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EXPLANATORY NOTES

DARWIN, N.T.

Sheet D/52-4
Australian National Grid

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

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Compiled by E. J. Malone

Issued under the authority of Senator the Hon. W. H. Spooner,

Minister for National Development,

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DEPARTMENT OF NATIONAL DEVELOPMENT.

Minister: SENATOR THE HON. W. H SPOONER, M.M.
Secretary: H. G. RAGGATT, C.B.E.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

Director: J. M. RAYNER.

These notes were prepared in the Geological Branch.
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Explanatory Notes on the Darwin Geological Sheet

Compiled by

E. J. Malone

The Darwin Sheet includes a land area of 3,300 square miles, in the north of the Northern Territory of Australia, bounded by the Arafura Sea to the north, by latitude 13°S., and by meridians 130°30'E and 132°E. It has a monsoonal climate and receives about 60 inches of rain per year, mainly during the wet season from November to April.

The Stuart Highway, a sealed all-weather road, and the North Australia Railway start at Darwin and extend to the south beyond the southern margin of the Sheet. Dry-weather vehicle tracks provide access to the parts of the area east and west of the Stuart Highway and the railway line.

The whole area has been photographed in separate sets for each 1-mile area. The photos of the Woolner, Mary River, and Mount Bundey 1-mile areas are at a scale of 1:30,000; those of the other 1-mile areas are at a scale of 1:16,000. One inch to one mile photomosaics of all the 1-mile areas are available from the Division of National Mapping, Canberra. The base for the present map was compiled by the Bureau of Mineral Resources from air photographs, one inch to one mile photomosaics, and emergency editions of the Military 1-mile Series sheets.

Lower Proterozoic rocks of the Agicondian System crop out in the south of the area. These rocks include sediments deposited around the north-western flank of the Pine Creek Geosyncline, the main part of which lies south of the Darwin area. The sediments are intruded by granites, also of Agicondian age. Cretaceous sediments crop out in cliff sections along the coast and as remnants overlying the Lower Proterozoic rocks.

Quaternary alluvium and a thin veneer of Tertiary sediments, mainly relics of a widespread Tertiary lateritization, cover much of the area.

History of investigations

The earliest geological work of any importance in the area dealt with the Mesozoic rocks exposed in the sea cliffs near Darwin. Tate (1882) and Tenison Woods (1886) referred to these rocks. Hinde (1893) identified radiolaria in specimens collected near Darwin, but could not determine their age. Brown (1895 and 1908) collected specimens from the Mesozoic rocks, and Etheridge identified them as Lower Cretaceous.

During this time, geological work in the area was extremely sketchy, as most workers confined their attention to the mining areas farther south, particularly the Pine Creek District. However, in 1914, Jensen investigated the Darwin Mining District and summarized the available geological information. The next work of any importance in the area was reconnaissance mapping by Noakes (1949) in 1946. His contribution also dealt mainly with the stratigraphy of the Cretaceous rocks.

Three years later, uranium was discovered at Rum Jungle. This resulted in intensive geological mapping and prospecting of the southern part of the area, by both private company and government geologists. From 1953 to 1958, the Bureau of Mineral Resources carried on a programme of regional mapping of the Katherine-Darwin Region, mainly at a scale of one inch to one mile. The Darwin Sheet is largely based on this mapping, with some contributions from Territory Enterprises Pty Ltd. *

PHYSIOGRAPHY

Plains of ferruginous gravel and sand occupy much of the area; they rise 10 to 20 feet above the level of the recent alluvium and, at present, are being eroded. They extend to the coast at Cape Hotham and Charles Point, where they lie about 40 feet above sea-level. The plains are a late Tertiary or Quaternary development: the ferruginous gravel and sand are mainly the residue remaining after the erosion of Tertiary laterites.

Alluvial plains are particularly well developed along the Adelaide and Mary Rivers in the north and the Finniss River in the south-west. The Mary River flows into swamps : its mouth was originally situated about 10 miles south of the present coast-line; traces of the old coast-line may be seen around the southern margins of the swamps. Apparently, the west-flowing coastal current built a bar extending from Point Stuart towards Cape Hotham. This bar, together with either a recent drop in sea level or a rise in land level, resulted in the formation of the swamps in the landlocked Mary River estuary.

Rocky hills, long ridges, and low rubble-covered rises, separated by alluvial flats, are found throughout the southern part of the area, extending as far west as Port Darwin. These hills include the highest relief in the area, rising to an altitude of more than 500 feet near the Stuart Highway at Manton River and farther south.

A characteristic topography is developed over the granites. This consists of low rounded hills, covered with granite soil and scattered granite boulders, and separated by narrow alluvial flats.

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* Of the 1-mile Geological Sheets in the area, Mount Bundey is published, and Southport, Tumbling Waters, Humpty Doo, and Marrakai are in press.

STRATIGRAPHY

The names of the rock units in the Darwin Sheet area have been approved by the Territories Committee on Stratigraphical Nomenclature. The stratigraphy is summarized in Table 1 and is briefly described below. The distribution of the Lower Proterozoic sedimentary units is shown on Figure 1.

Lower Proterozoic

Agicondian System

The oldest rocks cropping out in the area belong to the *Batchelor Group*, which consists of coarse clastic sediments with abundant feldspathic material, alternating with reef dolomites. They were deposited in a shallow-water near-source environment on the north-western flank of the Pine Creek Geosyncline. The *Beestons Formation*, the basal unit of the group, may have been deposited directly on basement. The Group was subsequently intruded and domed by the Rum Jungle Granite.

The Batchelor Group sediments lens out north-east, north-west, and south-west of Rum Jungle. To the south-east, they dip under the Golden Dyke Formation. They were derived from a source to the north-west and are conformably overlapped by Goodparla Group sediments derived from a source to the east and north.

Of the two dolomitic formations in the Batchelor Group, the *Celia Dolomite* is composed almost entirely of algal reef dolomite and reef detritus. The *Coomalie Dolomite*, on the other hand, contains some calcilutite and siltstone as well as dolomite.

