COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1958 No.81

GEOPHYSICAL SURVEY

WATERHOUSE NO.1 URANIUM PROSPECT,

NORTHERN TERRITORY

(1957).

By

J. Daly

&

K.H.Tate.

RECORD 1958/81.

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ABSTRACT.

The Waterhouse No. 1 Uranium Prospect was surveyed with the Turam electromagnetic and self-potential methods. Strong anomalies were discovered with both methods in an area several hundred feet east of areas investigated in 1953.

It is considered that the anomalies are caused by a mineralised bed containing sulphides in the Lower Proterozoic Golden Dyke formation.

Consideration of the results of the investigations at Rum Jungle and Waterhouse Uranium Prospect No. 2 leads to the conclusion that the Waterhouse No. 1 area should be tested by drilling for base-metal and/or uranium mineralisation. Drilling recommendations are given.

1. INTRODUCTION.

During the airborne radioactive survey in the Rum Jungle district (Wood & McCarthy, 1952), a number of radioactive anomalies was discovered to the south of Rum Jungle, mainly in the Hundred of Waterhouse. Subsequent ground radioactive surveys led to the selection of four areas, known as Waterhouse Nos. 1, 2, 3 and 4 uranium prospects, for closer examination. This examination involved ground radiometric gridding, geological mapping, geochemical testing, and a small amount of magnetic work (Rosenhain & Alle, 1953). A small amount of exploration based on this work did not lead to any useful discovery.

Consideration of the results of exploration at Rum Jungle has led to the conclusion that geophysical surveys over the Waterhouse prospects directed to the discovery of sulphide mineralisation, might be warranted for the following reasons :

(i) Extensive sulphide mineralisation occurs around the Rum Jungle granite. The uranium, where it occurs, is associated with this mineralisation ;

(ii) although the sulphide mineralisation is largely pyritic, it is not entirely so. Important bodies of lead and copper sulphides occur in some areas;

(iii) experience has shown that geophysical surveys using electromagnetic and self-potential methods give very clear indications of the sulphide mineralisation in the Rum Jungle area;

(iv) the geological setting of the Waterhouse uranium prospects is very similar to that of the Rum Jungle deposits;

(v) favourable surface indications of mineralisation are present, in the form of small areas showing higher uranium content, favourable geochemical indications of copper, and small showings of secondary copper minerals.

From these facts, the conclusions were drawn that deposits of sulphide minerals may occur in the Waterhouse area, that if such deposits are present, it is very likely that they will be discovered by surveys using electrical methods, and that, if such bodies are located, they may be associated with deposits of base metal sulphides or uranium of economic significance. It was therefore decided to carry out surveys over the areas surrounding the four prospects. The present report deals with the survey at Waterhouse No.1 Prospect. Results of surveys over Nos. 2, 3 and 4 Prospects are given in a separate report (Tate, 1958).

2. DESCRIPTION OF PROSPECT.

The Waterhouse No. 1 Prospect is about 70 miles south of Darwin, and about 4 miles south-east of Batchelor township. The position of all the Waterhouse prospects is shown on the map (Plate 1). This map also shows the approximate position of the boundary between the Hundreds of Goyder and Waterhouse. This boundary has not been established with reference to survey marks on the ground, so that its position in relation to the area of the survey cannot be specified exactly.

The geology of the Waterhouse area is described in broad outline by Joklik (1953) and in more detail by Malone (1958). Detailed geological mapping, geochemical testing, and magnetic work over the No. 1 Prospect itself are described by Rosenhain and Alle (1953). The results of their work are shown on Plates 2 and 3. Plate 2 shows

geological and radiometric mapping. Plate 3 shows magnetic and geochemical results. The geological mapping was confined to an area around the main radiometric indication, and has not covered the site of the most interesting electromagnetic anomaly. The salient features of this work are the following.

