near Arthur Creek. However in this area no capping formation is present.

Complex small scale pitching folds occur in region of greatest stress such as the nasal regions of folds in the Cambrian sandstone and in the "Dolomite".

Drag effects are present along large scale faults which appear to have occurred in association with the folding. Such effects are present in the Dolomites on photo 5018 run 10 Huchitta 4 mile mosaic.

Although slight tilting may have occurred during earlier times the main folding and faulting is of post Ordovician sandstone age.

Conclusion.

During the times available the information collected is obviously incomplete. The main problem to be resolved is the age of the "Dolomites". At this stage negative evidence suggests a Proterozoic age.

Structurally the various domal structures such as those in the middle Cambrian limestone south of Lucy Creek Station are of interest.

S.M. ROWE
V.G. SWINDON.

Addendum.

On the grounds of lithologic similarity and the presence of Collenia type Algal fossils, Opik tentatively correlates the "Dolomite" formation with the Camooweal dolomite. He regards the Camooweal dolomite as "sub cambrian" or "Pre cambrian" in age, that is, older than the middle Cambrian limestone.

N. Jones, geologist of the Mines Branch, Alice Springs reports finding fossils in the middle Cambrian limestones at 5.4"E, 3.0"N of SW corner of photo 5018 run 10 Huchitta 4 mile sheet and lower middle Cambrian fossils in shales sandstones and cherts at 3.0"E 1.0"N of SW corner of photo 5087 run 8 Huchitta 4 miles sheet. These two localities were not found during the present examination.

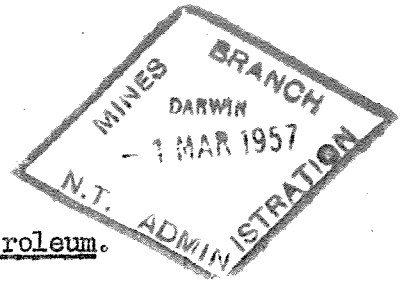
Ammaroo Oil Syndicate
Progress Report to Dec. 31st 1956.

on

Geological Explorations

In Permit No.12 to explore for Petroleum.

Ammaroo N.T.



During November and early December Geologists S. Rowe and G. Swindon commenced detailed geological explorations in the Lucy Creek area on the Southern aspect of this permit area. Visits were also made to the Ammaroo "Discovery" bore, and brief examination made of progress drilling sledges and of the local sedimentary sequence.

Dr. Brunnschweiler in the course of operations for another company made further flights over the Toko Range areas, tracing the Ordovician strata into the permit area, and certain basic information thus acquired will be incorporated in the field reports now in progress preparation by the field geologists.

Messrs. Rowe and Swindon occupied more than one week in Alice Springs studying air photographs of the Cambrian areas of the Georgina Basin and the Ammaroo embayment and this information will be supplemented by data now being obtained from the Queensland Government and Dr. F.W. Whitehouse for a more comprehensive report on the whole area.

Negotiations are in progress for interchange of basic geological data between Ammaroo Oil Company when formed and Santos Limited. In this way duplication of effort would be greatly minimised and the Georgina Basin, and other Cambrian areas in Central Australia since September. It is hoped that much of this preliminary reconnaissance information will be available to both companies by the end of the first quarter in 1957.

Drilling.

During this period the Ammaroo No.1 (discovery) percussion hole was deepened to 425 feet, and suspended temporarily. The log of strata for the additional 15 feet since the B.M.R. had completed their loggings is as follows:-

- 410-415 feet : Principally grey and light grey limestone, finely crystalline, with some black shale.
- 415-420 " Principally light to dark grey limestone.
- 420-425 " Grey to dark grey finely crystalline limestone with fossil fragments.

Operations on this hole have been suspended temporarily. At the conclusion of drilling the hole was still in (? Middle) Cambrian strata and there was no indication of close proximity to basement.

Ammaroo No.2 bore was drilled adjacent to the No.1 site to provide factual

data on the upper sections of the local strata, not sampled originally. The log of strata is appended explosive gases were first encountered at 91 feet in this bore, although "petroliferous" odours were recorded by the drillers at 88 feet. No samples were forwarded for testing.

Appended.

Composite log of strata, Ammaroo Bores No.1 and 2.

Ref. Spring