A REPORT

on a

GEOLOGICAL RECONNAISSANCE

BILLILUNA AREA

(AUTHORITY TO PROSPECT 769, NORTHERN TERRITORY)

by

A. B. CLARK

J. G. BLOCKLEY
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<td>Locality Map. Authority to Prospect 769 Northern Territory</td>
<td>1 inch = 79 miles (approx.)</td>
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<td>Regional Geological Reconnaissance Map Authority to Prospect 769 Northern Territory</td>
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<td>Geological Section Killi Killi Hills Authority to Prospect 769 Northern Territory</td>
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A programme of regional geological mapping by the Bureau of Mineral Resources was commenced in the north west of Australia in 1947. This work was primarily related to the search for oil, and the Mesozoic-Palaeozoic Rocks were examined in detail. By 1957 the eastern limits of this survey had extended to an area of Pre-Cambrian rocks along the Northern Territory and Western Australia border. As the Pre-Cambrian rocks are unfavourable oil reservoir rocks, only broad regional investigations were completed by the Bureau of Mineral Resources. The recognition of these new Pre-Cambrian Areas was of interest however to the Company with regard to their mineral potential. These new areas form part of a Pre-Cambrian belt which extends from the gold mining centre at the Granites in the Northern Territory to the old gold mining town of Hall's Creek in Western Australia.

It was decided to follow up the work done by the Officers of the Bureau of Mineral Resources and assess the mineral potential of the Pre-Cambrian areas within this border area.

LOCATION AND ACCESS

The Authority to Prospect 769 is located west of the Granites and Tanami in the Northern Territory of Australia (Plate 1). This area of 2,000 square miles was granted to the Company by the Mines Branch of the Northern Territory for a period of one year from the 31st March, 1960.

Access to the Authority to Prospect was made from Alice Springs along the sandy Tanami Track (Plate 1). Tanami, an abandoned gold field, is 400 miles north west from Alice Springs.

TOPOGRAPHY

The topography of the Authority to Prospect consists of two distinct features:-

(a) Vast plains covered with sand ridges, spinifex and low scrub. Traverses across the sand to rock outcrops involved distances of 10 to 20 miles.
(b) Elevated scarp remnants of sandstone laid down to an old peneplain surface. In the northern portions of the area these sandstones with some erosional breaks extend into the synclinal Area (Plate 1).

The area is semi-arid with an average rainfall of 5 inches. The surface water present during the months January to May of each year flows into small creeks all of which have interior drainage.

A.B. Clark, Senior Geologist, J.C. Blockley, Assistant Geologist and Field Assistants, R. Fembery and J. Bourke comprised the four men reconnaissance party. This party departed from Sydney by road on the 20th April and returned to Sydney on the 26th September, 1960.

Field Techniques.

The four members of the party used two Landrovers for transportation throughout the authority to prospect. Field investigations were carried out by a geologist and field assistant per vehicle. Each vehicle was equipped with a radio- transceiver for inter vehicle communication and for direct contact with the Flying Doctor Control Stations at Alice Springs and Sydney. The two vehicles operated separately and night camp intervals ranged up to a distance of 50 miles.

The investigations were carried out during the winter months. All the traverses necessitated low-year, four-wheel traction and, the radiators of the vehicles boiled at hourly intervals. A minimum performance of 5 miles per gallon for petrol and 5 gallons of water per day per vehicle restricted the desert traverses to a range of 75 miles from an access point. For several more remote points the vehicles operated in local convoy and set up intermediate stores daily. Field stores were obtained from the Gordon Downs cattle station and Alice Springs. In order to obtain the maximum coverage whilst the weather was ideal, no
permanent base camp was established and the field camp equipment was light and portable.

**PREVIOUS INVESTIGATIONS.**

The earliest records of systematic prospecting work completed in this general area were made by A.H. Davidson. Between 1895 and 1900 Davidson located gold at Tanami and the Granites whilst employed by the Central Australian Exploration Syndicate, financed from London. Davidson's traverses criss-crossed the area (Plate 1) east from the border and then on to Tanami. Within the area of the Authority to Prospect, Davidson discovered no mineral occurrences and it is now apparent that his work was thorough in respect to the known minerals of his day.

**STRATIGRAPHY.**

**LOWER PROTEROZOIC.**

The Lower Proterozoic meta-sediments comprise quartzites arkoses, cleaved sandstones, siltstones, and schists which have been metamorphosed in the greenschist facies. Restricted outcrops of these rocks are confined to the scarp country, i.e. at the exposed unconformity with the Upper Proterozoic sediments. The type area is at Larrangami Bluff (Plate 2). In this area the rocks have a general south-south-east strike, are highly foliated and form part of a major trough of meta-sediments which extends from Halls Creek through to Tanami. A direct correlation is possible with the upper portions of the Halls Creek metaschists and lithological similarity does suggest a correlation with the meta-sediments of the Brocks Creek Group of Lower Proterozoic age in the Northern Territory. These rocks of the area are younger than the Kalgoorlie Yilgarn Greenstone Series.