The *Goodparla Group* includes the Mount Partridge, Masson, and Golden Dyke Formations. These three units display a lateral rather than a vertical relationship. The *Mount Partridge Formation* in this area consists of platform or shelf-type sediments, including conglomerate and ripple-marked sandstone. It crops out in the east of the Darwin Sheet area and is found along the entire north-east flank of the Pine Creek Geosyncline. It is succeeded basinward by the *Masson Formation*, which occupies an area trending diagonally south-east across the area. The Masson Formation consists of tongues and lenses of quartz greywacke, probably turbidity current deposits, interspersed with siltstone. The *Acacia Gap Tongue* of the Masson Formation crops out west of the main area of outcrop of the formation. It intertongues with the Golden Dyke Formation, overlying about 1,000 feet of that formation. The tongue consists of beds of quartz greywacke or sandstone, in places pyritic, separated by siltstone and pyritic and carbonaceous siltstone. The beds are continuous over distances of several miles. The *Golden Dyke Formation* conformably succeeds and is interfingered with the Masson Formation. It was deposited in the main trough of the geosyncline, for the most part beyond the limit of coarse clastic sedimentation from the eastern and northern areas of provenance. The formation is best developed east of Rum Jungle; it crops out in the Rum Jungle dome, conformably overlying the Coomalie Dolomite, and is found as far north as the Elizabeth River.

TABLE 1

STRATIGRAPHY OF THE DARWIN SHEET

Age	Rock Unit and Symbol	Thickness (feet)	Lithology	Remarks
Quaternary	Alluvium, etc. (Qa)	—	Alluvium, soil, swamp deposits.	
Cainozoic undifferentiated	Superficial Deposits (Czs)	—	Ferruginous deposits including laterite, residual sand, gravel and cemented detritus.	
Lower Cretaceous	Mullaman Beds (Klm)	Variable up to 100	Freshwater and marine sediments: sandstone, conglomerate, radiolarian shale, porcellanite.	Unconformably overlies Precambrian rocks.
Upper Proterozoic	*Tolmer Group.* Buldiva Sandstone. Depot Creek, Sandstone Member (Puo)	Up to 100	Pink ripple-marked quartz sandstone, lenses of hematite-rich calcarenite, breccia, and quartz pebble conglomerate.	Remnants unconformably overlie Lower Proterozoic rocks.
Lower Proterozoic	*Finniss River Group.* Burrell Creek Formation (Plb)	Up to 8,000 but less in this area.	Siltstone, greywacke siltstone, greywacke.	Form lateral facies assemblage mainly derived from the west. Burrell Creek F. extends farther east where it conformably overlies Golden Dyke F.
	Noltenius Formation (Pln)	5,000	Siltstone, greywacke, quartz greywacke, quartz pebble conglomerate.	
	Goodparla Group. Golden Dyke Formation (Pld)	Up to 9,000	Quartz and carbonaceous siltstone, in places pyritic; thin bedded siltstone, marl and dolomite; bedded, massive and nodular chert; limonite-rich greywacke. Dolomitic slump breccia in places silicified. Pyritic, carbonaceous dolomitic marl, in places slumped and brecciated and containing chert lenses, bands and nodules. In places, the pyritic sediments are capped by a hematitic gossan.	Conformably overlies Masson F. and Batchelor Group.
	Masson Formation (Plm)	Variable up to 10,000	Quartz sandstone, quartz greywacke. Pyritic carbonaceous siltstone, banded siltstone, minor carbonaceous siltstone with chert nodules, quartz pebble conglomerate. The pyritic siltstone in places is capped by a hematitic gossan.	Composed mainly of lenses of quartz greywacke inter-tonguing with different types of siltstone.

Age	Rock Unit and Symbol	Thickness (feet)	Lithology.	Remarks.
Lower Proterozoic Agicondian System.	*Goodparla Group.* Masson Formation Acacia Gap Tongue (Pla)	3,000	Quartz greywacke and sandstone, pyritic and silicified in places, pyritic, carbonaceous siltstone, and siltstone.	Intertongues with Golden Dyke F.
	Mount Partridge Formation (Plp)	—	Quartz sandstone, in places current-bedded, siltstone, pebble conglomerate.	Mt Partridge and Masson Fs. constitute lateral facies assemblage mainly derived from north-east.
	Batchelor Group.	—	—	Consists of conformable repeated succession of clastic sediments followed by dolomitic sediments. All 4 units are lenticular and restricted to Batchelor area.
	Coomalie Dolomite. (Plo)	1,000	Silicified and metamorphosed dolomite in places containing algal bioherms, calcilutite, siltstone, tremolite schist.	Mainly reef dolomite, deposited in shallow water.
	Crater Formation (Plr)	2,000	Quartz greywacke, greywacke, arkose, fine and pebble conglomerate, siltstone. Pyritic carbonaceous dolomitic marl, in places slumped and brecciated, and containing chert lenses, bands and nodules.	Mainly coarse clastic sediments. Thickest and most widespread unit of Batchelor Group.
	Celia Dolomite (Pll)	1,000	Algal dolomite, in places silicified and metamorphosed, silicified dolomitic breccia, tremolite schist.	Mainly reef dolomite.
	Beestons Formation (Ple)	1,000	Arkose, greywacke, siltstone, conglomerate, arkosic conglomerate.	Includes oldest known sediments deposited in Pine Creek Geosyncline.