(i) the rocks are sedimentary rocks (slates, shales, sandstone and quartzites) considered to belong to the Golden Dyke formation of the Brock's Creek group. Rocks of this formation are the host rocks of the mineralisation at Rum Jungle;

(ii) the strike of the rocks is approximately northerly, and the dip steeply to the east;

(iii) the main radioactive anomaly is a small area centred at about 340S/200E, which gave readings up to 12 times background. This anomaly was tested by a costean 100 feet long. The costean was sampled in 5 feet sections, and samples radiometrically assayed. The following values for equivalent uranium content were obtained -

0.01% equivalent U_3O_8 over 100 feet

0.03% " " over one five foot section

0.07% " " in a spot sample taken where the highest reading was obtained.

(iv) The geochemical survey showed two areas of high copper content, one centred at 100N/700E, and one extending between traverses 300N and 500N, at about 600E. These were tested by bull-dozed costeans, one of which revealed a little malachite staining.

(v) The magnetic survey showed a well defined anomaly about 200 feet west of the radioactive anomaly. The later aeromagnetic survey showed that this is portion of an extensive anomaly which extends in a southwesterly direction from No. 1 Prospect to No. 2 Prospect, generally parallel to the regional strike. The geological significance of this anomaly is not clear, but its presence is a further point of similarity between the geological setting of the Waterhouse prospects and that of the Rum Jungle deposits. This matter has been briefly discussed by Daly (1957).

3. TECHNICAL DETAILS.

The methods used on the survey were the electromagnetic and self potential methods.

The electromagnetic method requires the application of a primary electromagnetic field to the ground, and its measurement at points on the ground surface. If the ground conductivity is uniform, the distribution of the field at the surface may be calculated. However, if formations of higher conductivity than the surrounding rocks are present, secondary currents are induced in them, the effects of which are also observed at the surface as anomalies in the field.

The method was used in two forms -

(i) the Slingram method, in which the primary field is a 500 cycle field produced by a horizontal transmitting coil driven by a small oscillator. The field is detected by another horizontal coil, kept at a fixed distance from the transmifting coil. The two coils are moved systematically along the traverses.

(ii) The Turam method, which uses a field of 440 cycles or 880 cycles, produced by a motor generator, and coupled to the ground, either inductively by means of a large loop, or directly by means of a long cable grounded at each end. The detecting element consists of two horizontal coils kept at a fixed separation, the quantities measured being the intensity ratio and phase difference of the currents induced in the two coils.

Both methods used measurements of vertical component only.

The Slingram method was used as a preliminary test on traverses 200S and 400S only. As the results showed that strong anomalies were present, the grid shown on Plate 2 was laid out for Turam work. The primary field was applied by a large rectangular loop, one side being laid through the zero points on the traverses, and the other three sides laid out to the north, south and west, using a landrover and odograph.

The self potential method is used to detect potentials in the ground caused by oxidising action in a body containing sulphide minerals which protrudes above ground water level. In such cases, the ground potential distribution has a characteristic shape, with a maximum negative value vertically above the oxidising body. However, the same type of anomaly can arise from several other causes (such as graphitic beds), so that the presence of the anomaly is not a certain indication of the presence of sulphide mineralisation.

4. RESULTS AND INTERPRETATION.

The results of the self potential survey are shown as contours on Plate 3, and the results of the Turam survey as ratio contours on Plate 4, and phase contours on Plate 5. Selected profiles are shown on Plate 6.

The Turam results show two intense anomalies, which have been termed anomalies A and B. Anomaly A extends from 600S/700E to 1000N/900E, and is attributed to a narrow body at shallow depth, of extremely high conductivity. It is considered that the conducting body does not extend to great depth, but the actual depth extent is not certain. Anomaly B extends from 200N/575E to 500N/470E. It is also attributed to a narrow body of high conductivity, which may have a slightly greater extent in depth than the body causing anomaly A.

The self potential results also show very strong anomalies, which can be correlated with anomalies A and B, although their axes are slightly displaced and their extent in length is not quite the same. The self potential anomalies are broad, and do not allow the position of the source to be located as precisely as do the electromagnetic anomalies.

By analogy with the results of testing similar anomalies in the Rum Jungle district, it is considered very likely that these anomalies are due to beds strongly mineralised with sulphides. It may be expected that the mineralisation is mainly pyritic, but other sulphides of economic value may be present. The geochemical copper anomalies are displaced somewhat downhill from anomaly A, and may be connected with this body. The main radioactive anomaly is several hundred feet south-west of the electrical anomalies, and has no obvious.....

