COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1971/134

MARY RIVER AREA GEOPHYSICAL SURVEY, NORTHERN TERRITORY 1970

by

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ILLUSTRATIONS

SUMMARY

The Bureau of Mineral Resources conducted a geophysical survey in the Mary River area, Northern Territory, in 1970 at the request of the Northern Territory Administration to assist in the investigation of an area of known geochemical anomalies. Magnetic and electromagnetic methods were used.

The results showed electromagnetic and minor magnetic anomalies over or close to geochemical anomalies. The electromagnetic anomalies are probably related to faults or to conducting carbonaceous rocks rather than to base metal mineralization.

1. INTRODUCTION

The Darwin Uranium Group of the Bureau of Mineral Resources (BMR) made a geophysical survey in 1970 in Government Mining Reserve No. 275 in the Mary River area, Northern Territory. The survey was made at the request of the Mines and Water Resources Branch of the Northern Territory Administration, to help locate drilling targets in an area of lead, zinc, and copper geochemical anomalies.

An earlier geophysical survey made in 1967 in an area immediately northwest of the 1970 area located Slingram, self-potential, and magnetic anomalies which were possibly related to mineral mineralization (Duckworth, 1969). Between 2 and 4 June 1970 a short test survey was made within the 1970 geochemical survey area using electromagnetic (Slingram and VLF) and magnetic methods, and anomalies were found approximately over the positions of some of the geochemical anomalies. A new grid (shown in Plate 1) was laid down with traverses approximately at right angles to outcropping gossan. This grid includes some strong geochemical anomalies (Plate 3). The main survey was made on this grid between 25 August and 9 September 1970. Methods used were Slingram, Turam, and magnetic. Self-potential and resistivity measurements were attempted but failed owing to the dry conditions. The first diamond-drill hole (DDH No. 1) is within the area of the geophysical survey and its position is shown in the relevant plates.

2. GEOLOGY

The geology of the area is described by Daly (1971); surface geology is shown in Plate 1.

The area contains interbedded sandstone and carbonaceous shale and siltstone in approximately equal proportions. Beds strike approximately 320°. The carbonaceous shale and siltstone generally do not crop out, but underlie much of the black soil plain. Sandstone has a tendency to crop out in low ridges, particularly where silicification and ferruginization have taken place adjacent to quartz and quartz-hematite veins. Faulting and shearing occur along two main directions, trending approximately northwest and northeast.

The rocks are all part of the Lower Proterozoic Masson Formation.

3. METHODS

Slingram is a conventional moving-transmitter/moving-receiver coplanar horizontal-coil electromagnetic method. The coil spacing was 200 ft (60 m) and the frequency used was 1760 Hz.

Turam is a fixed-transmitter/moving-receiver coplanar horizontal-coil electromagnetic method. Two Turam surveys were made, one with the primary field produced by a rectangular loop 3000 ft long by 1000 ft wide (915 x 305 m), and one with the primary field produced using a straight cable 3000 ft long and grounded at both ends.

VLF is an electromagnetic method which uses existing VLF radio stations as the transmitter and a portable receiver. In this survey, the radio station used was North West Cape (NWC) in Western Australia; the station frequency was 22.3 kHz.

The magnetic survey was made with a vertical-component fluxgate magnetometer.

4. RESULTS

The initial reconnaissance survey was made on the geochemical grid (east-west traverses) with stations 100 ft (30.5 m) apart. The results (Plate 2) show irregular Slingram profiles with a prominent anomaly between 10E and 16E on Traverses 30S and 32S. The VLF profiles show no distinct anomalies except one at 24E/32S which is related to a fence that crosses the traverse at about 45 degrees. The magnetic results show strong gradient at about 20E on two traverses - 32S and 36S; this may be due to a change in lithology. The magnetic readings on Traverses 24S, 26S, and 28S are within the detailed survey area discussed below.

Although the Slingram anomalies did not correlate exactly with the geochemical anomalies (Plate 3), they were in the same general area and it was decided that a more detailed survey was necessary if drilling targets were to be selected. Consequently a grid was pegged approximately at right angles to outcropping gossan in the area, with traverses 200 ft apart and stations 50 ft apart; Slingram, Turam, and magnetic surveys were made.

The Slingram results (Plate 4) show anomalous zones in the area. The strongest zone lies between 1500 NE and 1800 NE on Traverses 1 to 7. This zone is underlain by carbonaceous shale and siltstone, which may be the cause of the anomalies. Another anomalous zone shown mainly by the imaginary-component contours extends from Traverse 1 to Traverse 10 at about 500 NE. There is little correlation evident between the geochemical and Slingram anomalies; this fact suggests that either the sources of the geochemical anomalies are below the depth penetration of the Slingram method, or the sources are not conductive enough to produce recognizable anomalies.