DISTRIBUTION OF LOWER PROTEROZOIC SEDIMENTARY UNITS

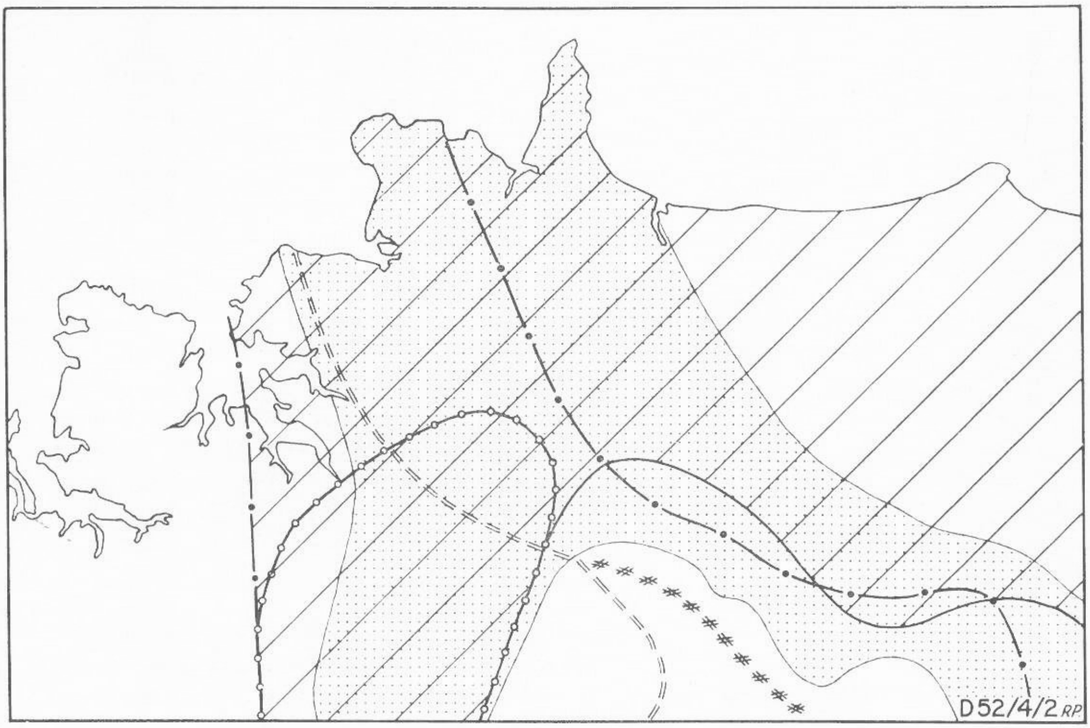

Fig. 1

REFERENCE

- Marginal environment – Mt. Partridge Formation and Batchelor Group
- Transitional environment – Masson Formation
- = = = Eastern limit of Noltenius Formation
- # # # Eastern limit of Burrell Creek Formation
- —•— Limit of Golden Dyke Formation
- —o—o— Limit of Batchelor Group

The *Finniss River Group,* which succeeds the Goodparla Group, is a lateral facies assemblage consisting in this area of the Noltenius and Burrell Creek Formations. The *Noltenius Formation* contains pebble and boulder conglomerate where it crops out along the western margin of the geosyncline. It grades basinwards into the *Burrell Creek Formation,* which consists mainly of medium to fine-grained greywacke and siltstone. Part of the Noltenius Formation was redistributed basinwards by turbidity currents, as a result of which lenses and tongues of coarse clastic material overlie and interfinger with the finer clastics of the Burrell Creek Formation. These coarse sediments show graded bedding and other structures typical of turbidity-current deposition. The group was derived from a provenance to the west. It was deposited during and after the deposition of the Goodparla Group, so that it conformably overlies or interfingers with the Goodparla Group in some places and disconformably overlies it in other places.

Upper Proterozoic

The *Depot Creek Sandstone Member* of the *Buldiva Sandstone* crops out at Rum Jungle, unconformably overlying the Lower Proterozoic rocks. These outcrops are remnants of widespread Upper Proterozoic sedimentation which was better developed south of the Sheet area. The remnants are preserved in hollows in the original surface of deposition or by down-faulting. They contain lenses of siliceous quartz breccia in a hematite-rich sandy matrix, the fragments being derived from the underlying Lower Proterozoic rocks.

Mesozoic

Lower Cretaceous

The Lower Cretaceous *Mullaman Beds* crop out in the coastal cliffs around Darwin and the Cox Peninsula. About 50 feet of Cretaceous sediments are exposed in these sections, unconformably overlying the Lower Proterozoic; the surface of unconformity is gently undulating or level. South-east of Darwin, remnants of Mullaman Beds crop out, apparently in depressions in the underlying Lower Proterozoic surface. In the eastern part of the Darwin area, the outcrops of Mullaman Beds consist mainly of ferruginous sandstone, capped in places by a Tertiary laterite profile. Erosion of this lateritized Cretaceous supplied much of the material for the ferruginous gravel and sand plains in the north of the area.

Marine fossils collected and described from the Mullaman Beds cropping out near Darwin have established their Lower Cretaceous age. Freshwater sediments are known at the base of the Mullaman Beds in areas to the south but are probably not present in the Sheet area.

Igneous Intrusions and Metamorphism

Five large intrusions crop out in the Sheet area : the Litchfield Complex, the Roberts Creek Granite, the Rum Jungle Granite, the Mount Bundey Granite, and the Mount Goyder Syenite.

The *Litchfield Complex* crops out in the south-west of the Sheet area. It consists of granodiorite and two-mica granite. The two rock types are similar in overall composition and texture; the two-mica granite differs in containing a greater proportion of alkali feldspar and appreciable quantities of muscovite and biotite. The granodiorite contains sporadically distributed grains of garnet. In most places, a faulted contact separates the Litchfield Complex from the adjacent Noltenius Formation. However, quartz-tourmaline veins from the Complex transgress the contact and intrude the sediments.

The *Roberts Creek Granite* is a garnetiferous granodiorite containing blebs of quartz-feldspar-tourmaline-muscovite pegmatite. It is probably an apophysis of the Litchfield Complex. Numerous pegmatite veins intrude the Noltenius Formation, south of Port Darwin; they are related to the intrusion of the Litchfield Complex and the Roberts Creek Granite. In the same area, the siltstone of the Burrell Creek and Noltenius Formations has been metamorphosed to mica schist and andalusite-mica schist.

The *Rum Jungle Granite* is a coarsely crystalline porphyritic granite. It commonly shows some deformation, ranging from marginal granulation of the feldspar phenocrysts to complete crushing and recrystallization of the rock. The granite intrudes the Batchelor Group sediments in the core of the Rum Jungle Dome. It is generally conformable to the structure, but transgresses the sediments in a few places. The deformation of the granite and its relationship to the sediments suggest that it was intruded at a very early stage in the orogeny.

