COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES,
GEOLOGY AND GEOPHYSICS

RECORDS 1956, No. 152

GEOPHYSICAL INVESTIGATIONS AT THE EDITH RIVER URANIUM PROSPECTS, NORTHERN TERRITORY, 1953

by

R. J. de GROOT

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ILLUSTRATIONS.

A B S T R A C T

Brief geophysical surveys using one or more of the radiometric, self-potential and magnetic methods were made during 1953 at six prospects within the Cullen Granite near Edith River and at one prospect (A.B.C.) in volcanic rocks near Katherine. These surveys followed preliminary investigations made in the area during 1952.

Results of the surveys are shown in the accompanying plates. In the first six prospects, no anomalies of any appreciable extent were observed, but preliminary investigations at the A.B.C. prospect, near Katherine, showed a considerable area of radioactivity.

1. INTRODUCTION.

The Edith River Area, is situated on both sides of the Darwin-Larrimah railway line, about 20 miles north-west of Katherine and 175 miles south-east of Darwin. The location of the uranium prospects in the area is shown on Plate 1.

The following brief geophysical surveys were made in the area during the field season of 1953.

Prospect.	Type of Survey.
(i) Edith River Find, Deposit A	Radiometric, Self-Potential and Magnetic.
(ii) Edith River Find, Deposit F	Radiometric and Magnetic.
(iii) Tennyson's No.1	Radiometric and Self-Potential.
(iv) Tennyson's No.2	Radiometric.
(v) Hawkins'	Radiometric.
(vi) Yenberrie	Radiometric, Self-Potential and Magnetic.
(vii) A.B.C., Katherine	Radiometric.

A preliminary radiometric investigation of prospects (ii) and (iii), and of the Edith Falls Area, was made by Dyson in October, 1952. The results of that investigation are given in Section 3 of this report.

The results of the Yenberrie survey have been reported by de Groot (1953). Only preliminary investigations of the A.B.C. Prospect are recorded here as, at the time of writing, work was still proceeding there.

Radiometric prospecting and the investigation of airborne scintillometer anomalies using car-borne Geiger-Muller and scintillometer recording ratemeters in the Edith River area are described in a separate report (Barlow, 1956).

2. GEOLOGY.

Prospects (i) to (vi) inclusive are situated within the Cullen Granite (Noakes, 1949), near its southern extremity. Proximity of other rock types is shown in Plate 1. The uranium mineralisation occurs in very narrow shear zones in the granite, the shear zones generally having a northerly trend.

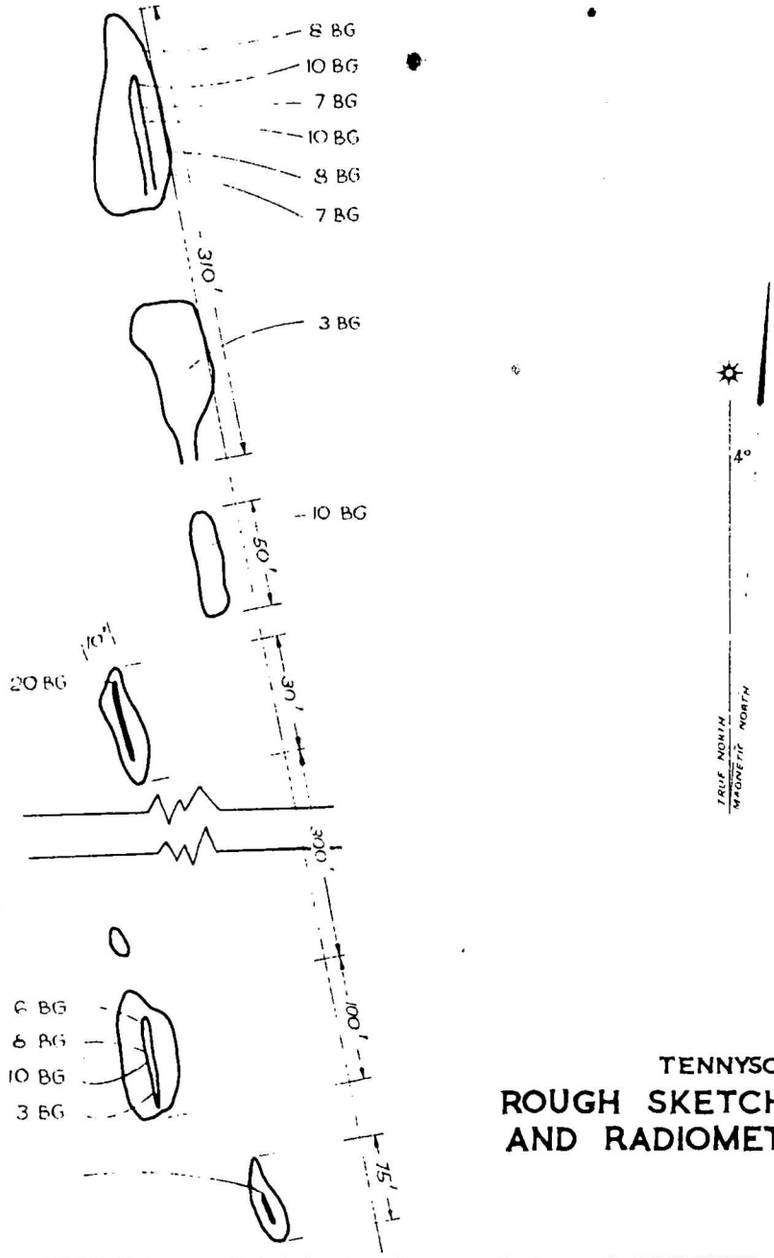
The prospects have been mapped geologically in detail and true N-S baselines laid down (Fisher, 1952; Gardner, 1953a; Jones, 1953).

Prospect (vii) occurs in a belt of basic to intermediate volcanics interbedded with quartzites and grits of the Buldiva Group of Upper Proterozoic age. These volcanics and sediments have a general strike of 30 degrees west of north (Matheson, 1953). This prospect is thus quite different in character from the other six.

3. PRELIMINARY RADIOMETRIC INVESTIGATIONS.

A geophysical party spent two days in the Edith River area in October, 1952, to inspect:-

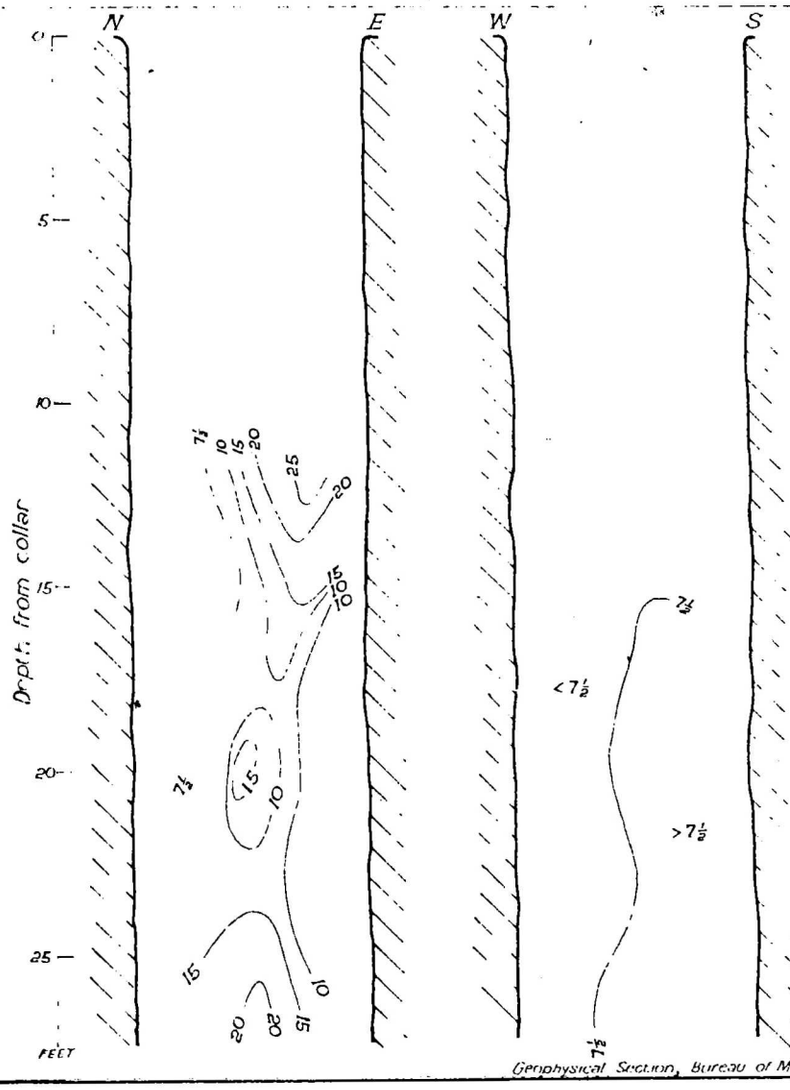
FIG. 1



TENNYSON'S FIND.