The Turam results are shown in Plate 5. Two surveys were made, one using a loop to produce the primary field and one using a straight grounded cable. Theoretically the Turam results produced by a loop are inductive effects; the results produced by a grounded cable are galvanic and inductive effects.

The Turam and Slingram contours show a northwesterly trend which is probably related to the geological strike. Breaks in the contour patterns may indicate faults; for example a fault may run along or close to Traverse 4, and another from 800 NE to 1200 NE on Traverse 9.

In the western part of the surveyed area the Turam phase difference contours confirm the existence of the weak conductor indicated by the Slingram results. This conductor occurs in the black soil plain area and is probably due to underlying carbonaceous rock. In the rest of the surveyed area there is not a very close agreement between the results of the Turam and Slingram surveys.

The Turam results indicate a conducting zone, comprising two or possibly three separate conductors, striking approximately northwest through 900 NE on Traverse 5. The only Turam anomaly that coincides with a lead geochemical anomaly is at 900 NE on Traverse 2. A diamond-drill hole DDH No. 1 has been drilled to test the geochemical anomaly. The geological log of this hole is described in detail by Daly (1971). It can be summarized as follows:

0 to 99 ft	Mainly shale and siltstone
99 ft to 321 ft	Mainly sandstone
321 ft to 359 ft	Mainly carbonaceous shale
359 ft to 422 ft	Mainly sandstone
422 ft to 440 ft	Mainly carbonate rock, with minor sulphides
440 ft to 520 ft	Mainly sandstone

The carbonaceous shale between 321 and 359 ft and the minor sulphides between 422 and 440 ft would be expected to constitute good conductors but there is no sound basis for correlating either of these with the Turam anomaly. Indeed, the anomaly appears to arise from a shallow source; furthermore, the dip of the formations here is not known with certainty (Daly, 1971).

The conducting zone shown by the Turam survey occurs in an area of sandstone outcrop and sandstone and quartz rubble. The anomalies may be related to beds of carbonaceous shale similar to that intersected in DDH1 or to faults. DDH1 was drilled to test the geochemical anomaly and does not represent a test of the Turam anomalies. Further investigation would be required to determine whether mineralization is associated with the anomalies.

The magnetic contours (Plate 6) show two sharp localized anomalies in one of the mapped areas of sandstone, one anomaly on Traverse 2 and one on Traverse 4. The sharpness of the anomalies indicates magnetic material very close to the surface. The magnetic anomaly on Traverse 2 coincides with the lead geochemical anomaly drilled by DDH No. 1. The geological log of the holes (Daly, 1971) does not mention magnetic rock. The magnetic anomaly may be due to magnetite on or just below the surface in the gossan.

The magnetic gradient across the area surveyed may indicate variations in lithology.