The metamorphism associated with the Rum Jungle Granite is confined to a narrow aureole. In the Rum Jungle open cut where the metamorphic effects have been closely studied, the rocks include tremolite schist, andalusite-mica schist, chiastolite schist, talc schist, and phyllite.

The granite has metamorphosed the dolomitic formations in the Batchelor Group, altering them to tremolite schist in places. It has had little effect on the clastic sediments, apart from quartz-tourmaline veining and some replacement of minerals by tourmaline.

The *Mount Bundey Granite* and the *Mount Goyder Syenite* are a plutonic complex intruding Lower Proterozoic rocks. The Mount Bundey Granite ranges in composition from granite to adamellite; the Mount Goyder Syenite includes quartz syenite and syenite. Both are intruded by syenite and aplite dykes. Two sets of joints affect the complex : one is related to the intrusion and affects only the intrusives; the other affects both the complex and the enclosing sediments.

The metamorphic aureoles around the intrusions are not more than a quarter of a mile wide. The metamorphosed sediments include chiastolite schist and black hornfels where the complex intrudes carbonaceous siltstone of the Golden Dyke Formation. The greywacke of the Burrell Creek and Masson Formations is silicified.

Small sills and rare dykes crop out north and east of Mount Goyder, intruding the Masson and Mount Partridge Formations. The sills are folded with the sediments; they were intruded during or before the folding. They are intermediate in composition and include hornblende microdiorite, microtonalite, and microsyenite.

STRUCTURE

The Finniss Graben is bounded on the east by the Finniss Fault Zone (Fig. 2.). Its western and northern limits are not known, though the displacement possibly decreases towards the west and north. The graben developed while deposition was continuing and is occupied by the Finniss River Group.

In the northern part of the graben, the sediments are folded into closed structures with steeply-dipping parallel flanks, steep plunging noses, but flat keels. Synclines are well exposed; anticlines have very sharp crests and are not well exposed. The folds are possibly due to the folding of a thin veneer of sediments, about 3,000 feet thick, resting directly on a basement which was not folded. Fold axes trend nearly due north, except near Port Darwin, where they swing north-east.

The Rum Jungle Dome lies east of the Finniss Graben. The structure comprises the Rum Jungle Granite in the core, and about 10,000 feet of sediments of the Batchelor Group, Golden Dyke Formation, and Acacia Gap Tongue. Other large domes and basins are found east and north-east of Rum Jungle. They are wholly or partly outlined by the resistant greywacke members of the Acacia Gap Tongue. These structures are elongated, with their long axes trending nearly north.

The northern end of the Central Trough of the Pine Creek Geosyncline lies within the Sheet area. Here, it is occupied mainly by the Burrell Creek Formation, which is not well exposed but appears to be tightly folded. Some folds plunging south-south-east were mapped, outlined by lenses of Noltenius Formation conglomerate.

West of the Mount Bundey Granite, the Masson and Golden Dyke Formations are folded into fairly broad folds, plunging first south-west and then south towards the Central Trough. East and south of Mount Bundey, however, the folding is more complicated and is displayed by the well-bedded sediments of the Golden Dyke Formation. Though the regional pitch of the structures is to the south, reversals of pitch and small closed structures are common.

The Mount Partridge Formation crops out north-east of Mount Goyder in a dome surrounded by the Masson Formation. Farther to the north-east, the Mount Partridge Formation is fairly tightly folded, the structures plunging south to south-west.

Faulting

The three prominent faults shown on Figure 2 represent the three main directions of faulting; north, north-east, and north-west.

The north-trending Finniss Fault Zone is not well exposed at the surface. However, mining and drilling at Mount Fitch Prospect has revealed the movement on the fault to be west block down : the throw is estimated at about 5,000 feet.

The Giants Reef Fault is a horizontal tear fault with a displacement of three miles, west block moving north. It is a late or post-Proterozoic structure, though there may have been earlier movement on the same line.

The north-west-trending fault is not well exposed. It probably involves both vertical and horizontal movement, the eastern block moving north and down.

STRUCTURAL SKETCH MAP

Fig. 2

REFERENCE

- Pg — Agicondian System, granite intrusives
- Strike of strata showing prevailing direction of dip
- Fault or fault zone
- Anticlinal axis, showing direction of plunge
- Synclinal axis, showing direction of plunge
- Plunge of minor fold
- Approximate limit of Central Trough

Metals

The Rum Jungle uranium field contains the only important mines in the area. It was discovered in 1949, when uranium minerals were found in old copper workings. Subsequent prospecting, mapping, and drilling added Whites East, Dysons, Mount Burton, Mount Fitch, and Rum Jungle Creek South uranium deposits and Browns lead deposit to the original Whites find. Of these, Whites, Whites East, Dysons, and Mount Burton deposits were mined out between 1953 and 1958, mainly by open-cut methods; Mount Fitch was extensively prospected and drilled but no ore was mined; Rum Jungle Creek South was being prepared for mining in 1960. Browns is a large, rather low-grade lead deposit. It was still being explored by drilling in 1960 and no ore has yet been mined.

The mineralization at Rum Jungle includes uranium, copper, lead, and cobalt. It is contained in carbonaceous siltstone of the Golden Dyke Formation, close to the contact with the underlying Coomalie Dolomite. The post-Proterozoic Giants Reef Fault and associated shears control the emplacement of the ore. Work on lead isotope ratios suggests that the original mineralization is about 1,600 million years old.

Production figures for the Rum Jungle mine are given below in Table 2.

Prior to the development of Rum Jungle, tin was the main mineral produced in the area. It was won from alluvial deposits or mined from pegmatite veins cropping out in a long narrow belt extending from Mount Finniss to the West Arm of Darwin Harbour. The mines and the total production were small.

Tantalite was mined from some of the pegmatite veins, commonly as a minor byproduct of tin mining. Small quantities of amblygonite and some wolfram were mined from the pegmatites north of Mount Finniss. Apparently some mica was mined in the area, but there are no records of the quantity or source.

