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fr R.E.B. ...

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RADIOACTIVE DEPOSITS CARCOAR, N.S.W.

by

R.S. Matheson.

CANBERRA.

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CONTENTS

	Page
SUMMARY	1
INTRODUCTION	1
GEOLOGY	2
GEOLOGICAL STRUCTURE	2
THE WORKINGS	3
THE DEPOSITS	3
THE MINERALISATION AND ITS CONTROL	4
CONCLUSIONS AND RECOMMENDATIONS	4
REFERENCES	5

PLANS

Plate		Scale
1	Geology Vicinity Carcoar	½ mile to 1 inch
2	Geological Map Vicinity Cobalt Workings, Carcoar	200 ft. to 1 inch

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SUMMARY

The occurrence of radioactive minerals with cobaltiferous deposits in the Carcoar area has been known since 1894, but until recently they have not received much attention.

The present geological survey has been carried out following the discovery of three rather significant radioactive anomalies in the north-eastern part of the mined area, during radiometric surveys in 1950 and 1951.

The geological survey has shown that the cobaltiferous-uranium deposits occur in strong north-south shears in an area of Silurian slates and volcanic rocks intruded by diorite sills and dykes, close to the south-eastern boundary of a large mass of hornblende diorite. Opportunities occur for the discovery of other uranium deposits in parallel shears outside the area, in which radioactive anomalies have already been found.

The three main anomalies in the area which has been geologically mapped (Plate 2) are recommended for testing, and further radiometric surveys of the area should be carried out with more sensitive instruments.

There are also opportunities for detailed and regional prospecting around the hornblende-diorite mass, and the Carcoar granite. The airborne scintillometer could probably be used to advantage for regional prospecting.

INTRODUCTION

Geological investigations and mapping were carried out in the Carcoar area by the writer and D.N. Smith during the period 8th to 25th July, 1952. These investigations followed radiometric surveys of the area by the Geophysical Section of the Bureau of Mineral Resources in 1950 and 1951.

The area in which radioactive minerals occur and of which a detailed geological map has been prepared, coincides with the area embracing the old cobalt workings. These workings are scattered over a distance of about ¾ mile on portions 1, 2, 7, 8 and 25, Parish of Shaw, County of Bathurst, and are about 1 mile south of the Carcoar township.

Cobalt was discovered in the area in 1888 and several lenses of ore were later mined from shallow workings for the total production of 111.15 tons of cobalt ore with a cobalt content of 12.15 tons valued at £1,921. The occurrence of uranium minerals in the area, namely torbernite, was first recorded from the area in 1894 (Card, 1896).

GEOLOGY

The area which has been geologically mapped (Plate 2) is situated along the south-eastern margin of a large mass of hornblende diorite, occurring in the shape of a large south pointing arrow head at the southern end of an extensive area of granitic rocks, which extends north for about 20 miles and has a maximum width of about 10 miles west of Blayney. Both the hornblende diorite and granite intrude a group of interbedded volcanics and slates considered to be of Silurian age, and the granite is younger than the diorite. The direction of dip of the Silurian rocks changes from south-easterly on the south-east side of the diorite mass to westerly on its western side, and it appears that the diorite mass occurs at the nose of a southerly pitching anticline the core of which is occupied by granite.

By reference to the detailed plan (Plate 2) it will be seen that the cobalt workings occur at irregular intervals close to the main hornblende diorite mass, in an area of slates and volcanic rocks intruded by numerous diorite sills and dykes.

The slates and volcanic rocks range in strike from N25°E to N60°E and in dip from 20° to 70°SE. In a few places steeper dips are present.

Silicification is fairly widespread in the slates and in places they are quite cherty. Silicification is usually well developed along their junction with the diorite intrusions.

Volcanic rocks have been recognised interbedded with the slates in the south-eastern half of the map area.