5. CONCLUSIONS

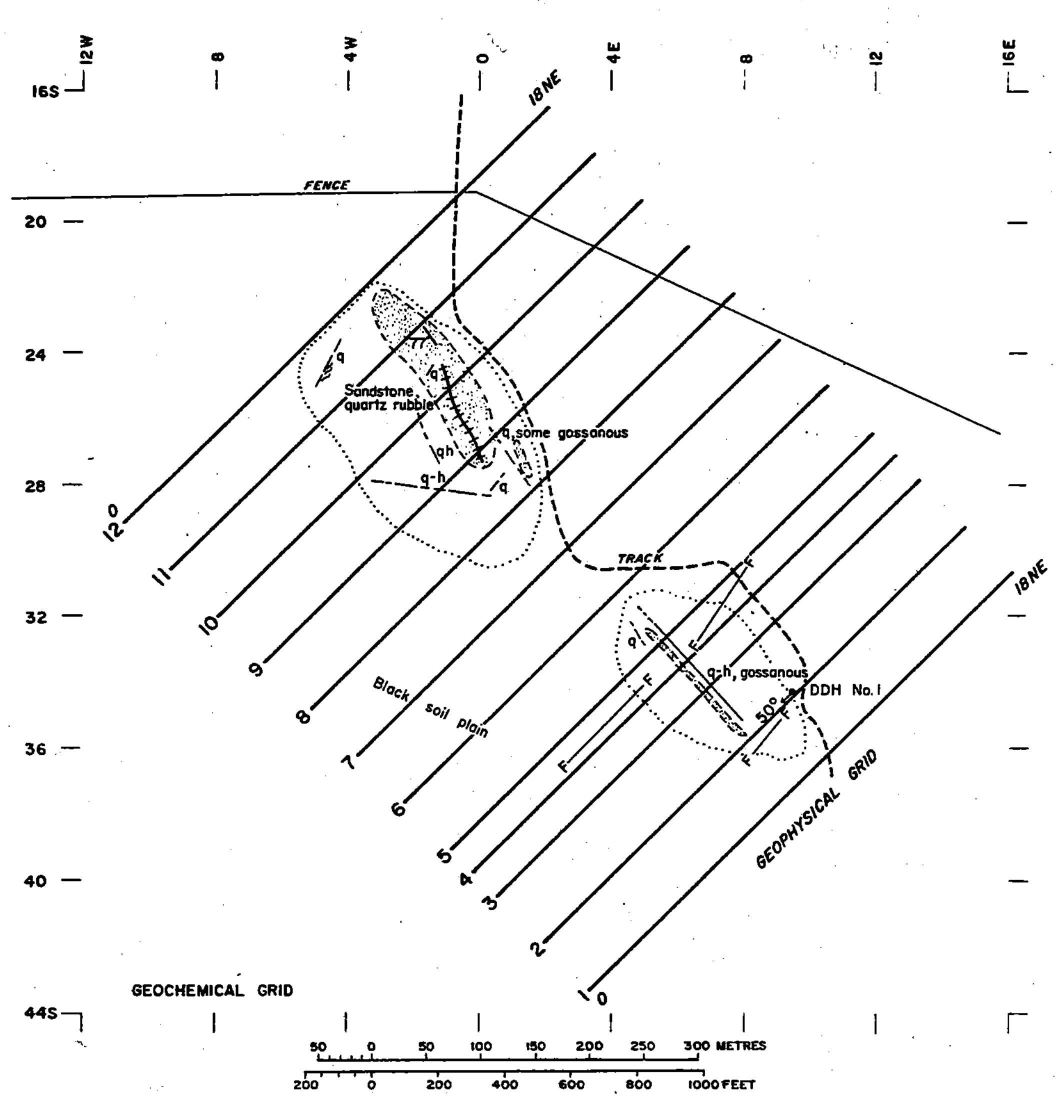
The electromagnetic anomalies could be due to the carbonaceous rocks known to occur in the area, but the possibility that they are associated with mineralization could not be ruled out without further investigation.

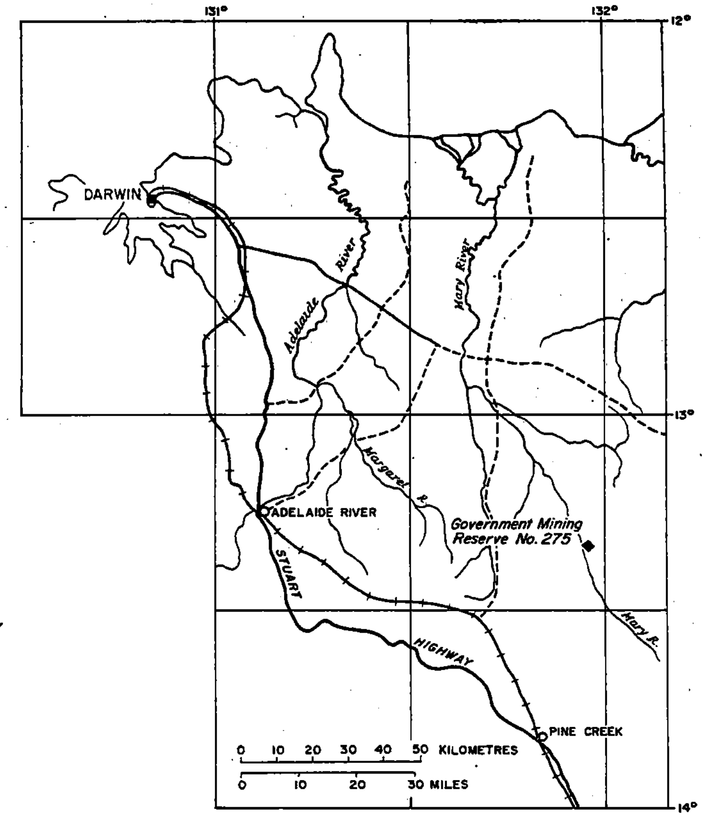
The magnetic anomalies are from near-surface sources and have no obvious relation to mineralization. Magnetic gradients in the area may reflect lithological changes.