TABLE 2 — RUM JUNGLE URANIUM MINE

Production Figures

ORE TREATED	54/55	55/56	56/57	57/58	58/59	59/60
Uranium and Uranium/ copper ore (tons)	22,134	50,720	71,628	70,898	73,284	75,649
Uranium oxide content (lb./ton)	5.0	8.4	9.1	6.8	5.1	5.1
Copper content (%)	2.2	2.7	2.5	2.6	2.3	2.6
Base Metal Ore (tons	597					25,472
Copper content (%)						2.5
PRODUCTION						
Uranium oxide in conc. (lb.)	62,207.5	333,546	541,652	443,807	335,840	326,506
Total Production of Uranium	1,864,439 lb U_3O_8, value £A.11,632,303.					
Copper Concentrate (tons)						
Copper Cement (tons)	67.6	424	1,028	1,033	1,119	1,244
Copper Flotation (tons)	234	1,651	3,651	3,430	4,891	8,658
Contained Copper (tons) in concentrates	88est.	658	1,406	1,387	1,791	2,686

TABLE 3 — MINERAL PRODUCTION
Excluding Rum Jungle Uranium Field

Mineral	Quantity	Value
Gold	32 oz.	£499
Tin	570 tons	£51,500
Tantalite	17 tons 3 cwt	£5,400
Amblygonite	64 tons	
Wolfram	9 cwt	£110

Water

123 water bores were sunk in the Darwin Sheet area, mainly around Darwin and along the Stuart Highway and the railway line. Table 4 lists the available data concerning these bores, and indicates which are still in use. The location of the bores and the reference numbers used by the Water Resources Branch of the Northern Territory Administration are shown on the Sheet, or on Figure 3 for the bores in the vicinity of Darwin.

Only 8 bores were dry and 3 others produced salt water. The average production of successful bores was more than 1,000 gallons per hour, the highest recorded flow being 4,000 gallons per hour. The depth of the bores rarely exceeded 250 feet: the bore records indicate that water may be obtained in almost any part of the Sheet area at less than 250 feet. The salt-water bores were drilled very close to the sea.

Construction Materials

Sand and gravel for concrete construction are obtained from the Blackmore River, west of Southport. Silicified quartz greywacke of the Acacia Gap Tongue is worked in a large quarry beside the Stuart Highway at Acacia Creek, 38 miles from Darwin. The quarry produces aggregate for concrete, road and airfield construction. Smaller quarries near Elizabeth River Siding and Darwin River Siding produced aggregate from the same formation. There are numerous good sites for aggregate and road metal quarries in the area but development of these is dependent on transport facilities and markets.

Coral reefs and associated calcareous muds around the coast at Gunn Point and around the offshore Vernon Islands may be suitable for cement manufacture. Raised beaches at Lee Point are very rich in shell fragments and might also be suitable for this purpose.

Iron

A mass of magnetic iron ore in the Mount Goyder Syenite, near old Mount Bundey Homestead, is over 2,000 feet long and up to 80 feet wide. On the surface the lode is mainly composed of hematite pseudomorphous after magnetite. A single hole drilled by the Bureau of Mineral Resources failed to intersect the lode 350 feet below its thickest development on the surface. Other occurrences of iron appear in hematitic, gossanous cappings on the pyritic sediments of the Masson, Golden Dyke and Crater Formations, particularly above the pyritic carbonaceous dolomitic marl containing chert nodules. These gossans commonly contain numerous fragments of siltstone and chert nodules.

TABLE 4 — BORE DATA, DARWIN SHEET

Bore No.	Depth (feet)	Standing Water Level (feet)	Water struck at (feet)	Supply (g.p.h.)	Salt Content p.p.m.	Strata (feet)
19	110	40	65	720		26 Quat., 84 Prot.
*22	323	40	55, 150	450		60 Cret., 263 Prot.
23	118	82	90	600		118 Prot.
30	260	70	96-116 197-230	800		260 Prot.
*34	212	50	167-212	720		50 Cret., 162 Prot.
35	117	70	38, 94	1000		117 Prot.
*37	140	42	104-140	900		135 Prot.
38	141	15		1400		141 Prot.
39	141	18	21, 110-135	1200		141 Prot.
40	103	35	92	1400		50 Cret., 53 Prot.
*42	170	30		750		104 Cret., 66 Prot.
47	136	50	100-136	880		136 Prot.
*51	377	20		750		101 Cret., 276 Prot.
*54	150	30	64-145	1000		150 Prot.
57	109	54	60-80	1320		20 Quat., 80 Prot.
72	133	80	60	600		133 Prot.
73	168	60	40-60 150-168	400		40 Quat., 128 Prot.
79	210	60	78, 202	720		210 Prot.
*99	195	35	45, 155	780		
101	148	70	78	500		32 Quat., 116 Prot.
*102	130			800		
106	130	52	50, 70	1700		130 Prot.
*113	135	35	75	4000	1520 (total salt)	60 Cret., 75 Prot.
128	208	50	50, 170	400		56 Quat., 152 Prot.
*130	220	30	85, 200	2000		95 Cret., 125 Prot.
*132	195	40		500		
139	178	40		1000		80 Cret., 98 Prot.
153	135	36	50-95	1900		52 Quat., 83 Prot.
179	126	100	76-86 110-124	500		126 Prot.
181	118	50	50-60 80-95	350		118 Prot.
182	149	65	68-98 105-136	1800		149 Prot.
184	241	40	190	600		241 Prot.
185	164	40	60-80 130-150	750		164 Prot.
186	135	50	65-68	1000		135 Prot.
187	207	30	115	250		207 Prot.
188	125	42	42, 100	400		125 Prot.
189	133	80		600		
190	122	35	90	600		122 Prot.
196	170	60	60-140	600		170 Prot.
197	168	60		400		
198	120	54	85	600		120 Prot.
199	114	45	43, 106	600		40 Quat., 74 Prot.
200	164	52	54	600		50 Quat., 114 Prot.
202	109	40	75-101	420		52 Quat., 57 Prot.
208	127	65	68-95	1200		127 Prot.
209	112	31	36-40	1800		36 Quat., 76 Prot.
212	138	32	60-130	1200		20 Quat., 118 Prot.
213	153	23	60, 115, 150	600		12 Quat., 141 Prot.