ROUGH SKETCH OF OUTCROPS AND RADIOMETRIC READINGS

FIG. 2



EDITH RIVER FIND
ISORAD CONTOURS OF SHAFT "A"

AS ON 24.10.52.

Contours expressed as times background

GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources, Geology & Geophysics G 121-19

(a) A radioactive mineral prospect reported by Mr. S. Tennyson (Tennyson's Find).

(b) An anomaly recorded during an airborne scintillograph survey carried out by the Bureau.

(c) The shaft of the Edith River Find.

(d) The Edith River Falls Area, where radioactive readings had been reported.

(a) Tennyson's Find. A sample from this area, submitted by Mr. S. Tennyson, gave a field assay of 0.126 percent eU_3O_8. The area is just south of, and about 3 miles along, the track to Florina from the Stuart Highway (Plate 1).

Three parallel lines of activity, about 200 yards apart, occur in the area, the greatest radioactivity being associated with the centre line. This is the most pronounced geological feature, and preliminary radiometric work was concentrated along it.

The general direction of the line is north-north-west, and the main lode consists of a series of elongated outcrops over a distance of about 300 yards. These outcrops are along a sheared zone within granite, and consist of vertically-dipping lenticular quartz zones ranging in width from half-an-inch to two feet. The gamma-ray activity is associated with these lenticular structures.

Fairly large variations in radioactivity were recorded along the centre line, some of the maxima being off-set from the general axis of the line (see Fig.1). Although isolated readings of up to 20 times background count were recorded, the general level was only 2 to 3 times background. A sample from the outcrop giving the highest reading assayed 0.13 percent eU_3O_8.

Maximum readings along the two smaller, parallel shear zones were about 4 times background count.

The prospect resembles that of the Edith River Find, where readings were obtained intermittently over a longer distance, but where the mineralisation appeared to be stronger. Results from work done at Edith River Find should give some indication of the possible value of this prospect, which, from this preliminary investigation is not very encouraging.

(b) A fairly large area was inspected where an aerial scintillometer anomaly had been recorded, a few hundred yards to the south-east of Hawkins Prospect (see Plate 1).

The only readings worthy of note were recorded along a relatively narrow zone of parallel, steeply dipping shears within the granite. Some of the shears, where hematitic material occurred similar to that at Tennyson's Find, gave readings up to 4 times background count, compared with the values of slightly greater than twice background obtained on the granite in the area. In a small pot-hole 6 inches deep, near which there was considerable surface rubble, a reading of 6 times background was recorded.

It is possible that higher readings might have been obtained if each shear zone had been followed along its complete length. This was not done, as it was known that another party would be making a more detailed survey of the area during the following field season.

The general strike of the zone indicates that it may be a southern extension of the find reported by Mr. Tennyson.

(c) Edith River Find. The isorad contours of the shaft at Edith River Find (Deposit "F") are shown on Fig.2.

Readings on the south-western wall were consistently lower than those on the opposite wall and little information can be gleaned from the contours. Assay results of samples from the face of the shaft are given in the geological report (Fisher, 1952).

(d) Edith River Falls Area. At the base of the Cambrian rocks, which form an escarpment at Edith River Falls, is a bed of pyroclastic material which showed gamma-ray activity up to $3\frac{1}{2}$ times background. A conglomerate overlying this bed gave readings of twice background count.

Another pyroclastic bed, stratigraphically lower than and separated by basalt from the previous one, was encountered along the track to the west of the falls. Readings here, which were slightly in excess of three times background, were fairly constant across the bed, and appeared to be due to a gamma-ray source evenly disseminated throughout the bed.

The high readings recorded over the conglomerate could have been caused by pebbles of the underlying pyroclastic beds within the conglomerate.

Mineralogical work on specimens of this pyroclastic bed and possible correlation with the rock type causing the anomalies along fracture zones within the granite of the Edith River Area may be of interest.

4. METHODS AND INSTRUMENTS.

(a) Radiometric Surveys.

The instruments used were:

(i) A "Cintel" portable Geiger-Muller ratemeter, Type 1011C, Serial No. 2, fitted with three G24H G.M. tubes. The background reading of this instrument on the sedimentary rocks of the region was taken as 6 microamps on the "C" scale. The scale was assumed to be linear, with interscale conversion factors as follows:-

4 times "B" scale reading equivalent to "C" scale reading.

10 times "A" scale reading equivalent to "C" scale reading.

(ii) A "Cintel" portable Geiger-Muller ratemeter, Type 1011, Serial No. 066, fitted with three GM5B G.M. tubes. The background reading of this instrument on the sedimentary rocks was taken as 6 microamps on the "C" scale. The scale was assumed to be linear, with interscale conversion factors as follows:-

4.2 times "B" scale reading equivalent to "C" scale reading.

10.9 times "A" scale reading equivalent to "C" scale reading.

(iii) A "Halross" portable scintillometer, Model 939, Serial No. 313. The background reading of this instrument on the sedimentary rocks was taken as 14 counts per second. The scale was assumed to be linear.

These three instruments measure the intensity of the gamma radiation in the immediate vicinity of the probe. The readings taken are quoted as multiples of the background count of the sedimentary rocks of the region, as these give the lowest recorded count of any rocks. Some observers quote results as multiples of the background count of the country rocks adjacent to the prospect (Fisher, 1952; Matheson, 1953, et al.), but for the first six prospects the granite in the area generally gave a reading twice as high as the background reading of the sedimentary rocks. Some parts of the shear zones gave readings less than the average granite reading, and a few granite exposures gave readings greater than three times background.

It should be noted that, due to greater efficiency, "times background" measured with a scintillometer is usually more than three times the "times background" recorded with a G.M. ratemeter.

(b) Self-Potential Surveys.

Attempts were made to conduct self-potential surveys on some of the prospects in order to obtain indications of any sulphide ore bodies in the shear zones in the granite.

The results of these surveys were inconclusive, mainly because of high contact potentials and high ground resistivity. Although precautions were taken to eliminate as much error as possible due to these causes, the resulting S.P. profiles were not reproducible. These precautions consisted of digging three shallow holes about 5 inches deep at each station, each hole being dug so that the electrodes had good contact with soil rather than rubble. The holes were watered several hours before the readings were taken and in many cases watering was done on the previous day. The potential at each station was read with the electrode in each hole in turn. Stations were re-occupied and electrodes reversed at frequent intervals. Readings were averaged after neglecting any obviously spurious results due possibly to high ground resistivity or high contact potentials. The readings at each station frequently had a scatter of more than 50 millivolts.

It is considered that no major S.P. anomalies exist in the areas surveyed. Any small anomalies that may exist would be obscured by the observed contact effects.

(c) Magnetic Surveys.

The instruments used were:

(i) An Askania dual-purpose magnetic variometer, Type G.F.6, Serial No. 521642, with vertical force movement.

(ii) A Hilger and Watts vertical force magnetic variometer, Type B6000, Serial No. 69106.

Both these instruments measure the local variation in the vertical component of the earth's magnetic field caused by different types of rocks having different magnetic properties.

5. DETAILS OF SURVEYS AND RESULTS.

(a) Edith River Find, Deposit A.

Readings of gamma ray intensity were taken along 16 traverses ranging from 200 to 500 feet long, at intervals ranging from 25 feet to one foot; the smaller intervals were used where changes in the gamma ray intensity were large. The traverses were surveyed with tape and compass at right angles to the main geological N-S baseline, and were spaced at 50 feet intervals over a length of 750 feet. Readings were also taken for 800 feet along the baseline.

Additional readings were taken some feet to either side of the traverses in an attempt to obtain more accurate delineation of anomalous areas.

These readings showed that the radioactive anomalies were of very small extent and it was not practicable to represent them satisfactorily by contours on the standard geological mapping scale of 1 inch = 100 feet.

The results are shown as "high spots" on Plate 2.

Some anomalies, small in area, but possibly high in intensity may have been missed between traverse lines, but such points would be of no structural geologic interest. Plate 3 shows iso-rad contours on the north and south walls of the shaft marked in Plate 2.

A self-potential survey was made along traverses 00, 25S and 50S, ranging in length from 150 ft. to 300 ft. No consistent results were obtained.

The results of a magnetic test survey along traverses 50N and 100N, each 700 feet long, are shown on Plate 4. Observations were made at intervals of 10 feet to detect any anomalies associated with the shears. No results of any significance were obtained.

(b) Edith River Find, Deposit F.

This deposit was examined radiometrically in the same manner as Deposit "A". Ten traverses were surveyed, ranging in length from 150 to 350 feet, over a length of 500 feet along the baseline.

Magnetic measurements were made along two traverses, but no significant anomalies were observed.

The results are shown on Plates 5, 6 and 7.

(c) Tennyson's No.1 Prospect.