6. REFERENCES

DUCKWORTH, K., 1969 - Mary River area geophysical survey, 1967. In: Minor metalliferous investigations, Northern Territory Resident Geological Section. Bur. Miner. Resour. Aust. Rec. 1969/90, pp. 9-12. (unpubl.).

DALY, M.R., 1971 - 1970 Mary River survey. N.T. Geol. Survey report.





LOCALITY MAP

MARY RIVER, NT 1970

GEOPHYSICAL SURVEY

LEGEND

Sandstone within outcrop boundary	Fault q = Quartz infilling, q-h = " hematite-infilling
Edge of scree	F——F Inferred fault
Shear zone	Strike and dip of beds (77)
Ridge	

To accompany Record No. 1971/134

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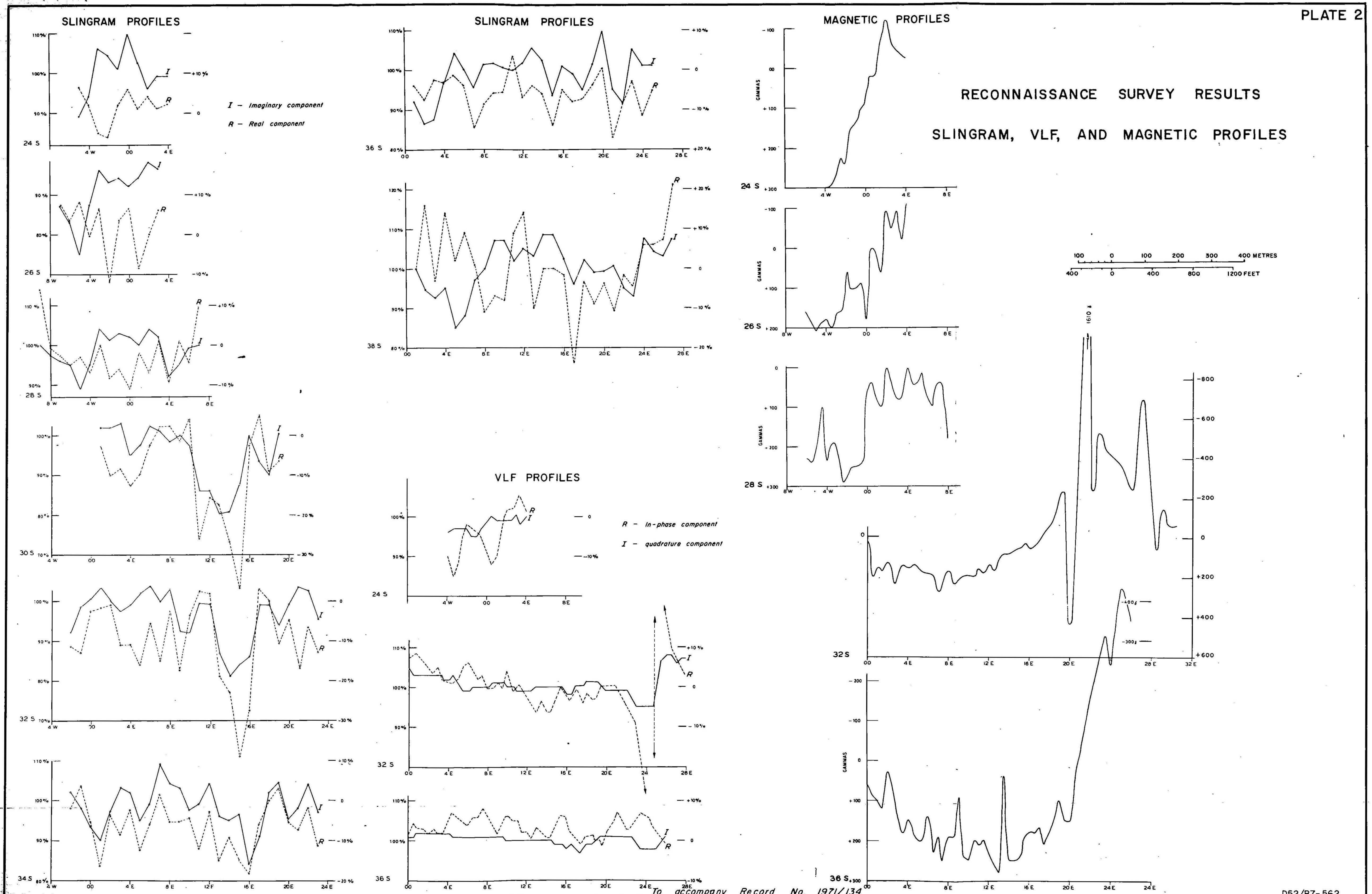
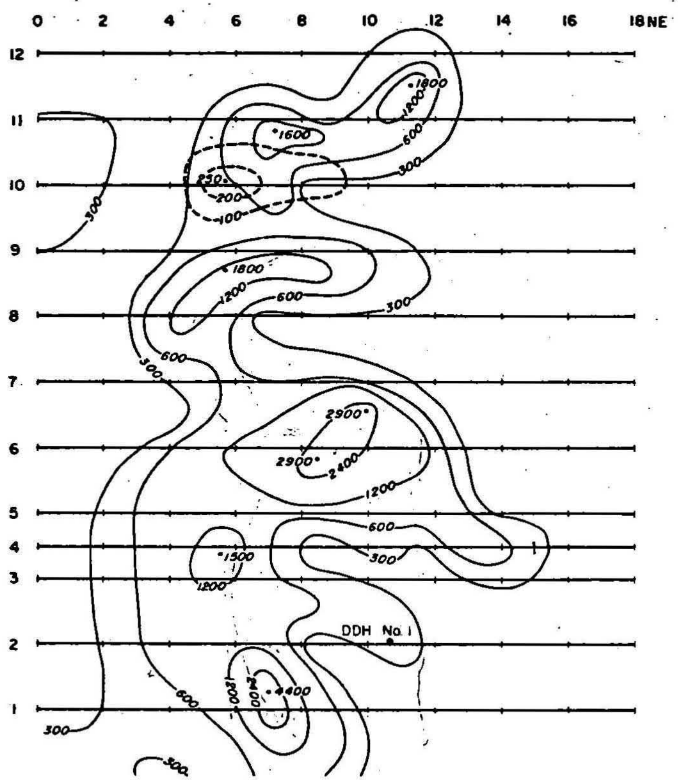