* Thought to be still in use.

Bore No.	Depth (feet)	Standing Water Level (feet)	Water struck at (feet)	Supply (g.p.h.)	Salt Content p.p.m.	Strata (feet)
*216	177	48	117-177	1500		44 Cret., 133 Prot.
217	177	71	80-177	1320		25 Cret., 152 Prot.
230	231		50-100	1400		231 Prot.
233	175					175 Prot. Dry
234	159	70	50	Good		21 Quat., 138 Prot.
*236	242	18	140, 200	3500		95 Cret., 147 Prot.
238	200	7	54-200	1800		28 Cret., 172 Prot.
239	122	23	27, 100-117	1100		122 Prot.
*240	145	90	112	480		40 Quat., 105 Prot.
*241	202	24	83	1450	99 (Chloride)	81 Cret., 121 Prot.
*242	209	42	118-124	1800	neg. ,,	
244	110					110 Prot. Dry
245	242					242 Prot. Dry
246	149	15	{ 20, 90 } { 144-149 }	1800	70 (Chloride)	149 Prot.
247	223	30	26, 209	900	28 ,,	223 Prot.
248	235	40	37, 220	1200	42 ,,	235 Prot.
249	128	35	102-120	1500		128 Prot.
250	96		65-90			96 Prot. Failure
251	374	11	345	1800		374 Prot.
252	113	30	95-100	1800		113 Prot.
253	170	60	33, 73, 160	1800	42 (Chloride)	35 Quat., 135 Prot.
254	265	28	27, 216, 262	2000	28 ,,	265 Prot.
255	125	20	110-113	1000		20 Quat., 105 Prot.
256	178	94	106, 143, 161	1600		178 Prot.
257	116	37	75, 114	650		116 Prot.
258	100	45	60	1450		100 Prot.
259	130	74	100	1200		130 Prot.
260	282	50	66, 235	1000		282 Prot.
261	101	39	89	2000		101 Prot.
262	132					132 Prot. Dry
263	190	32	91-101	600	28 (Chloride)	190 Prot.
264	211	15	120, 180-211	500	neg. ,,	211 Prot.
265	213	35	65, 190-213	1200	28 ,,	213 Prot.
266	144	35	25, 125	1200	28 ,,	144 Prot.
792	Presumed dry :		no other information			
267	246	100	243	900	42 (Chloride)	246 Prot.
268	161	50	42, 110, 149	1200	42 ,,	161 Prot.
269	252	60	220-250	1600	28 ,,	252 Prot.
*270	153	18	35-92	1680		153 Prot.
*271	238	37	160, 215	1200		85 Cret., 153 Prot.
272	127	100	105-127	1800		13 Quat., 114 Prot.
273	150		106-137	1200		30 Quat., 120 Prot.
274	165	60	80, 155	1000	42 (Chloride)	84 Cret., 81 Prot.
275	200	40	150, 200	360	42 ,,	16 Cret. 184 Prot.
*276	195	90	179	1800	14 ,,	90 Cret., 105 Prot.
277	154	55	60-154	1200	42 ,,	154 Prot.
278	239	60	210	1200	14 ,,	239 Prot.
279	141	45	30	1500	neg. ,,	141 Prot.
280	180	50	80	1700	28 ,,	180 Prot.
*281	152	35	128	1800	42 ,,	152 Prot.
*282	252	25	90, 160	1600	42 ,,	90 Cret., 162 Prot.
*283	158	30	37	1800		85 Cret., 73 Prot.
286	212					212 Prot. Dry
287	276	70	180	100		276 Prot.

* Thought to be still in use.