At this prospect, a radiometric survey was made along one traverse for 200 feet along the line of lode at deposit C, and along three short traverses across the three main points of activity. These results are shown as profiles on Plate 8 and illustrate the typically small extent of the radioactive anomalies in the area. Some other notable "high spots" are also shown.

A self-potential survey was made along three traverses ranging in length from 100 to 200 feet, and straddling deposit F, but no consistent results were obtained.

(d) Tennyson's No. 2 Prospect.

At this prospect, a detailed radiometric survey on a one-foot-square grid was made over three small deposits. The results are shown on Plate 9 as iso-rad contours of surface radioactivity.

(e) Hawkins' Prospect.

This prospect was examined radiometrically similarly to (a) and (b) above. Thirteen traverses were surveyed, ranging in length from 50 to 200 feet, along a base-line length of 400 feet.

The results are shown on Plate 10 as iso-rad contours of surface radioactivity.

(f) A.B.C. Prospect, Katherine.

This prospect was examined radiometrically similarly to (a) and (b) above. Twelve traverses were surveyed, ranging from 200 to 450 feet in length, along a base-line length of 500 feet. The results are shown on Plate 11 as iso-rad contours of surface radioactivity.

6. CONCLUSIONS AND RECOMMENDATIONS.

The observed geophysical anomalies were all of such small extent or so uncertain, that no further geophysical work was recommended on prospects (i) to (vi). At the time of writing, geophysical work was continuing at the A.B.C. Prospect, Katherine.

7. REFERENCES.

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Noakes, L.C., 1949. A Geological Reconnaissance of the Katherine-Darwin Region, Northern Territory, Bur.Min.Res.Geol. and Geophys., Bull. No. 16.

PLATE I

14° S

132° E

TO PINE CREEK APPROX. 14 M.

FERGUSSON RIVER

River

YENBERRIE

MT. TODD BATTERY

River

EDITH FALLS

Edith

A

EDITH RIVER FIND

No.1

TENNYSONS

No.2

HAWKINS

F

TO FLORINA

Fergusson

STUART HIGHWAY

DARWIN — LARRIMAH RAILWAY

A.B.C.

River

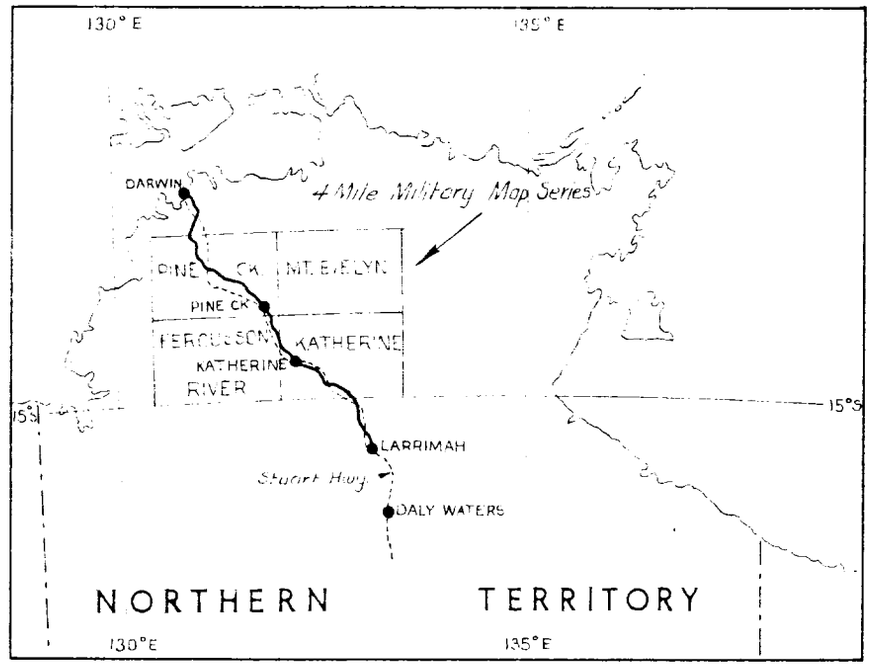
KATHERINE

Katherine

14° 30' S

132° E

14° 30' S



4°

TRUE NORTH
MAGNETIC NORTH

LEGEND

- LOWER CAMBRIAN LIMESTONE
- LOWER CAMBRIAN EDITH RIVER VOLCANICS
- UPPER PROTEROZOIC BULDIVA QUARTZITE SANDSTONE
- LOWER PROTEROZOIC GRANITE
- LOWER PROTEROZOIC BROCKS CREEK GROUP SEDIMENTARY ROCKS

- ROAD
- TRACK
- RAILWAY
- GEOLOGICAL BOUNDARY
- URANIUM PROSPECT

GEOLOGY BY L.C NOAKES AND G.A.STEWART.

GEOPHYSICIST

GEOPHYSICAL SURVEY, EDITH RIVER – KATHERINE AREA, N.T.

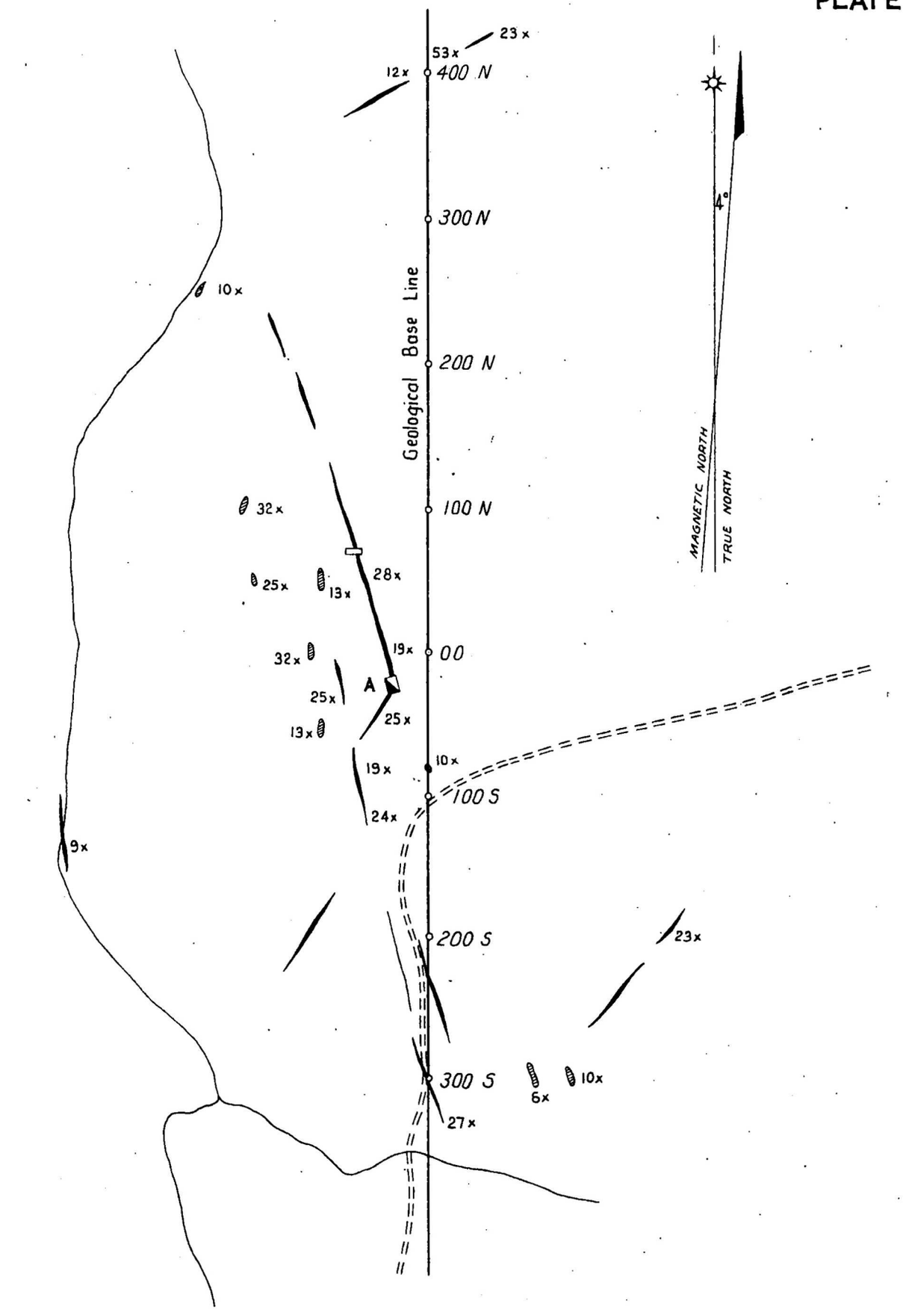
LOCALITY MAP

SCALE IN MILES

4 0 4 8 12

Geophysical Section : Bureau of Mineral Resources, Geology and Geophysics G 121–8