...../4.

connection with them. In the Darwin area, it is commonly found that well defined radioactive anomalies are no indication of the presence of uranium mineralisation of economic grade in the immediate neighborhood. However, experience has shown that costeaning is not a reliable method of testing such anomalies. Pattern wagon or percussion drilling has proved much more satisfactory, and this anomaly should certainly be tested in this way.

5. RECOMMENDATIONS.

(i) Detailed geological mapping and radiometric gridding should be extended to cover at least the area of the geophysical grid.

(ii) The electrical anomalies should be tested by diamond drilling. As an initial programme, four drill holes are recommended, as follows:

Anomaly	Drill Hole No.	Target	Collar	Depression	Bearing	Length
A	1	0/830E	0/750E	45°	90°	180ft.
			0/950E	45°	270°	200ft.
A	2	200S/830E	200S/750E	45°	90°	180ft.
			200S/950E	45°	270°	200ft.
A	3	500N/780E	500N/675E	45°	90°	220ft.
			500N/875E	45°	270°	220ft.
B	4	300N/560E	300N/610E	50°	270°	120ft.

Alternative sites are given for drill holes 1, 2 and 3. This is because, although geological evidence suggests a steep easterly dip, the easterly sites are on the uphill side of the target, and therefore less convenient to drill. The site of drill hole 4 is on flat ground, and can conveniently be drilled from the eastern side.

(iii) The radioactive anomaly at 340S/200E should be tested by wagon or percussion drilling to about 70 feet, on a grid surrounding the anomaly.

6. REFERENCES.

Daly, J (1957) — Notes on the Results of Aeromagnetic Surveys in the Northern Territory B.M.R.G.G. Records 1957/72.

Joklik G.F. (1953) — Uranium Prospects Waterhouse Area N.T. B.M.R.G.G. Records 1953/95.

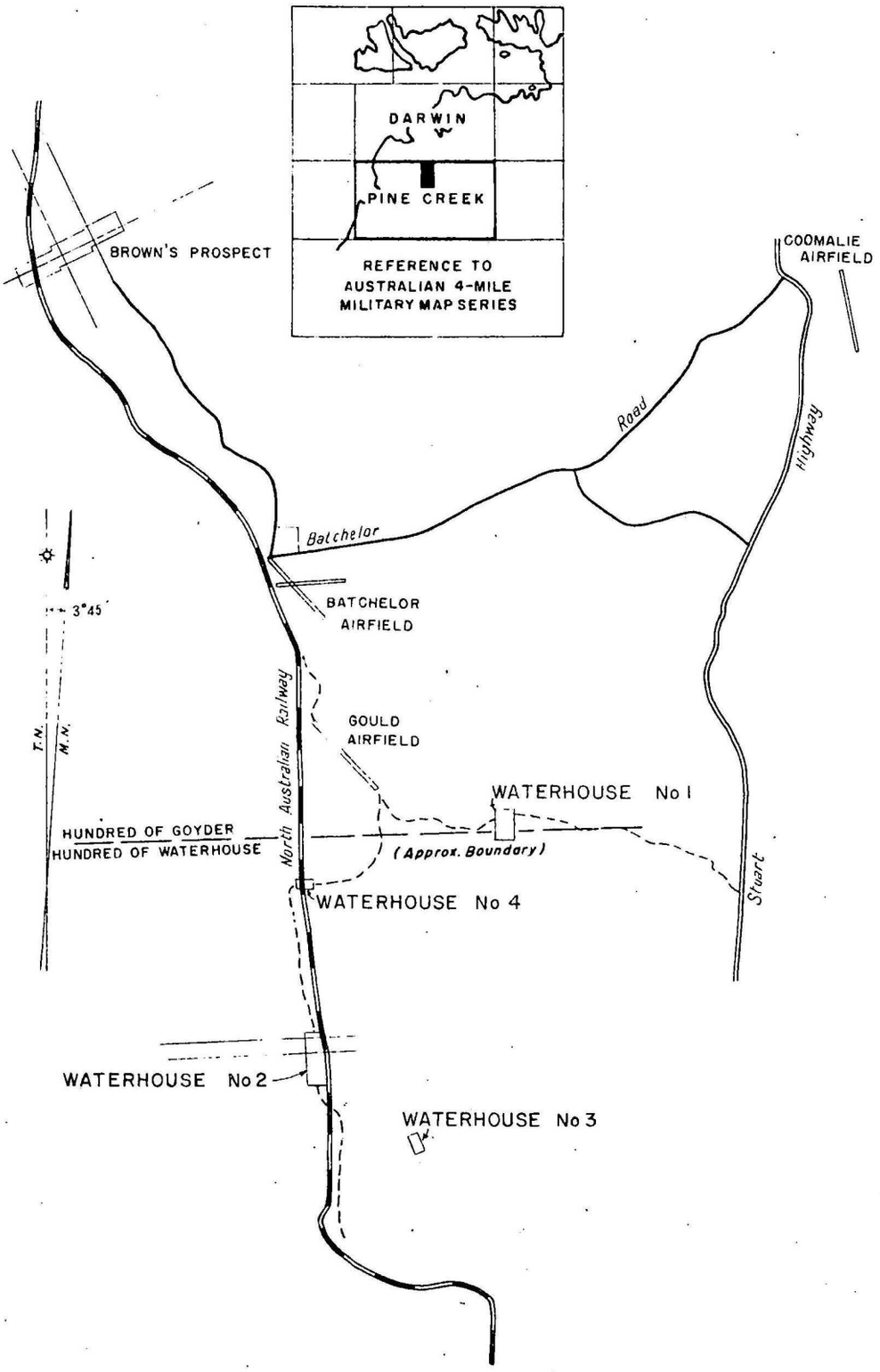
Malone, E.J. (1958) — The Geology of the Darwin - Adelaide River area B.M.R. G.G. Records 1958/96.