Outcrops of andesitic crystal tuff occur in the vicinity of F workings, and an andesite (or porphyrite) flow occurs south-east of G workings. Both these rocks show evidence of metamorphism by diorite. It is possible that some of the rocks mapped as slates may represent fine grained tuffs.

A narrow, well defined, silicified zone extends in a north-easterly direction through the central part of the map area, and it appears in part to follow a slate - diorite junction, and in part the bedding in the slate. A few pot holes have been sunk on this silicified zone but it does not appear to have had any connection with mineralisation..

A similar, though shorter, silicified zone occurs at the junction of the slates and andesite flow south-east of G workings. These silicified zones have previously been mapped as felsites.

The hornblende-diorite (Bruce and Langley, 1949) ranges from fine to coarse grained, and from a rock composed almost entirely of hornblende to a rock composed of about equal proportions of hornblende and felspar.

Quartz veinlets occur in both the slates and hornblende diorite.

GEOLOGICAL STRUCTURE

As has been already described the map area is on the south-eastern side and close to the nose of a south-pitching regional anticlinal fold.

Two well developed sets of shears and joints occur in the area being described, and these occur in both the slates and the hornblende diorite. Both sets are steeply dipping; one set strikes approximately north and south, and the other set N25°E. The north-south set is parallel with the strong shear zones shown on the general geological map of the Carcoar area (Plate 1), and it is probably parallel to the axial plane of the regional anticlinal fold. The intersection of this set of shears and joints (cleavage in the slates) with the bedding will have a southerly pitch similar to that of the regional anticline. As will be seen later in the report the north-south set of shears has an important bearing on mineralisation.

Although small dragfolds have been noted in the slates in a few places, no evidence is at present available that the slates are tightly folded. Strike and dip observations indicate only a slight swing in the strike and slight rolls in the dip.

THE WORKINGS.

Shallow mining of cobalt deposits has been carried out in workings A, B, C, D, E, G and H, and there are some shallow copper workings a few hundred feet both north and north-west of G workings. The cobalt workings are very shallow and the depth of the copper workings would not exceed 30 feet. Little information regarding the deposits could be obtained from the workings as the bottoms of them are covered, and the sides largely obscured by slumped material.

A number of shallow potholes have been sunk at F workings, but there are no indications of mineralization, and it is fairly obvious that they were not connected with either cobalt or copper mining operations.

All cobalt or copper mining operations have been carried out in proximity to the main hornblende-diorite mass, the farthest from it being G workings which are within 900 feet of the boundary.

THE DEPOSITS

The cobalt ore occurred in the deposits as small lenses and irregular bunches (David, 1889), and deposits are situated close to junctions of slate and diorite.

The radiometric survey (Daly, Dyson and Pearce, 1951) showed definite indications of radioactivity around the dumps of all the old cobalt workings, but only near the north-eastern deposits were significant radio-active anomalies detected away from the workings. These three anomalies have been plotted on the accompanying plan (Plate 2), and it will be seen that they all have a general northerly strike showing that mineralisation has occurred in the northerly trending set of shears. It seems likely that work with more sensitive instruments would allow the anomalies to be extended on their strike beyond the limits shown.

The anomaly at H working is on the strike of a strong north-south and west dipping shear, which has been mapped about 600 feet north of the anomaly.

No cobalt workings occur in the vicinity of the central anomaly, but it is on the strike of some old copper workings.

Copper workings also occur on the strike of the anomaly at G workings, and although it seems likely that they occur in the same shear, no continuity of mineralization has yet been established between them.

There is also some suggestion of the occurrence of four other weaker anomalies in the area. Two occur between H workings and the main central anomaly, and the other two in the vicinity of E workings, one being 450 feet east and the other 500 feet south south-east of E workings.

The radioactive mineral content of the cobalt deposits at A, B, C, D and E workings is apparently less than at G and H workings, as radioactivity cannot be detected away from the dumps. The radioactivity could be masked however, if leaching has been more active in this area.