PLATE 2



LEGEND

- Track
- Stream
- Lode Formation
- Shaft
- Costean
- Areas of Radioactivity
- 13x Radioactivity times background

GEOPHYSICIST

GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

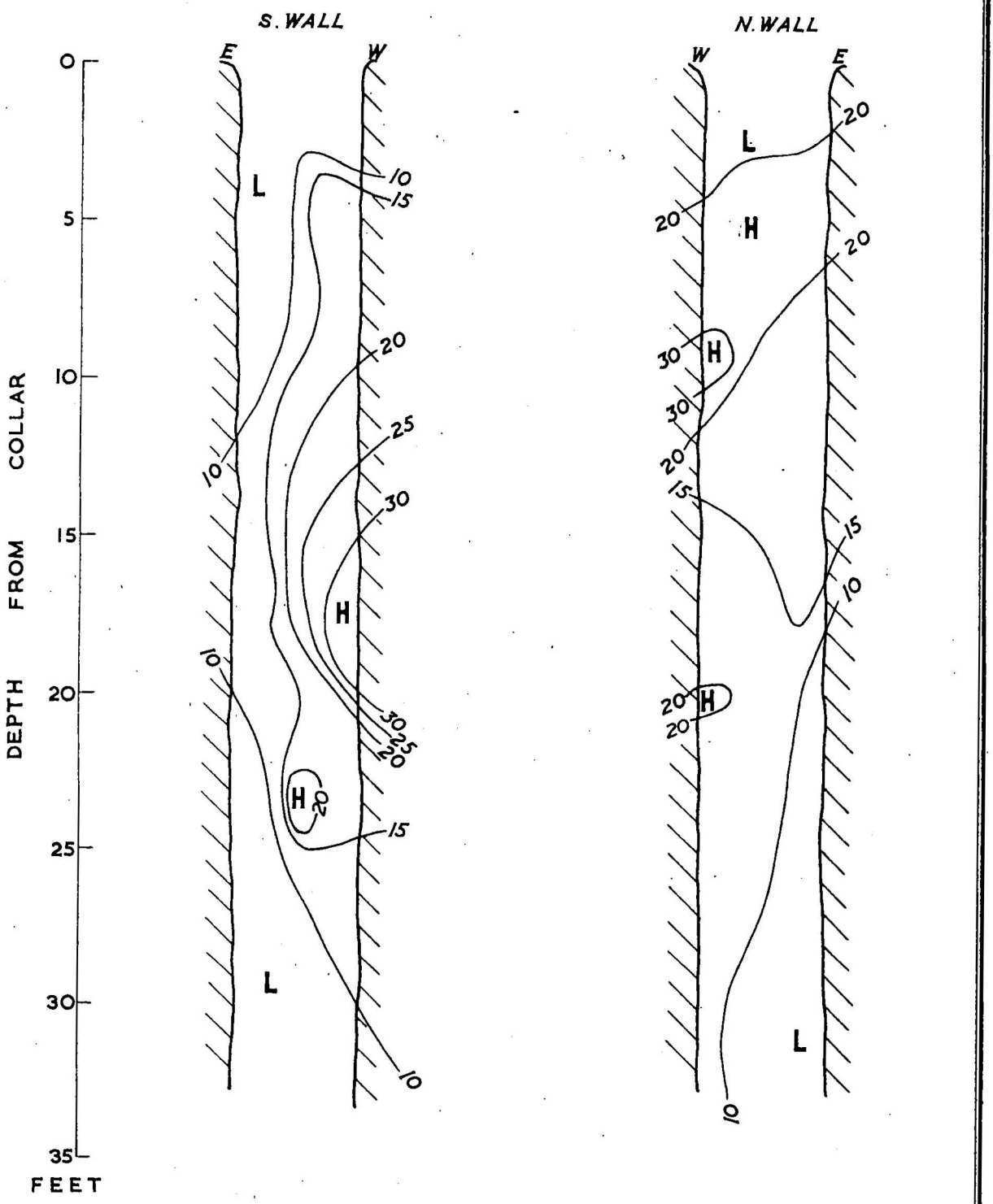
POSITION OF RADIOACTIVE ANOMALIES AS AT AUGUST 1953 EDITH RIVER FIND, DEPOSIT "A"

Measurements taken with a "Halross" Scintillometer Model 939 Serial No. 313.
Background taken as 14 counts per second, equivalent to reading on sediments.

SCALE IN FEET

100 0 100 200

Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics. G 121 – 9



GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

EDITH RIVER FIND, DEPOSIT "A"

ISORAD CONTOURS OF GAMMA RAY INTENSITY AS ON 2·10·53

Shaft at point "A" on Plate 2
Measurements taken with a "Cintel" Portable Geiger-Muller Ratemeter Type 1011 Serial No. 066 using type G.M. 5B. tubes.
Background taken as 6 Microamps on "C" scale, equivalent to reading on sediments. Contours expressed as times background.

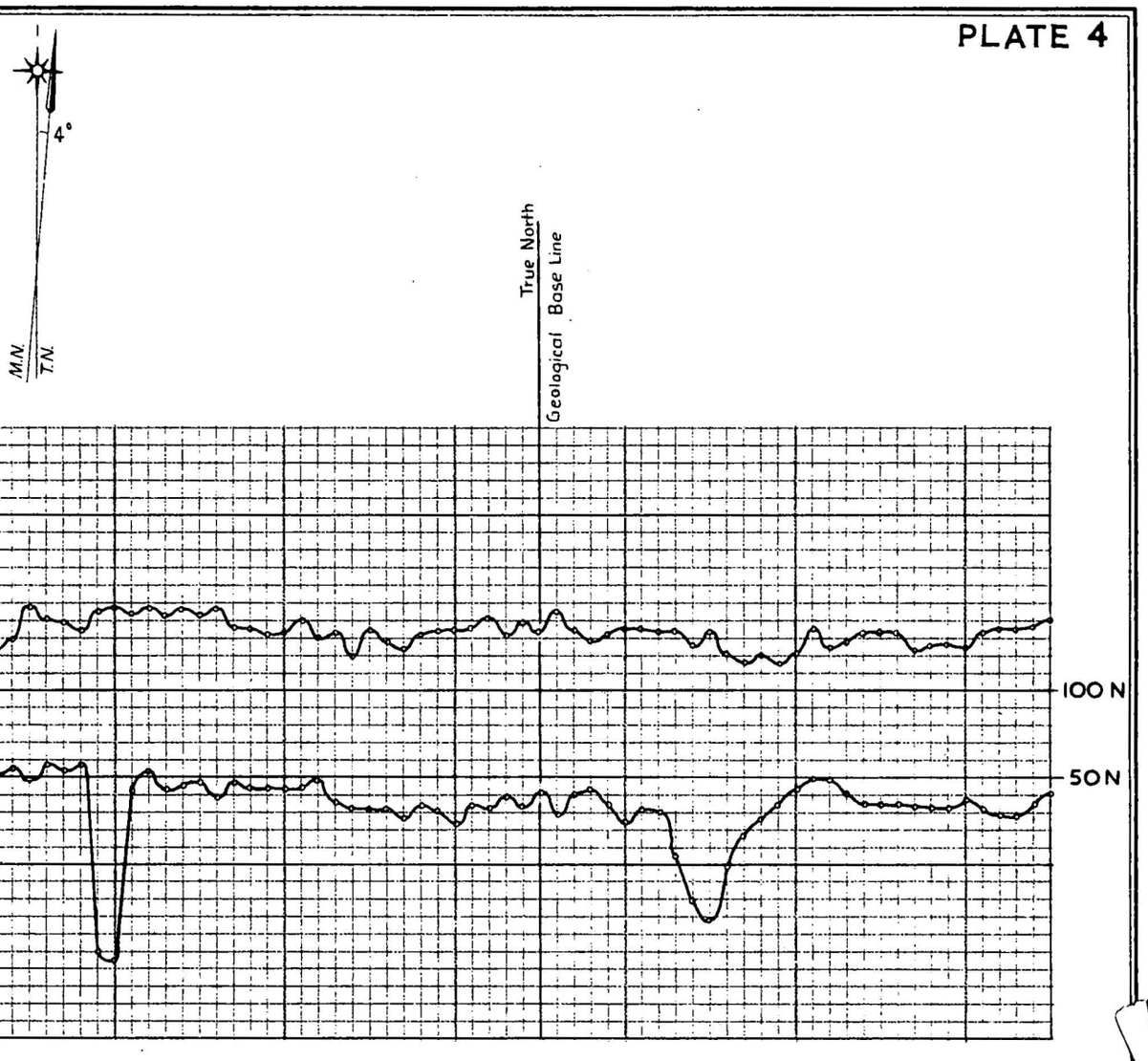
SCALE IN FEET

5 0 5 10

R.L. Brook
GEOPHYSICIST

Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics. G 121-10

PLATE 4



GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

PROFILES OF VERTICAL MAGNETIC INTENSITY

EDITH RIVER FIND, DEPOSIT "A"

ASKANIA VERTICAL MAGNETOMETER No. 521642

SCALE VALUE 11·1 γ/DIV.