It is not possible to define the Lower Proterozoic rocks of the area in great detail simply because both outcrop and correlative thickness are poorly exposed. In the flat desert areas, principally in the central portions of the area the rock
outcrop is covered largely by sand. Trend lines apparent on the aerial photographs are difficult to follow on the ground. The field examination of these trends reveals residual quartz scree and gravel which reflects the general strike pattern of the underlying rocks; no igneous intrusive rocks were located.

**UPPER PROTEROZOIC.**

The Upper Proterozoic succession called the Gardiner Formation is exposed throughout the Authority to Prospect and is typically exposed as flat-lying rock scarps. The rocks were laid down with violent unconformity upon a highly folded but deeply weathered Lower Proterozoic landform.

The full section of the Gardiner Formation is exposed at Larrangamari Bluff and at the Kili Kili Hills (Plates 2). The flat-dipping Gardiner Formation varies in thickness from 750 feet to a 1,000 feet and consists of three members:

(a) A basal member, 150 feet thick of pebble conglomerates, cobble conglomerates, grits, and current-beded quartz sandstone. The mentioned beds are lenticular and, along the unconformable contact contemporaneous deposition is a feature. The conglomerates consist of rounded quartzite cobbles, unstratified and well sorted in certain horizons. A few sub-angular fragments of a red jasper are also present. It can be concluded that the source of the conglomerates was a stable landform. Radio-activity is associated with this basal unit in the Kili Kili Hills at a point 1.5 miles inside Western Australia.

(b) An intermediate member, 250 feet thick of platey micaceous siltstones and platey micaceous sandstones. This member is typically purple and green in colour, is fairly incompetent and erodes at a faster rate than the other members. The sections tend to develop vertical faces, although the dip is low.

(c) The upper member, 300 feet thick consists of silicified cross-beded sandstone and quartzite and well jointed ferruginous sandstone. Surface silification and jointing is a distinctive feature of this member. This member has the greatest areal extent
throughout the Authority to Prospect. It extends from the Illilli
Killi Hills northwards to the Gardiner Range and is typically
exposed at Larrangamni Bluff (Plate 2). It would be possible to
subdivide this upper member.

TERTIARY.

Tertiary laterites up to 20 feet thick are located 25 miles
north to Tanami (Plate 2). These residual deposits have no
economic significance.

RECENT.

The area exhibits a vast development of surface sand, sand
ridges, sand dunes and travertine. The blank uncoloured portions
of Plate 2 represent areas of the recent deposits.

ADJOINING AREAS.

The remoteness of the Authority to Prospect allowed the
party the opportunity to observe and record the general geology
of the intermediate country traversed over from the permanent
watering point at Tanami. These general observations add to the
regional geology of the Authority to Prospect.

The oldest rocks sighted by the party were fine grained
compact ribbon stones which crop out along a low ridge sixteen
miles due west of Tanami. The ribbonstones strike at 100 magnetic
and dip 700 to the east. They have been faulted and veined trans-
versely by quartz reefs. The lithology is unlike any specimen
within this region and is similar to certain rock types of Archean
Age of Western Australia. This outcrop may be equivalent strat-
graphically to an outcrop of vertical banded ironstone, south at
Inningarra Range (Plate 2). These older rocks form a definite
south-south-east line sub-parallel with the trend of the lower
Proterozoic rocks. At Inningarra Range a fine grained granite has
intruded the ironstone bands. This granite is similar to the
granite at the Granite Goldfields but is dissimilar to the presumably
younger granodiorite just across the Western Australian border.
It is significant that both the ribbonstones and banded ironstone form a meridinal trend in relation to the Lower Proterozoic rocks. The general lack of ribbonstone cobbles in the Upper Proterozoic conglomerates suggest that the Archean rocks were well buried by the Lower Proterozoic.

The lithology of the Lower Proterozoic meta-sediments is identical to the lithology defined in the Authority to Prospect. It is unfortunate that no contacts between the Lower Proterozoic rocks and the possible Archean rocks were observed.

The Upper Proterozoic is represented by the upper member of the Gardiner Formation which has been faulted in regional trends which parallel the inferred trends of the Lower Proterozoic. This particular pattern of faults in the Upper Proterozoic is not repeated with similar intensity elsewhere throughout the region. The Gardiner Formation thickens westwards to the Killi Killi Hills and northwards to the Gardiner Range but thins to the east and south.