No detailed sampling of the deposits has been carried out, but grab samples of ore from the dumps of G and H workings have shown values up to 1.35% equivalent U_3O_8.

THE MINERALIZATION AND ITS CONTROL

The cobalt ore from the area is described (David, 1889) as consisting of glaucodot (a variety of cobaltiferous mispickel), erythrine (cobalt bloom), molybdenite, and thin films of an apple-green to dark green mineral determined as annabergite (arsenate of nickel). Molybdenite is said to be rare at the western workings namely the A, B, C and D workings. Torbernite was first recorded as occurring in association with the cobalt ore in the area in 1894 (Card, 1896) and is the only uranium mineral so far recognised at the locality. Samples of radioactive cobalt ore have been submitted for determination of the primary uranium mineral, and of other secondary uranium minerals which may be present.

There is no doubt that the radioactive minerals are intimately associated with cobalt mineralization as radioactivity has been detected at all workings. The greater radioactivity and the more frequent occurrence of molybdenite in the eastern workings also suggests that there may be a close association between molybdenite and the radioactive minerals. The copper occurrences in the area are also apparently associated with the same period of mineralization. The presence of torbernite (a uranium copper phosphate) suggests it, and old copper workings are on the strike of the radioactive anomalies.

The source of the mineralizing solutions has previously been attributed to the hornblende-diorite, but in the writer's opinion evidence is more in favour of the later granite being the source. The occurrence of the orebodies in shears intersecting the diorite, supports this view. Additional evidence is the occurrence, in many places in the area, of quartz veins in shears in the diorite.

Ore deposition appears to have been localized in a narrow belt, of the order of 1,000 feet in width, around the margin of the main mass of hornblende diorite, and deposition appears to have occurred close to the junctions of slate, and diorite sills and dykes. In the north-eastern part of the area mineralization has occurred along northerly-trending shears, and it is possible that a similar control, which has not yet been recognised, occurs at the south-west workings. Outside the main mass of diorite the lode shears would pass through alternating belts of slate and diorite, and these variations apparently produced conditions suitable for ore deposition.

In places in the area strong quartz veins in north-south shears can be seen forming angular branches along the bedding, and into the north-easterly set of shears, the result being south-pitching arrow head structures. It is thought that similar structures are likely to occur in the orebodies.

CONCLUSIONS AND RECOMMENDATIONS

The geological survey of the Carcoar area has shown that the three main radioactive anomalies occur in strong northerly trending shears, and that they are likely to persist along the strike beyond their present limits. There are also possibilities of the occurrence of uranium deposits in parallel shears at the south-western cobalt workings, and in the intervening country. The failure to detect them during the radiometric surveys may be due to the effects of leaching.

The area is considered a good prospect for the occurrence of small lenticular uranium deposits, and testing of it by diamond drilling, costeaning and pit sinking is recommended.

Further radiometric surveys of the geological map area are also recommended if more sensitive instruments than the Geiger Counter, which was previously used, are now available.

Further radiometric surveys should extend outside the areas already radiometrically surveyed, and particular attention should be paid to trying to trace known radioactive anomalies in north and south directions beyond their present limits. Some quartz with pyrite occurs about 700 feet slightly west of south of the anomaly at G workings, and this is outside the area previously radiometrically surveyed.

Detailed and regional prospecting is also warranted outside the geological map area around the margin of the hornblende-diorite and the granite. The airborne scintillometer could probably be used to advantage for regional prospecting.

The following areas need particular attention:-

1. The southern nose of the diorite mass. The axis of the anticlinal fold should strike through this area, and the north-south shearing may be better developed and allow for the occurrence of larger deposits.

2. The western margin of the diorite mass. The strong north-south shear zone on which the Coombing iron mine is situated follows the western diorite boundary closely, and some weak copper deposition in a north-south shear is already known near this boundary west of Carcoar.