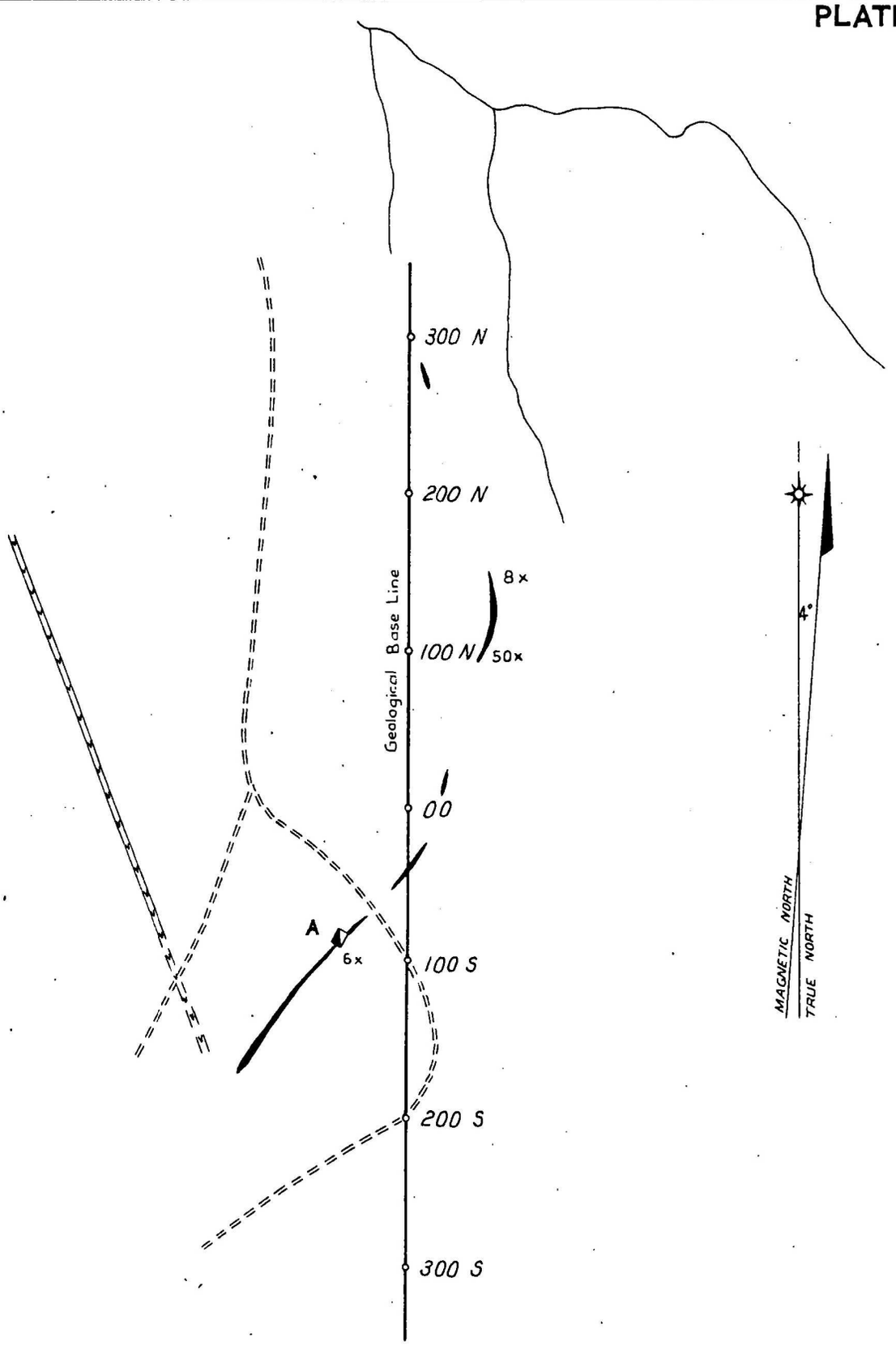
SCALES

HORIZONTAL	100	0	100	200	FEET
VERTICAL	100	0	100	200	GAMMAS

GEOPHYSICIST

Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics G 121 – 11

PLATE 5



LEGEND

Track

Stream

Lode Formation

Shaft

Dolerite

20x Radioactivity times background

GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

POSITION OF RADIOACTIVE ANOMALIES AS AT AUGUST 1953 EDITH RIVER FIND, DEPOSIT "F"

Measurements taken with a "Halross" Scintillometer Model 939 Serial No. 313

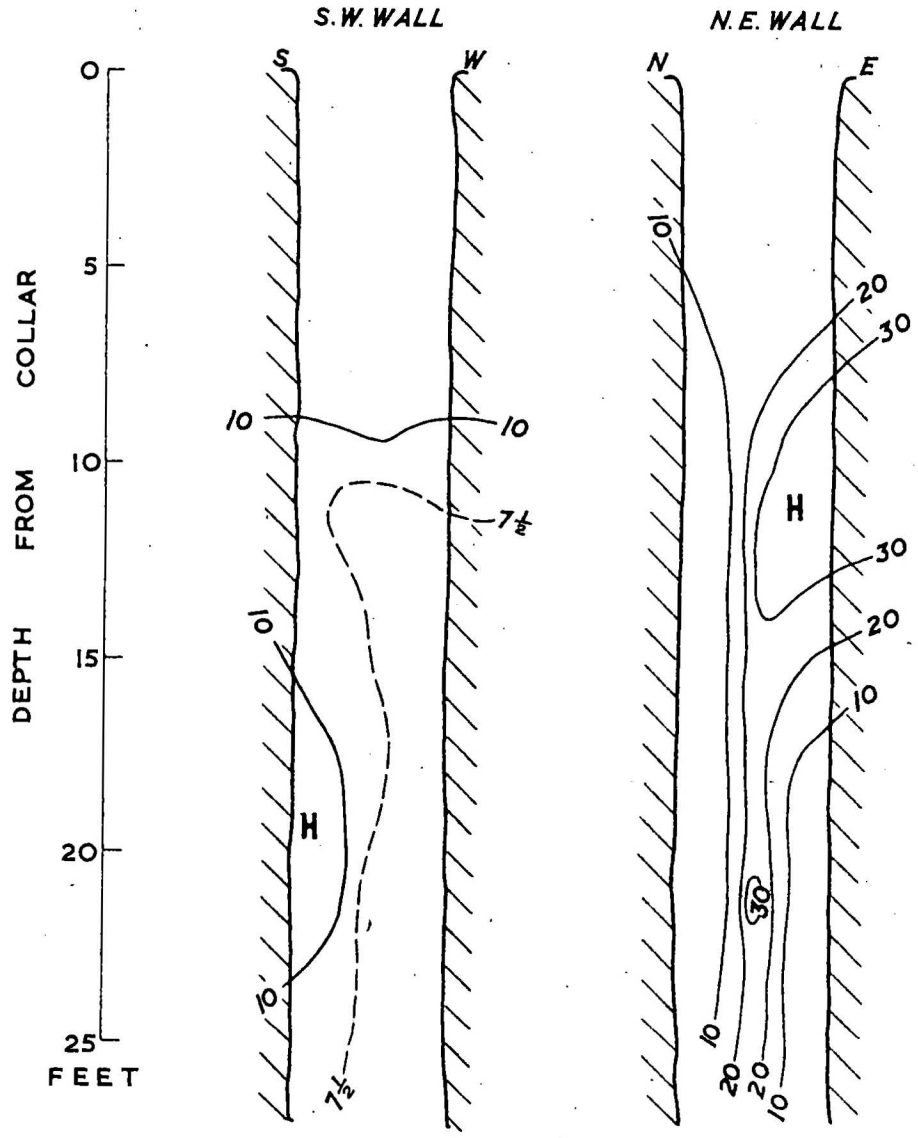
Background taken as 14 counts per second, equivalent to reading on sediments.

SCALE IN FEET

100 0 100 200

Rob Brook
GEOPHYSICIST

Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics. G121-12



GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

EDITH RIVER FIND, DEPOSIT "F"

ISORAD CONTOURS OF GAMMA RAY INTENSITY AS ON 20·8·53

Shaft at point "A" on Plate 5 Timbered to a depth of 12 feet.
Measurements taken with a "Halross" Scintillometer Model 939, Serial No. 313
Background taken as 14 counts per second, equivalent to reading on sediments. Contours expressed as times background.