STRUCTURAL GEOLOGY.

The Lower Proterozoic meta-sediments are part of the Halls Creek Mobile Zone (Traves 1959). The belt of rocks has a south-south-east strike and within the confines of the Authority to Prospect no intrusive igneous rocks were located. The lithology and outcrop pattern are consistent throughout the area.

The Upper Proterozoic rocks were deposited unconformably on to a stable continental Lower Proterozoic land mass by sapric marine and this sedimentation is essentially arenaceous and rubaceous. The Upper Proterozoic basins thicken to the north and the section from Killi Killi Hills represent filled channels which existed in the old basement. Faulting within the Authority to Prospect is not a major feature of the Upper Proterozoic although there is a suggestion a south-east-north-west fault north of Tanami (Plate 2). Warping of the strata has been the main factor in movement. Diagenetic and surface silification of the Upper Proterozoic is common.

The Tertiary laterite remnants indicate a flint mature land-
scape during a period of sub-tropical erosion.

ECONOMIC GEOLOGY.

GENERAL.

There is no recorded production of mineral wealth from the Authority to Prospect. This lack of any large mineral prospects is due in part to the granodiorite which crops out just over the western Australia border. Throughout the Authority to Prospect, streams were pumped, soils looted, rock samples drilled and panned, all with a negative result. Significant and large auriferous deposits are not superficially present in this area. The party located no mineral prospects within the Authority to Prospect.

URANIUM.

The uranium prospect discovered at the Killi Killi Hills (Plate 2) within eastern Australia is important and applicable stratigraphically to the Authority to Prospect 769. The prospect is approximately 1.5 miles over the border but similar sections as yet radioactively unsurveyed occur at Larranganni Bluff (Plate 2).

The uranium material is restricted to lenses of silicified grits and silicified conglomerates which overlie with angular unconformity lower Proterozoic meta-sediments (Plate 2).

It is essential to bear in mind that the radio-activity discovered in the complimentary area was located whilst a stratigraphical section was being examined and with the general nature of reconnaissance all similar sections on the aerial photographs were not examined. The sections at Larranganni Bluff were inspected regionally before the Killi Killi Hills prospect was found. It will therefore be necessary to check all the sections with the Authority to Prospect which extend over an outcrop length of 100 miles through this border strip.

REGIONAL APPRAISAL.

The main field result to emerge from the 1960 investigations is that auriferous grits may be present in the basal member of
the Gardiner Formation of Upper Proterozoic Age on unsurveyed portions of the Authority to Prospect. The field evidence from Western Australia supports a syngenetic origin for this mineralisation and the known stratigraphical location is highly applicable in the search for additional prospects.

The writer considers that further investigations are required on the Authority to Prospect from Milli Milli Hills to Larranganni Bluff. In the first instance this additional work is to be directed to the search for further radio activity. An aerial scintillograph survey is the most effective means to search for such occurrences. The Bureau of Mineral Resources may assist on such work. The results from an airborne survey will determine the future extent of ground investigations to be completed on the Gardiner Formation throughout the reduced area. The survey should consist of low aerial flights along the scarps of the Gardiner Range of which Larranganni Bluff is a part. The flight lines should extend laterally 1 mile from the scarp edge down to the low country.

In the search for low grade ore bodies the small prospects may represent the key to locating blanket type mineral deposits associated with what were once ancient alluvial deposits. The possibility of a gold uranium is suggested by the writer.

RECOMMENDATION.

It is recommended that the Bureau of Mineral Resources be approached for aid in completing a programme of airborne scintillograph over the likely radio-active areas. To protect the likely areas it is also recommended that the area of the 1960 Authority to Prospect be reduced to 950 square miles (Plate 1).

CONCLUSIONS.

The Upper Proterozoic meta-sediments of the Authority to Prospect area poorly mineralised and resemble lithologically rocks of the broccoli Creek Group of the Katherine-Darwin area of the Northern Territory.
The basal conglomerates and grits of the Upper Proterozoic are uraniferous just inside the Western Australia border and the type prospect at Killi Killi Hills may be the key in locating "bannet" type mineralisation in similar sections throughout this remote portion of Australia. In this regard a possible aerial scintillograph survey to locate additional radiometric prospects by the Bureau of Mineral Resources is important.

The Authority to Prospect 759 was examined by a reconnaissance geological party and the possibility of locating uraniferous deposits in the area has arisen. This possibility confirms an important exploration point that remote areas can be successfully assessed by a private mining company if pertinent regional geological information can be supplied to the Company by a Government Geological Agency.

REFERENCES