Rosenhain, P.E. & Allo, A.F. (1953) — Preliminary Geological Report on Waterhouse Uranium Prospect No.1. Preliminary Geophysical Report on Waterhouse Uranium Prospect No.1. B.M.R. G.G. . Record 1953/104.

Tate, K.H. 1958. — Geophysical Survey at Waterhouse Uranium Prospect No.2 B.M.R.G.G. Records 1958/82 (in preparation).

Wood, F. W. & McCarthy, E. (1952). — Airborne surveys over the Rum Jungle and other portions of the Northern Territory. B.M.R. G.G. Records 1952/79.

PLATE I



GEOPHYSICAL SURVEY AT WATERHOUSE No 1

URANIUM PROSPECT, N.T.

LOCALITY MAP

(AFTER DEPARTMENT OF INTERIOR, CANBERRA, MISCELLANEOUS 86)

SCALE IN MILES

2 1 0 2 4 6

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To Accompany Records 1958, No. 81

PLATE 2

LEGEND

Alluvium		Quaternary
Shale		Pre-Cambrian (Brocks Creek group)
Quartzite (silicified shale)		
Siltstone		
Limonite pseudomorphs after pyrite		
Geological boundary		
75 / Bedding		
80 / Cleavage		
2X	Radiometric contour	
325	Topographic ..	(interval 25 feet)
Recommended drill-hole.		
Steel stake		
Watercourse		
Costean		
Recommended costean		
?	Fault inferred from regional mapping	

T.N. M.N. 4°

1110 N 400 E 600 E 800 E 1000 E 1200 E 1100 N

900 N 700 N 500 N 300 N 100 N 0 100 S 300 S 500 S 700 S 900 S 1100 S

300W 200W 0 200E 1110S 400E 600E 800E 1000E 1200E

From Gould Firstrip 2M. (Approx)

To Stuart Highway 3M (Approx)

TURAM INDICATION B

TURAM INDICATION A

D.H. No 3 45° 220'

D.H. No 3 (Alternative) 45° 220'

D.H. No 4 (50° 145')

D.H. No 1 45° 150'

D.H. No 1 (Alternative) 45° 150'-200'

D.H. No 2 75° 130'

D.H. No 2 (Alternative) 75° 200'

Pegged with E-W locksuits

Limit of Geological Mapping

Limit of Geological Mapping

0°33'10" True North

275 300 325 350 375

SCALE IN FEET

100 0 100 200 300

K. L. Tate
GEOPHYSICIST

GEOPHYSICAL SURVEY AT WATERHOUSE No 1 URANIUM PROSPECT, N.T.