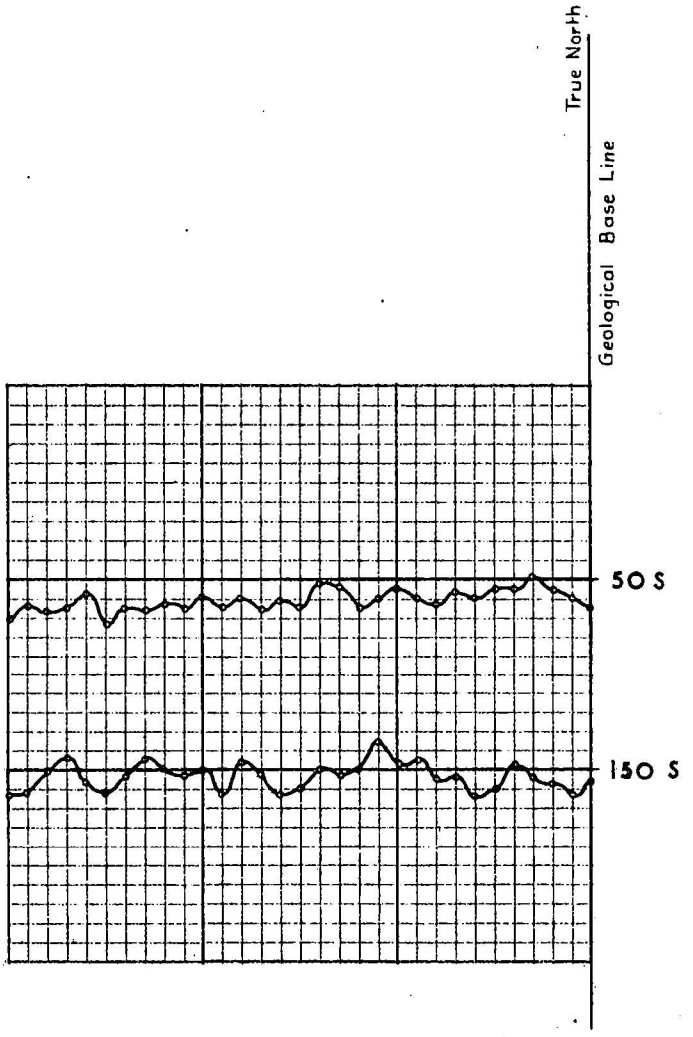
SCALE IN FEET

5 0 5 10

Rde Grasl.
GEOPHYSICIST

Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics. G121—13

PLATE 7



GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

PROFILES OF VERTICAL MAGNETIC INTENSITY

EDITH RIVER FIND, DEPOSIT "F"

WATTS VERTICAL MAGNETOMETER 69106

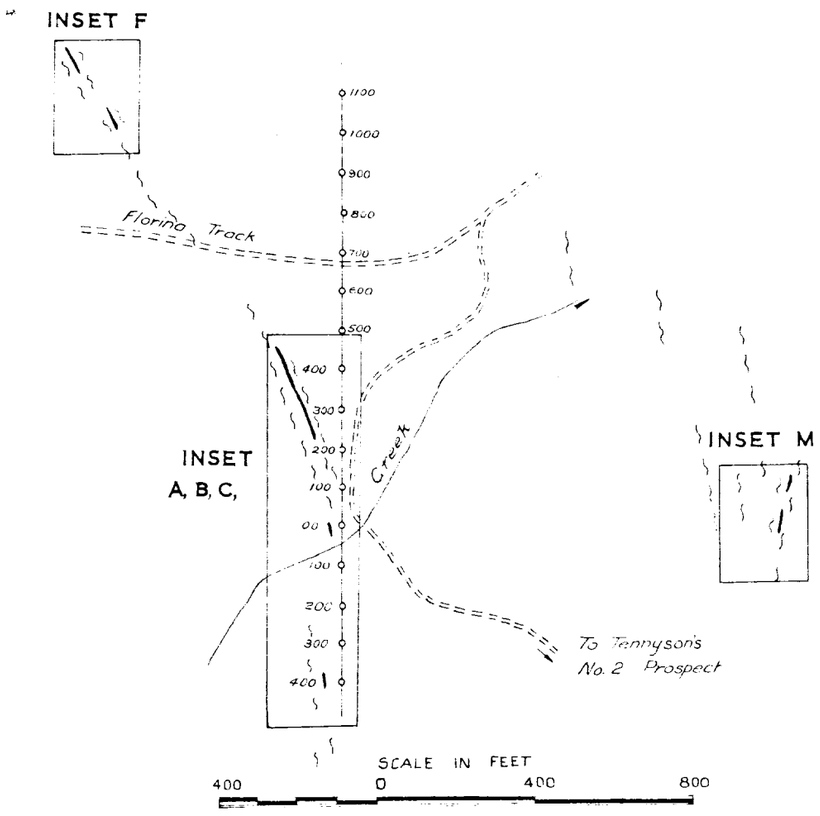
SCALE VALUE 29·7 γ/DIV.

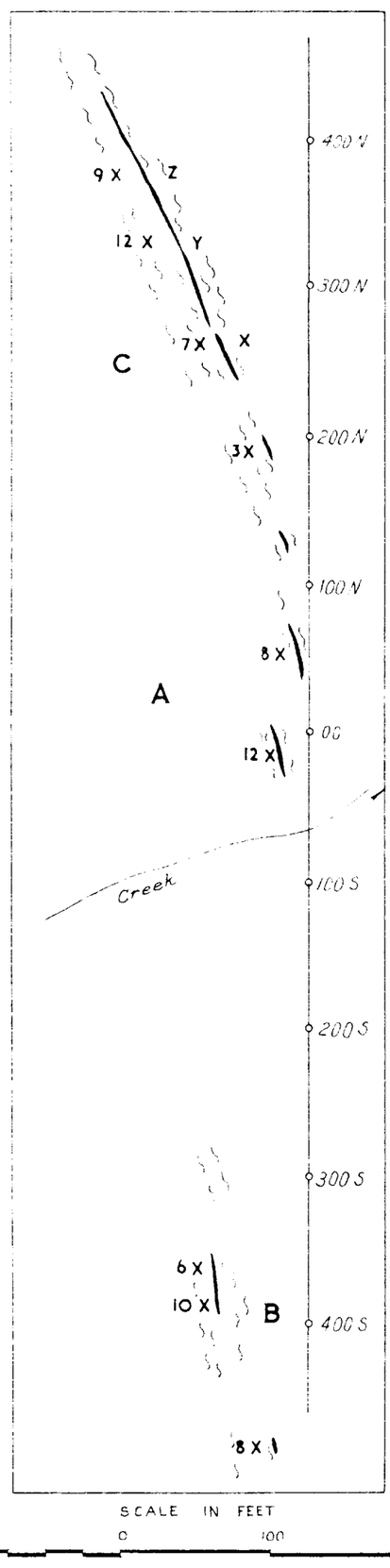
SCALES

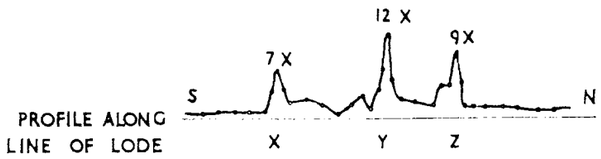
HORIZONTAL	100	0	100	200	FEET
VERTICAL	100	0	100	200	GAMMAS

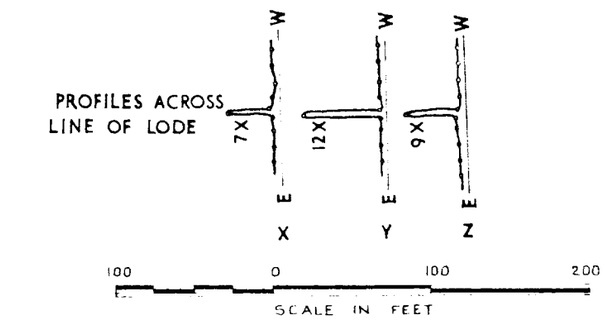
R.de Brock
GEOPHYSICIST

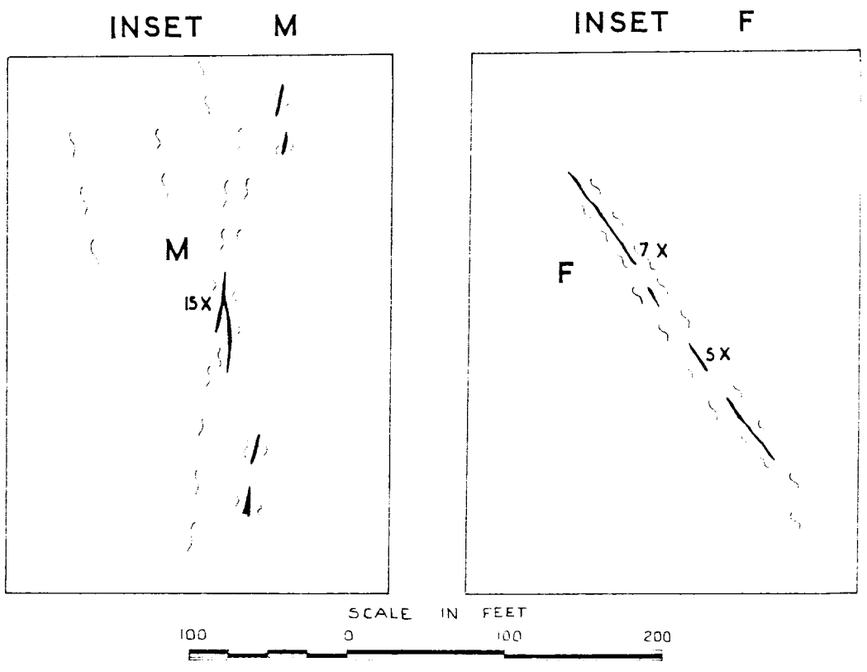
Geophysical Section: Bureau of Mineral Resources, Geology & Geophysics. G 121-14