3. The marginal country rocks around the northern end of the granitic mass, about 20 miles north of Carcoar, also warrant prospecting. Strong north-south shearing similar to that occurring at the south end of the granitic mass may have occurred here, and there may be similar mineralisation.

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to accompany 1952/65

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION

MINERAGRAPHIC INVESTIGATIONS

Report No.507. August 26, 1952.

Uraniferous Cobalt Ore from Carcoar, N.S.W.

A specimen of radioactive cobalt ore from Carcoar, N.S.W., has been submitted for examination by the Bureau of Mineral Resources, Geology and Geophysics.

The specimen is iron stained and shows a little molybdic ochre but no fluorescent uranium mineral can be detected. The gangue consists of a serpentinous substance, partly green, partly red, enclosing a few scattered and fractured quartz grains, and crossed by veins of fibrous serpentine. The opaque minerals embedded in the gangue are cobaltite, arsenopyrite, molybdenite and uraninite.

Cobaltite occurs as numerous, disseminated grains averaging 0.03-0.04 mm. across. A few larger crystals up to 0.18 mm. are present and are usually fractured and broken. The cobaltite is detected by its pinkish tint and has been confirmed by microchemical tests for cobalt and arsenic.

Arsenopyrite occurs in larger crystals, up to 0.5 mm. across which are also commonly fractured. The crystals are anisotropic and are attacked with slow effervescence by HNO_3. Where tested, no cobalt has been found.

Molybdenite occurs in groups of parallel, curved and twisted laminae in the serpentinous gangue between areas impregnated with cobaltite and arsenopyrite. Some of the laminae are only a few microns in width, being separated by similar widths of gangue. The mineral is very soft and characterised by marked pleochroism and strong anisotropism.

The location of the radioactive grains has been determined by autoradiographs and the most intense result is reproduced in fig.1. Clusters of particles of uraninite have thus been located (fig.2) which collectively appear to represent fractured and partially altered crystals up to 1 mm. across. A considerable number of such clusters have combined to produce the result in fig.1. The individual particles are hard and grey on the polished surface and conform with uraninite in being slowly tarnished by HNO_3 and by $FeCl_3$.

Frank L. Stillwell

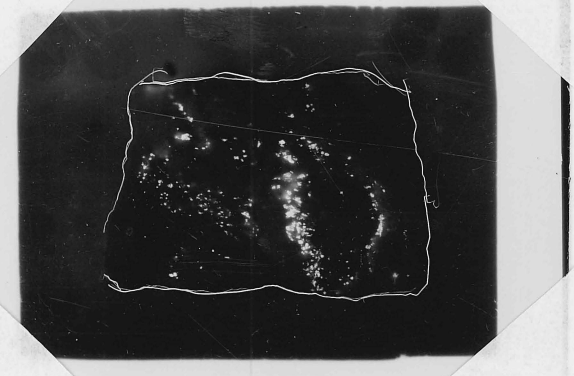


Fig.1. Autoradiograph of a polished section of ore outlined by the white line. The bright spots determine the location of the radioactive mineral. Nat. size.

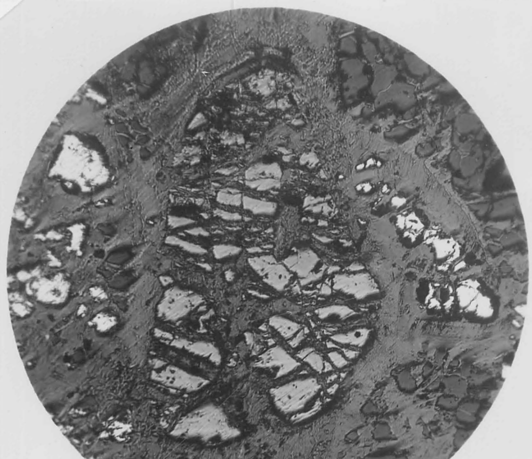


Fig.2. A fractured and partially altered crystal of uraninite (light grey) in dark, soft gangue. The white particles are cobaltite. Mag. 100.