TOPOGRAPHY AND GEOPHYSICAL TRAVERSES, GEOLOGY, RADIOMETRIC CONTOURS AND RECOMMENDED DRILL HOLES

(GEOLOGY AND RADIOMETRIC CONTOURS AFTER ROSENHAIN AND ALLE, 1953)
(BASE PLAN AFTER DEPARTMENT OF INTERIOR, CANBERRA, MISC. 82)

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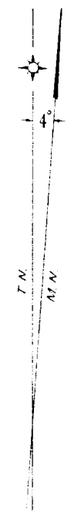
PLATE 3



LEGEND

- 450 / 400 — SELF-POTENTIAL CONTOUR (INTERVAL 50 MILLIVOLTS)
- 2000 — MAGNETIC " (" 200 GAMMAS)
- 325 — TOPOGRAPHIC " (" 25 FEET)
- COSTEAN
- GEOCHEMICAL COPPER HIGH (ROSENHAIN AND ALLE, 1953)
- WATERCOURSE

SCALE IN FEET

100 0 100 200 300

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GEOPHYSICAL SURVEY AT WATERHOUSE No1 URANIUM PROSPECT, N.T.

SELF-POTENTIAL CONTOURS, MAGNETIC VERTICAL FORCE CONTOURS AND TOPOGRAPHY

(MAGNETIC CONTOURS AFTER ROSENHAIN AND ALLE, 1953)

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PLATE 4

SCALE IN FEET

100 0 100 200 300

CONTOUR INTERVAL 0·200

K.H. Sate

GEOPHYSICIST

GEOPHYSICAL SURVEY AT WATERHOUSE No I URANIUM PROSPECT, N.T

TURAM RATIO CONTOURS

FREQUENCY 440 CYCLES/SEC.

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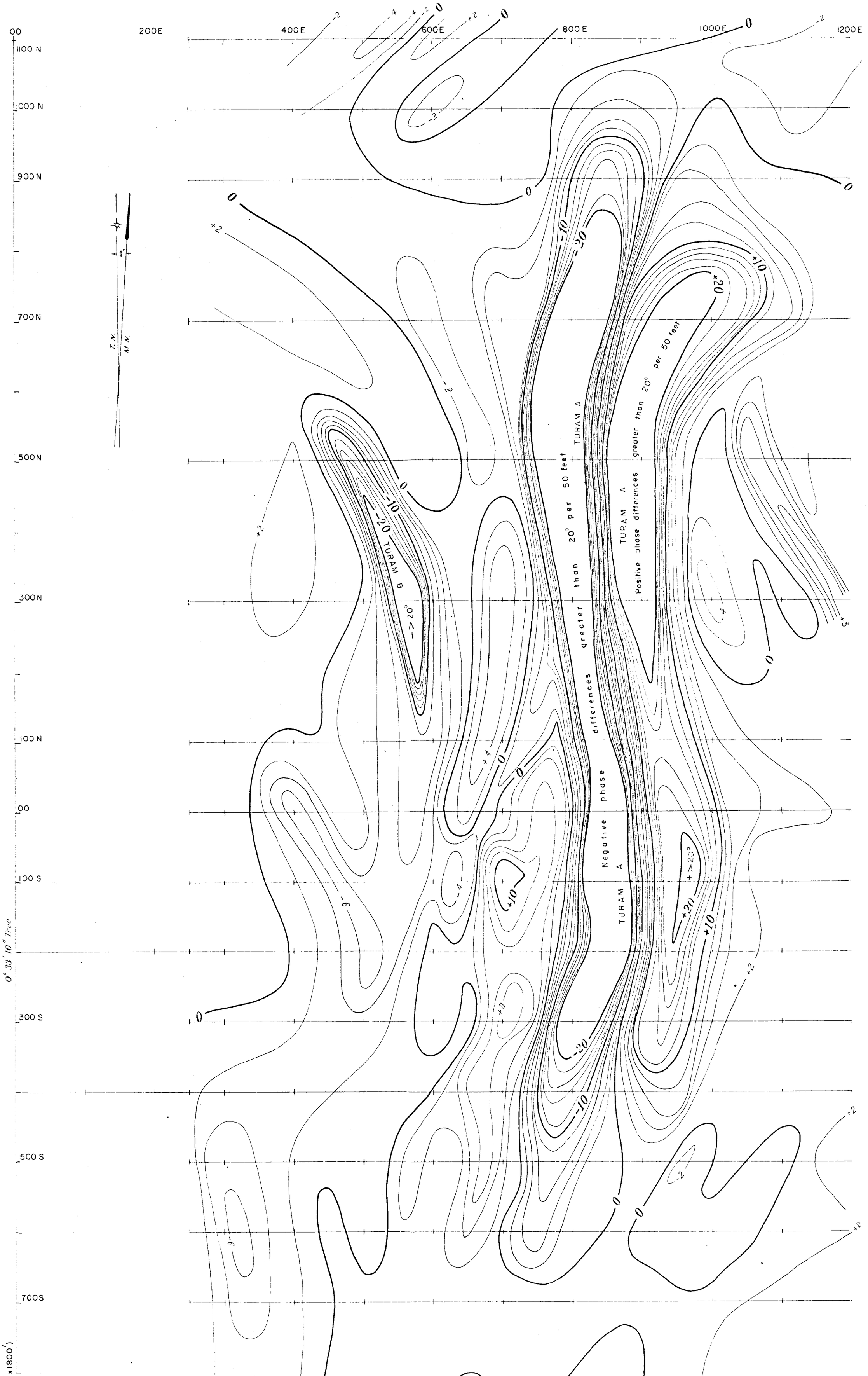
PLATE 5