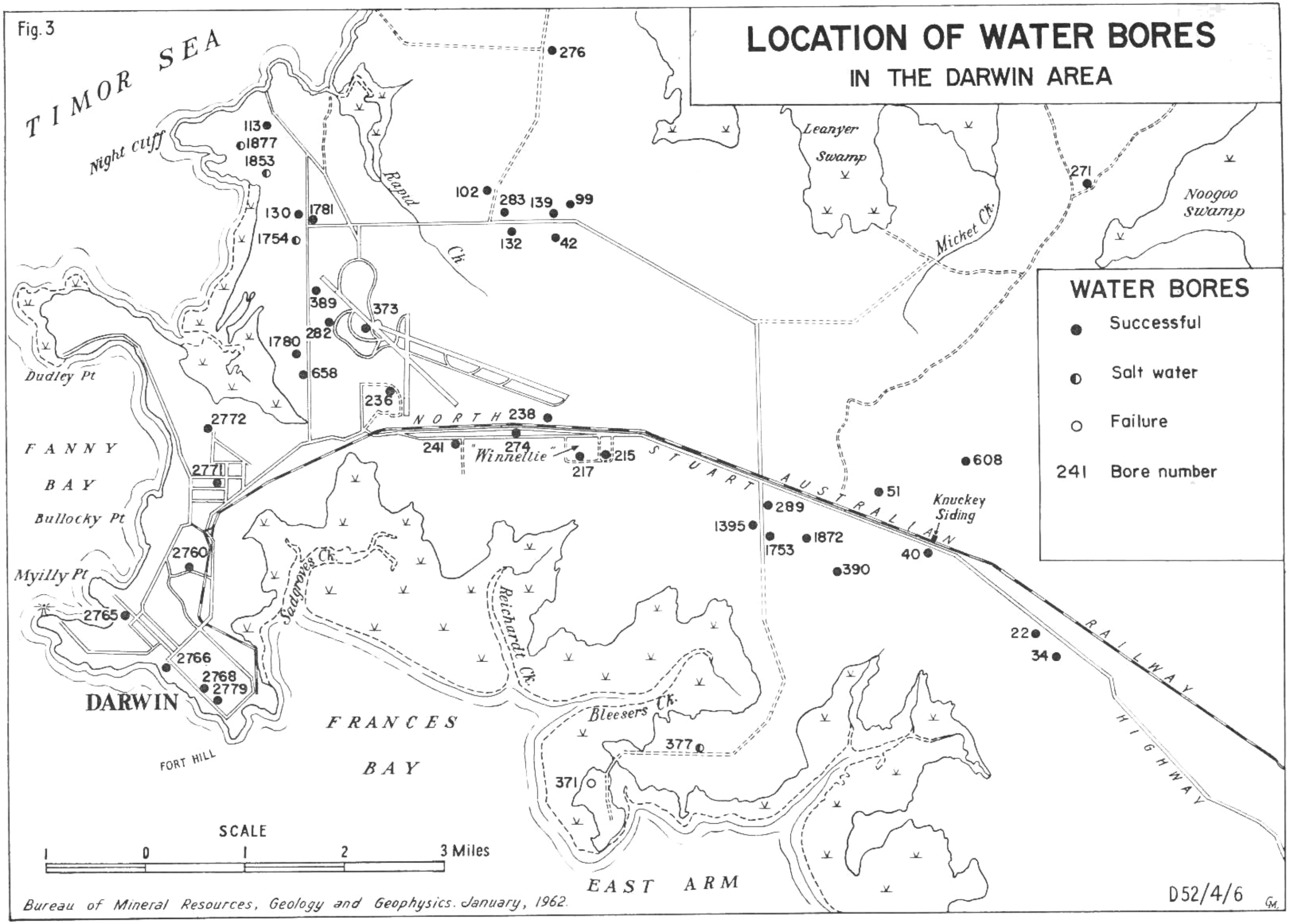
Fig. 3
LOCATION OF WATER BORES
IN THE DARWIN AREA
TIMOR SEA
Night cliff
Rapid Ck
Leanyer Swamp
Micket Ck.
Noogoo swamp
WATER BORES
Successful
Salt water
Failure
241 Bore number
Dudley Pt
FANNY BAY
Bullocky Pt
Myilly Pt
DARWIN
FORT HILL
"Winnellie"
NORTH STUART AUSTRALIAN RAILWAY
HIGHWAY
Knuckey Siding
Sadgroves Ck.
Reichardt Ck.
Bleesers Ck.
FRANCES BAY
EAST ARM
113
1877
1853
130
1781
1754
389
373
282
1780
658
236
2772
2771
2760
2765
2766
2768
2779
276
102
283
139
99
132
42
238
274
241
217
215
271
608
51
289
1395
1753
1872
390
40
22
34
377
371
SCALE
1 0 1 2 3 Miles
Bureau of Mineral Resources, Geology and Geophysics. January, 1962.
D52/4/6
GM.

Bore No.	Depth (feet)	Standing Water Level (feet)	Water struck at (feet)	Supply (g.p.h.)	Salt Content p.p.m.	Strata (feet)
288	159		67-125	300		159 Prot.
*289	285	45	89, 174	700		57 Cret., 228 Prot.
348	96	30	68	400		96 Prot.
371	420					420 Prot. Dry
*373	360	35		500		78 Cret., 282 Prot.
377	216			500		216 Prot. Salt Water
*389	263	13		960		70 Cret., 193 Prot.
*390	233	30		1400		9 Cret., 224 Prot.
*608	183		22	650		20 Cret., 163 Prot.
*658	155	18	70	1000		80 Cret., 75 Prot.
*1395	82	25	73	800		76 Cret., 6 Prot.
*1753	125	17	115	1500		103 Cret., 22 Prot.
*1754	123		61	?		41 Cret., 82 Prot. Salt Water
*1780	152	8		500	95 (Total salt)	
*1781	99	38	75	1000	320 (Sodium Chloride)	
*1844	134	17	65	480		
1853	61			?		Salt Water
1872	165	26	119	1150	25 (Sodium Chloride)	
*1873	92	24	85	2000		
1877	160			?		Salt Water
*1903	60	21		300		
2760	—	25				
2765	—	24				
2766	—	26				
2768	—	32				
2771	—	—				
2772	—	—				
2779	—	44				

* Thought to be still in use.

BIBLIOGRAPHY

BROWN, H. Y. L., 1895 — Government Geologist's Report on Explorations in the Northern Territory. Appendix on Fossils by Etheridge, R. *N.T. of S. Aust., parl. Pap.* 82.

BROWN, H. Y. L., 1906 — Explorations made by the Government Geologist and Staff during 1905. *S. Aust. parl. Pap.* 55.

BROWN, H. Y. L., 1908 — Report on geological reconnaissance of the eastern coast from Van Diemans Gulf to the MacArthur River. *S. Aust. parl. Pap.* 25.

BROWN, H. Y. L., 1908 — Government Geologists Report on Recent Mineral Discoveries and further record of Northern Territory Boring Operations. *S. Aust. parl. Pap.* 85.

CARTER, E. K., 1953 — Geology of the embayment area. *Bur. Min. Resour. Aust. Rec.* 1953/130 (unpubl.).

CHRISTIAN, C. S., and STEWART, G. A., 1953 — General Report on Survey of Katherine-Darwin Region, 1946. *Sci. ind. Res. Org. Melb. Land Res. Ser.* 1.

CONDON, M. A., and WALPOLE, B. P., 1955 — Sedimentary environment as a control of uranium Mineralization in the Katherine-Darwin Region, Northern Territory. *Bur. Min. Resour. Aust. Rep.* 24.

DEBNAM, A. H., and WHITE, D. A., 1954 — Geochemical prospecting in the vicinity of radio-active deposits and prospects in the Northern Territory Australia. *Bur. Min. Resour. Aust. Rec.* 1954/1 (unpubl.).

DODD, P. H., 1953 — Crater line investigations. *Bur. Min. Resour. Aust. Rec.* 1953/29 (unpubl.).

DOW, D. B., and PRITCHARD, P. W., 1958 — The geology of Woolwonga, Mt. Bundey, and Marrakai East Areas, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1958/122 (unpubl.).

ETHERIDGE, R., Jun., 1906 — Official contributions to the palaeontology of South Australia. *Supp. to S. Aust. parl. Pap.* 55.