LEGEND

Lode Formation

Shear zone in granite

20X Radioactivity times background

Rob Brooks
GEOPHYSICIST

GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

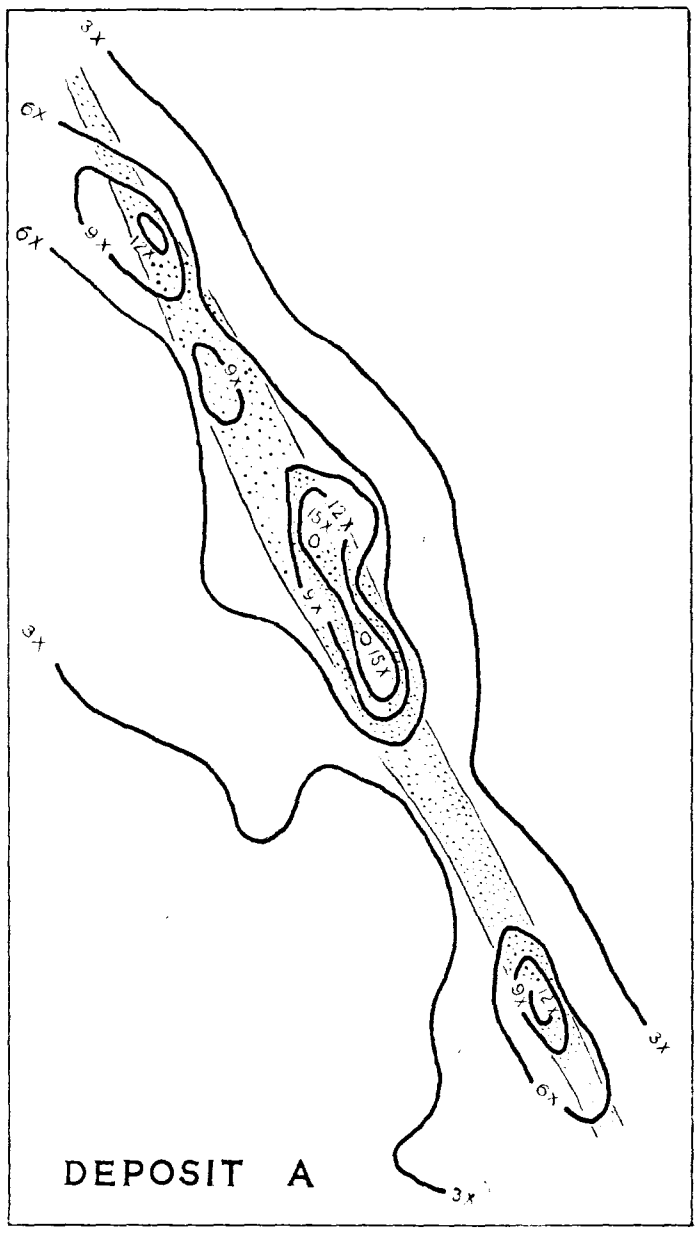
POSITION OF RADIOACTIVE ANOMALIES AS AT JULY, 1953

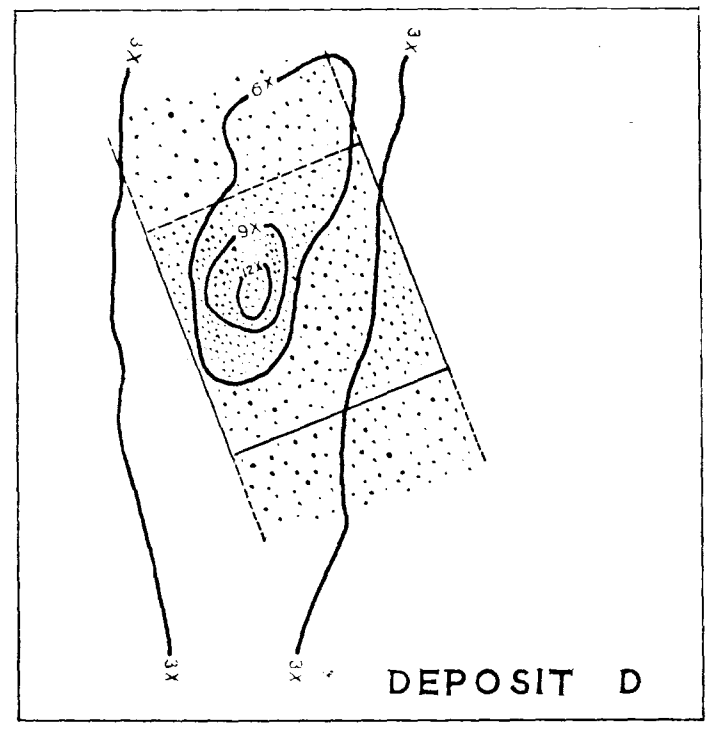
TENNYSONS No. 1 URANIUM PROSPECT

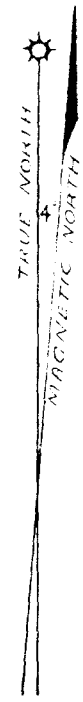
Measurements taken with a "Cintel" portable Geiger-Muller ratemeter type 1011C, using type G 24 H tubes.
Background taken as 6 microamps on "C" scale, equivalent to reading on sedimentary rocks of the region.
Geology from sketch by N.O.Jones.

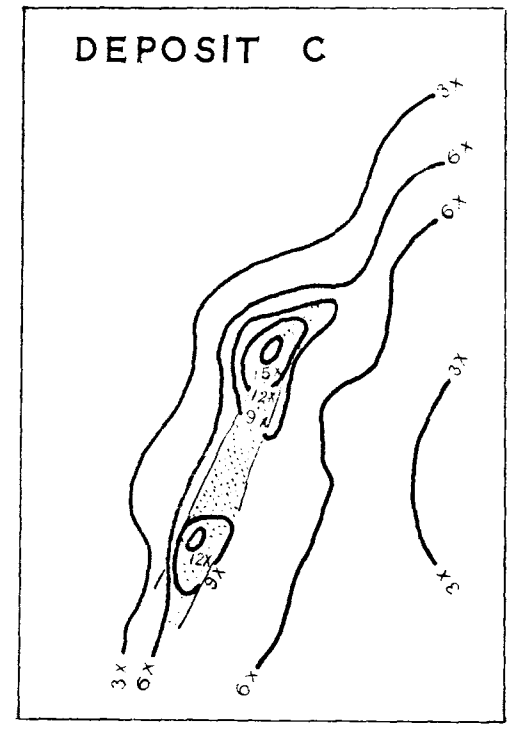
Geophysical Section: Bureau of Mineral Resources, Geology and Geophysics