PLATE 1

GEOLOGY, VICINITY CARCOAR
N.S.W.

SCALE

0 ¼ ½ ¾ 1 1¼ 1½ 1¾ 2

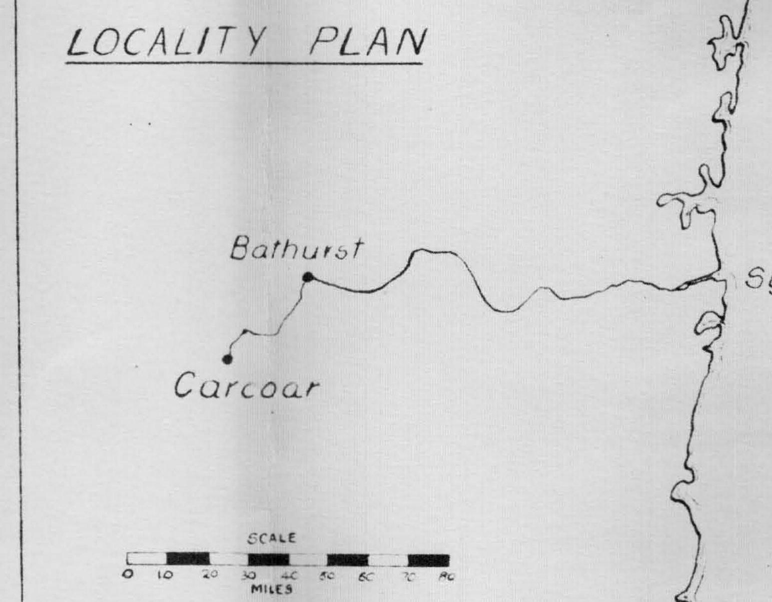
MILES

LEGEND

- Alluvium
- TERTIARY — Basalt
- Minor Plutonic Intrusions
- Granite
- Hornblende Diorite
- Silurian — Slates
- Silurian — Volcanics
- Shears