SCALE IN FEET

100 0 100 200 300

CONTOUR INTERVAL 2°

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GEOPHYSICAL SURVEY AT WATERHOUSE No I URANIUM PROSPECT, N.T.

TURAM PHASE DIFFERENCE CONTOURS

FREQUENCY 440 CYCLES/SEC.

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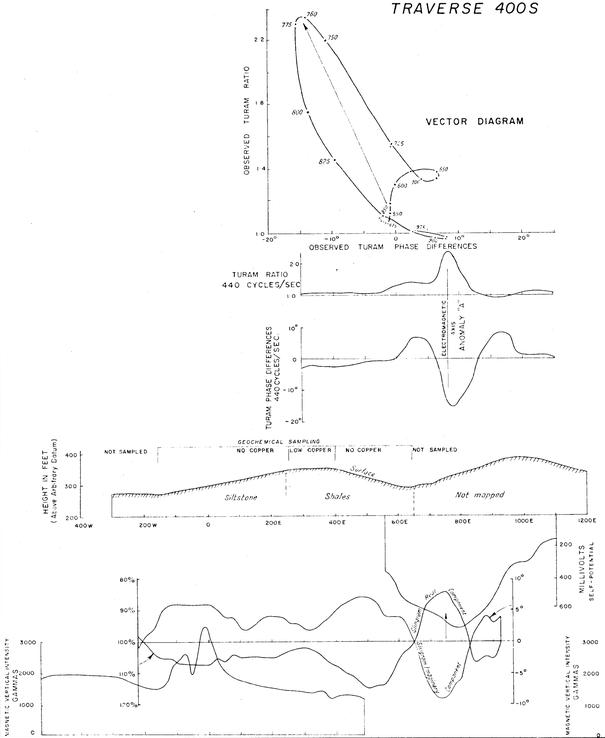
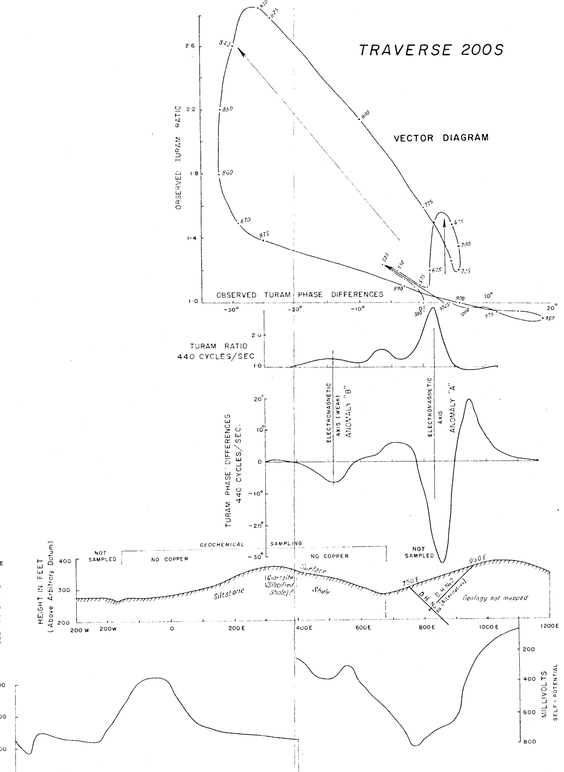
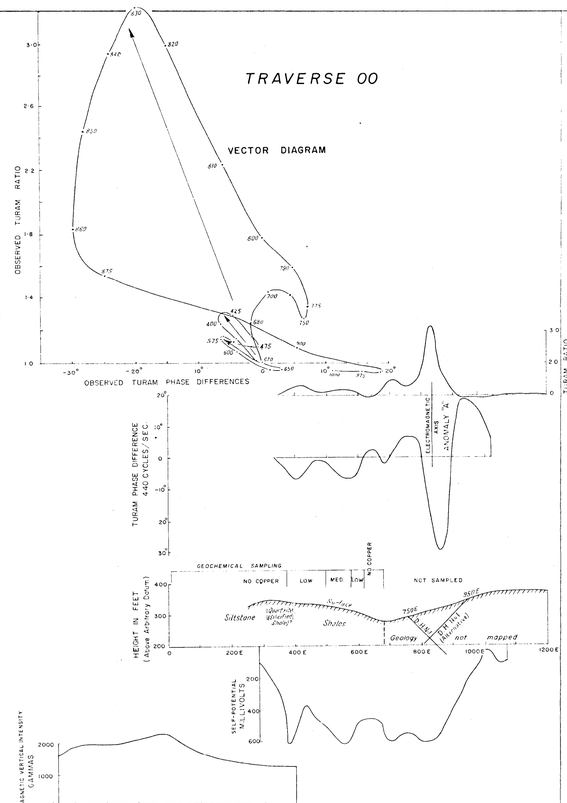