PLATE 9









10X *Radioactivity times Background*

GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

TENNYSON'S Nº 2 URANIUM PROSPECT

ISORAD CONTOURS

OF SURFACE RADIOACTIVITY

AS AT JULY 1953

GEOLOGY FROM SKETCH PLANS
BY D.E. GARDNER

HEMATITIC LODE

DEPOSITS A,C AND D OCCUR IN SHEARED GRANITE

MEASUREMENTS TAKEN WITH "CINTEL" PORTABLE GEIGER-MULLER RATEMETER TYPE 101IC, USING TYPE C24 H TUBES

BACKGROUND TAKEN AS 6 MICROAMPS ON "C" SCALE, EQUIVALENT TO READING ON SEDIMENTS OF THE REGION

SCALE IN FEET

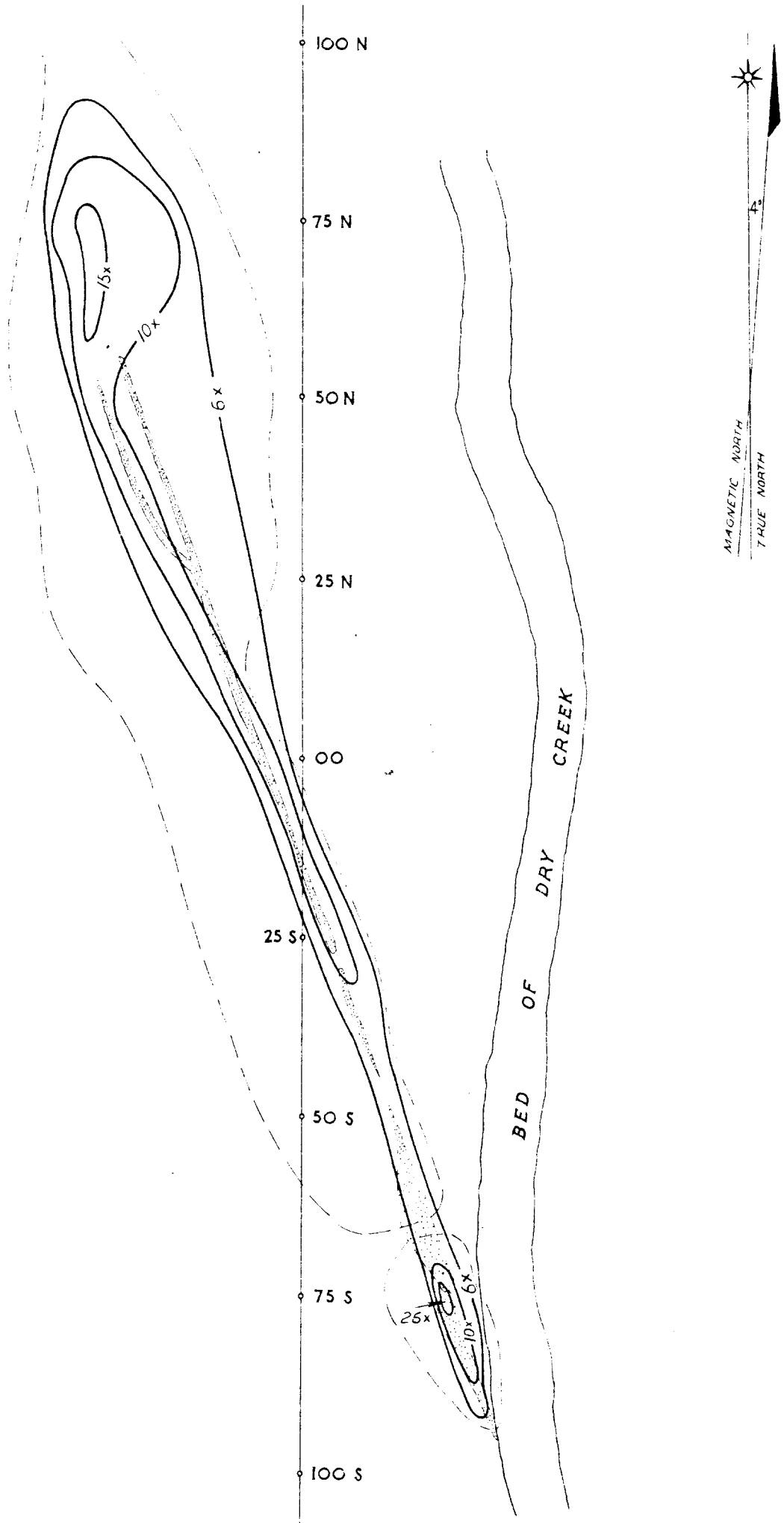
4 0 4 8 12

GEOPHYSICIST

Geophysical Section, Bureau of Mineral Resources, Geology and Geophysics

G 121-16

PLATE 10



GEOPHYSICAL SURVEY, EDITH RIVER AREA, N.T.

ISORAD CONTOURS OF SURFACE RADIOACTIVITY AS AT AUGUST 1953

HAWKINS' URANIUM PROSPECT

LEGEND

Hematitic Lode

Boundary of shear zone in granite

26 x Radioactivity times background

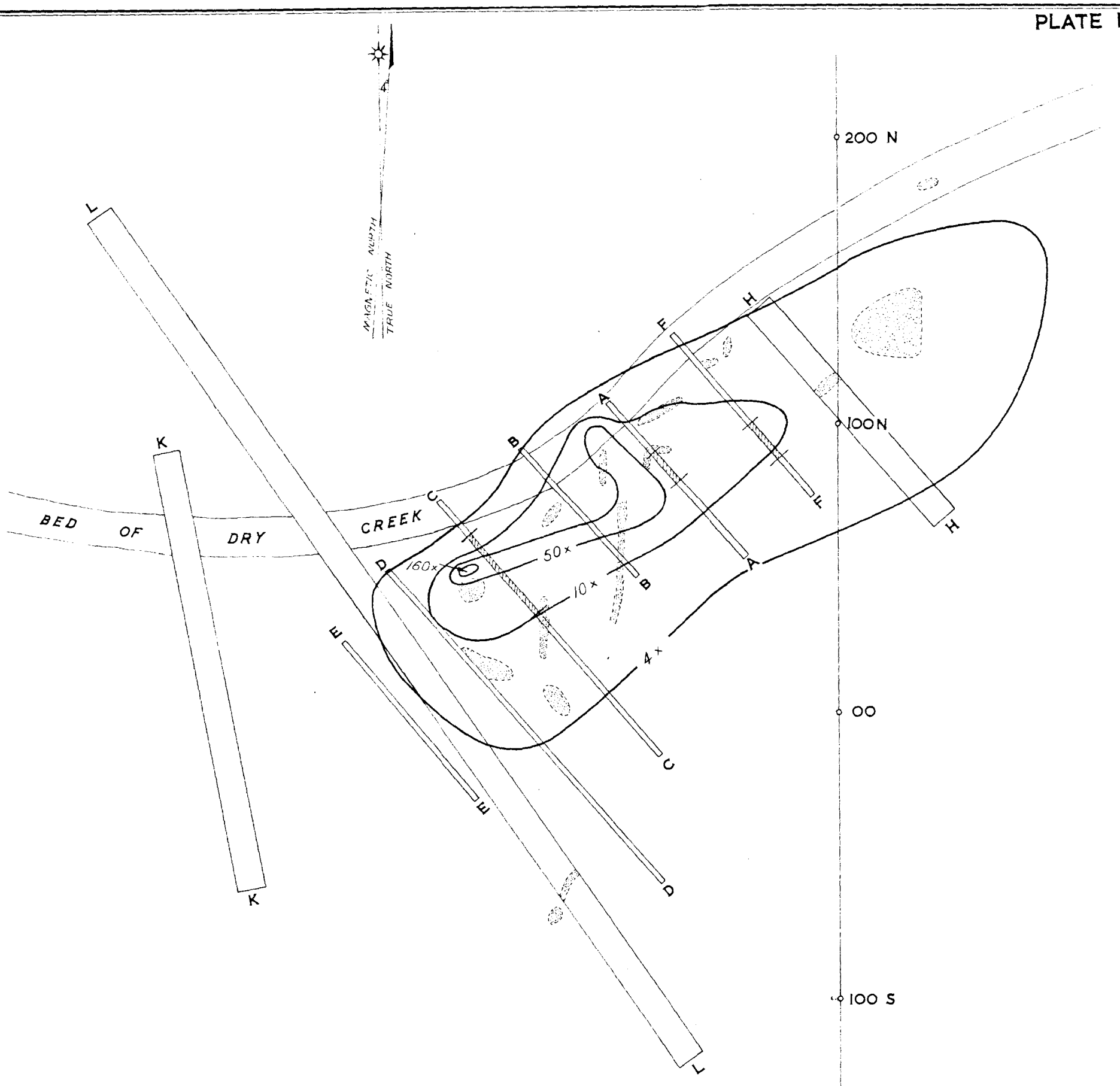
Measurements taken with a "Hairass" Scintillometer Model 339 Serial No. 313.
Background taken as 14 counts per second, equivalent to reading on sediments.
Reference: Survey 330 Leivin Springs Run 5 Photo 38 153" South — 112" East — 19" Diagonal
Geology from sketch by D.E. Gardner.

R.A. Broad
GEOPHYSICIST

SCALE IN FEET
20 0 20 40

Geophysical Section: Bureau of Mineral Resources, Geology and Geophysics. G 121 – 17

PLATE II



LEGEND

Silicified and hematised veins.

Section of costean assaying > 0·1 % eU_3O_8

50× Radioactivity times background

K. L. Broad
GEOPHYSICIST

GEOPHYSICAL SURVEY, KATHERINE AREA, N.T.

ISORAD CONTOURS OF SURFACE RADIOACTIVITY AS AT SEPTEMBER 1953

A.B.C. URANIUM PROSPECT

Measurements taken with a "Halross" Scintillometer Model 939 Serial No. 313.
Background taken as 14 counts per second equivalent to reading on sediments.
Geology by D.E. Gardner and N. Jones, 1953.

SCALE IN FEET
40 0 40 80

Geophysical Section: Bureau of Mineral Resources, Geology and Geophysics G 121-18