Geology after BRUCE & LANGLEY
1949 Sydney University
Honours Thesis

LOCALITY PLAN



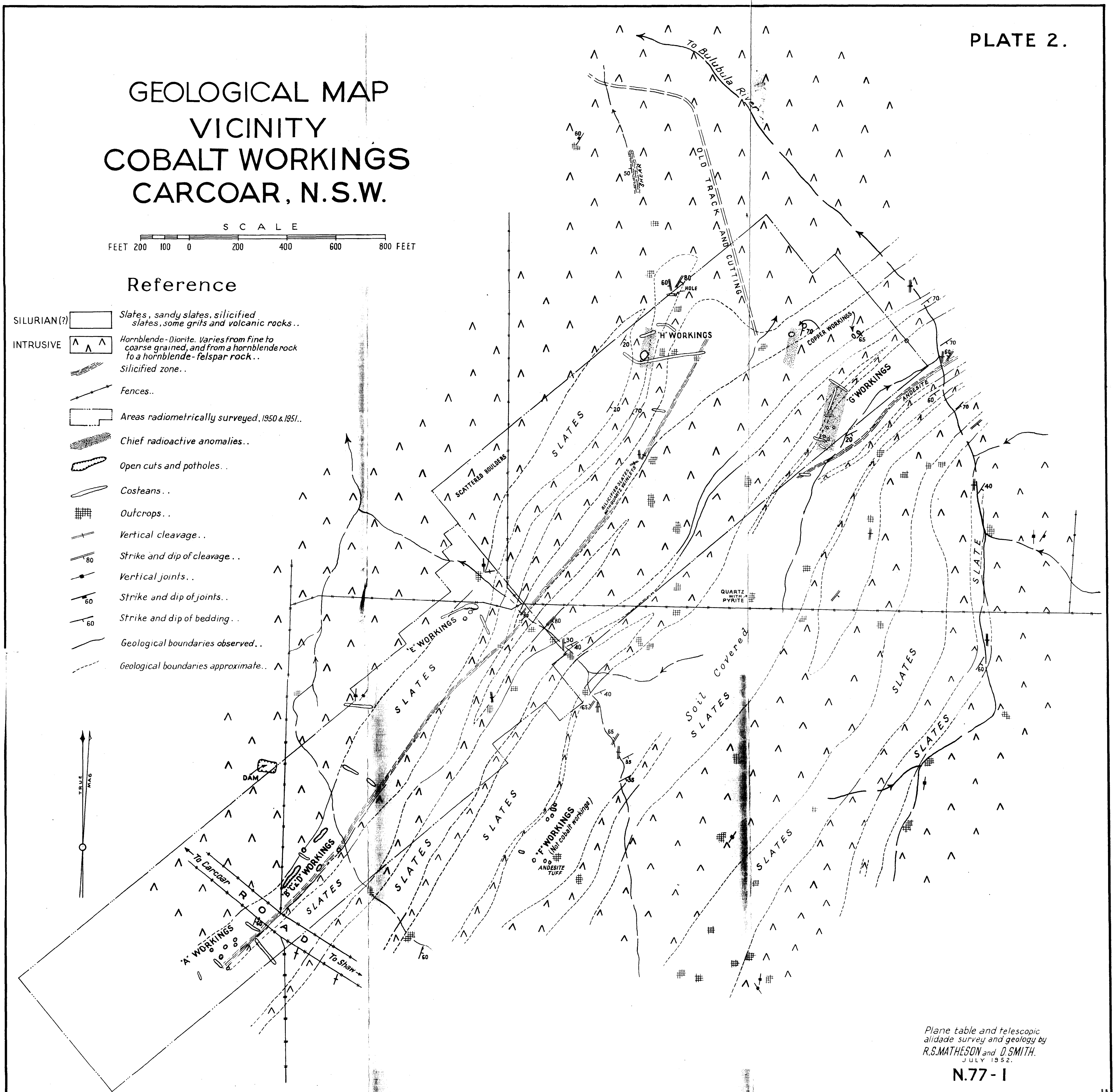


PLATE 2.
GEOLOGICAL MAP
VICINITY
COBALT WORKINGS
CARCOAR, N.S.W.
SCALE
FEET 200 100 0 200 400 600 800 FEET
Reference
SILURIAN (?)
Slates, sandy slates, silicified slates, some grits and volcanic rocks..
INTRUSIVE
Hornblende-Diorite. Varies from fine to coarse grained, and from a hornblende rock to a hornblende-felspar rock..
Silicified zone..
Fences..
Areas radiometrically surveyed, 1950 & 1951..
Chief radioactive anomalies..
Open cuts and potholes..
Costeans..
Outcrops..
Vertical cleavage..
Strike and dip of cleavage..
Vertical joints..
Strike and dip of joints..
Strike and dip of bedding..
Geological boundaries observed..
Geological boundaries approximate..
TRUE
MAG
To Bulubula River
OLD TRACK AND CUTTING
SHEAR
HOLE
'H' WORKINGS
COPPER WORKINGS
'G' WORKINGS
ANDESITE
SCATTERED BOULDERS
SLATES
SILICIFIED SLATE WITH QUARTZ VEINLETS
QUARTZ WITH PYRITE
'E' WORKINGS
Soil Covered
SLATE
DAM
'F' WORKINGS (Not cobalt workings)
ANDESITE TUFF
'B' 'C' & 'D' WORKINGS
'A' WORKINGS
To Carcoar
ROAD
To Shaw
Plane table and telescopic alidade survey and geology by
R.S. MATHESON and D. SMITH.
JULY 1952.
N.77 - 1