FISHER, N. H., and SULLIVAN, C. J., 1954 — Uranium exploration by the Bureau of Mineral Resources, Geology and Geophysics, in the Rum Jungle Province, Northern Territory, Australia. *Econ. Geol.*, 49(8), 826-836.

HINDE, G. J., 1893 — Note on a radiolarian rock from Fanny Bay, Port Darwin, Australia. *Quart. J. geol. Soc. London*, 49, 221.

FRANKOVITCH, F. J., and FIRMAN, J. B., 1954 — Regional geology of the Rum Jungle district, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1954/26 (unpubl.).

JENSEN, H. I., 1914 — Geological report on the Darwin Mining District. *Bull. N. Terr. Aust.* 10.

LANGRON, W. J., 1956a — Geophysical survey of the Rum Jungle area, N.T., 1954. *Bur. Min. Resour. Aust. Rec.* 1956/43 (unpubl.).

LANGRON, W. J., 1956b — Interim report on regional gravity reconnaissance survey, Darwin-Katherine area, Northern Territory. *Ibid.*, 1956/84.

LANGRON, W. J., and STOTT, P. M., 1959 — Preliminary report of a reconnaissance gravity survey in the Darwin-Katherine Area, N.T. *Bur. Min. Resour. Aust. Rec.* 1959/72.

MACKAY, N. J., 1953a — Dysons find (1951). *Bur. Min. Resour. Aust. Rec.* 1953/26 (unpubl.).

MACKAY, N. J., 1953b — Intermediate prospect (1951), Rum Jungle. *Ibid.*, 1953/27.

MALONE, E. J., 1958 — Geology of the Darwin-Adelaide River area, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1958/96 (unpubl.).

MATHESON, R. S., 1950 — Report on the geology of the Rum Jungle uranium-bearing area, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1950/47 (unpubl.).

MATHESON, R. S., 1953a — Rum Jungle investigations, 1951 and 1952. Progress Report. *Ibid.*, 1953/24 (unpubl.).

MATHESON, R. S., 1953b — Progress report on Brodribb Prospect at 31st October, 1953. *Ibid.*, 1953/122 (unpubl.).

MATHESON, R. S., 1954 — Radioactive surveys Katherine-Darwin Region. Annual Report for 1953. *Bur. Min. Resour. Aust. Rec.* 1954/23 (unpubl.).

NOAKES, L. C., 1947 — The geology and mineral resources of the northern portion of the Northern Territory. *Min. Resour. Surv. Aust. Rep.* 1947/40 (unpubl.).

NOAKES, L. C., 1949 — A geological reconnaissance of the Katherine-Darwin Region, Northern Territory. *Bur. Min. Resour. Aust. Bull.* 16.

ROSENHAIN, P. B., and MUMME, J. A., 1953 — Preliminary geological and geophysical report on Madigans uranium prospect, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1953/109 (unpubl.).

SMITH, D. N., 1953 — Preliminary report on diamond drilling at the Brodribb Prospect, N.T. *Bur. Min. Resour. Aust. Rec.* 1953/143 (unpubl.).

SMITH, K. G., 1953 — Preliminary geological report on the Ella Creek uranium prospect, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1953/120 (unpubl.).

SULLIVAN, C. J., 1953 — The uranium prospects of the Brodribb Ella Creek and Frazer area. *Bur. Min. Resour. Aust. Rec.* 1952/18 (unpubl.).

SULLIVAN, C. J., 1953 — The Katherine-Darwin Metalliferous Province. *5th Emp. Min. metall. Cong.*, 1, 297-304.

SULLIVAN, C. J., and MATHESON, R. S., 1952 — Uranium-copper deposits, Rum Jungle, Australia. *Econ. Geol.* 47(7), pp. 751 - 758.

SUMMERS, K. W. A., 1957 — The mineral deposits of the West Arm, Bynoe Harbour and Bamboo Creek fields, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1957/68 (unpubl.).

TATE, R., 1882 — Report on Northern Territory. *S. Aust. parl. Pap.* 63.

TENISON WOODS, J. E., 1886 — Report on geology and mineralogy of Northern Territory. *S. Aust. parl. Pap.* 122.

VOISEY, A. H., 1939 — Notes on the stratigraphy of the Northern Territory of Australia, with special reference to the Jurassic System. *J. Roy. Soc. N.S.W.*, 62.

WHITEHOUSE, F. W., 1926 — Correlation of the marine Cretaceous deposits of Australia. *Rep. Aust. Ass. Adv. Sci.*, 18, 278.

WALPOLE, B. P., 1956 — Annual report, Regional Radioactive Parties, Katherine-Darwin area, Northern Territory, 1955. *Bur. Min. Resour. Aust. Rec.* 1956/57 (unpubl.).

WALPOLE, B. P., and WHITE, D. A., 1955 — Progress report on geological mapping, Katherine-Darwin region, 1954. *Bur. Min. Resour. Aust. Rec.* 1955/49 (unpubl.).

WARD, H. J., 1950 — Report on the occurrence of radioactive minerals in the vicinity of Rum Jungle siding, Northern Territory. *Bur. Min. Resour. Aust. Rec.* 1950/14 (unpubl.).

WARD, H. J., 1953a — Whites South Prospect. *Ibid.*, 1953/132 (unpubl.).

WARD, H. J., 1953b — Whites Extended Prospect. *Ibid.*, 1953/139 (unpubl.).

WARD, H. J., 1953c — Mt. Fitch Prospect. *Ibid.*, 1953/40 (unpubl.).

WARD, H. J., 1953d — Browns Deposit. *Ibid.*, 1953/141 (unpubl.).

WARD, H. J., 1953e — Whites Deposit. *Ibid.*, 1953/142 (unpubl.).

WARIN, O. N., 1959 — Report of investigation of radiometric anomalies discovered by Auster Aircraft in the Rum Jungle District, N.T. *Bur. Min. Resour. Aust. Rec.* 1959/18 (unpubl.).

WOOLNOUGH, W. G., 1912 — Report on the geology of the Northern Territory. *Bull. N. Terr. Aust.*, 4.

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