TRAVERSE 400S



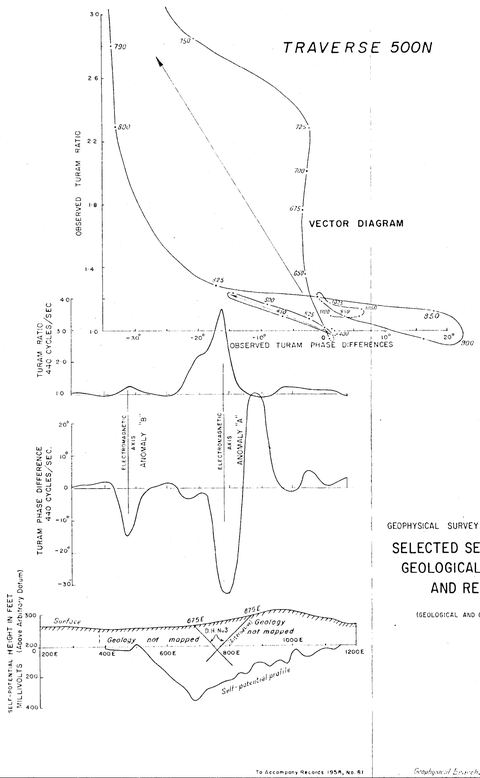
TRAVERSE 200S



TRAVERSE 00



TRAVERSE 500N



GEOPHYSICAL SURVEY AT WATERHOUSE No I URANIUM PROSPECT, N.T.

SELECTED SECTIONS SHOWING GEOPHYSICAL, GEOLOGICAL AND GEOCHEMICAL RESULTS AND RECOMMENDED DRILLHOLES

(GEOLOGICAL AND GEOCHEMICAL DATA AFTER ROSENHAIN AND ALLE, 1953)

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To Accompany Records 1958, No. 61