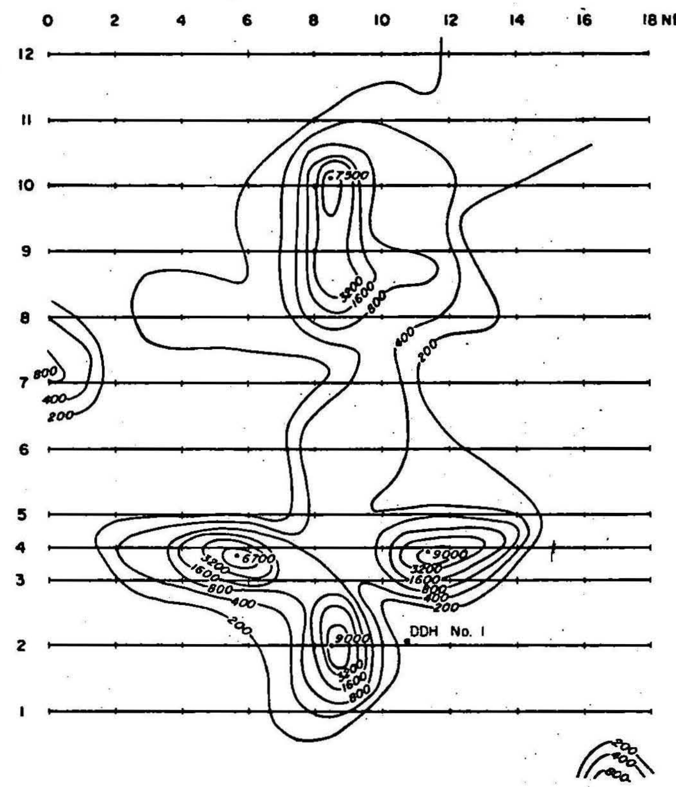


PLATE 2
RECONNAISSANCE SURVEY RESULTS
SLINGRAM, VLF, AND MAGNETIC PROFILES
SLINGRAM PROFILES
SLINGRAM PROFILES
MAGNETIC PROFILES
VLF PROFILES
I - Imaginary component
R - Real component
R - In-phase component
I - quadrature component
24 S
26 S
28 S
30 S
32 S
34 S
36 S
38 S
GAMMAS
100 0 100 200 300 400 METRES
400 0 400 800 1200 FEET
1610 γ
To accompany Record No. 1971/134
D52/B7-562



COPPER AND ZINC
GEOCHEMICAL CONTOURS



LEAD
GEOCHEMICAL CONTOURS

CONTOURS AND PEAKS IN P.P.M.

Copper

Zinc

50 0 50 100 150 200 250 300 METRES
200 0 200 400 600 800 1000 FEET

To accompany Record No. 1971/134

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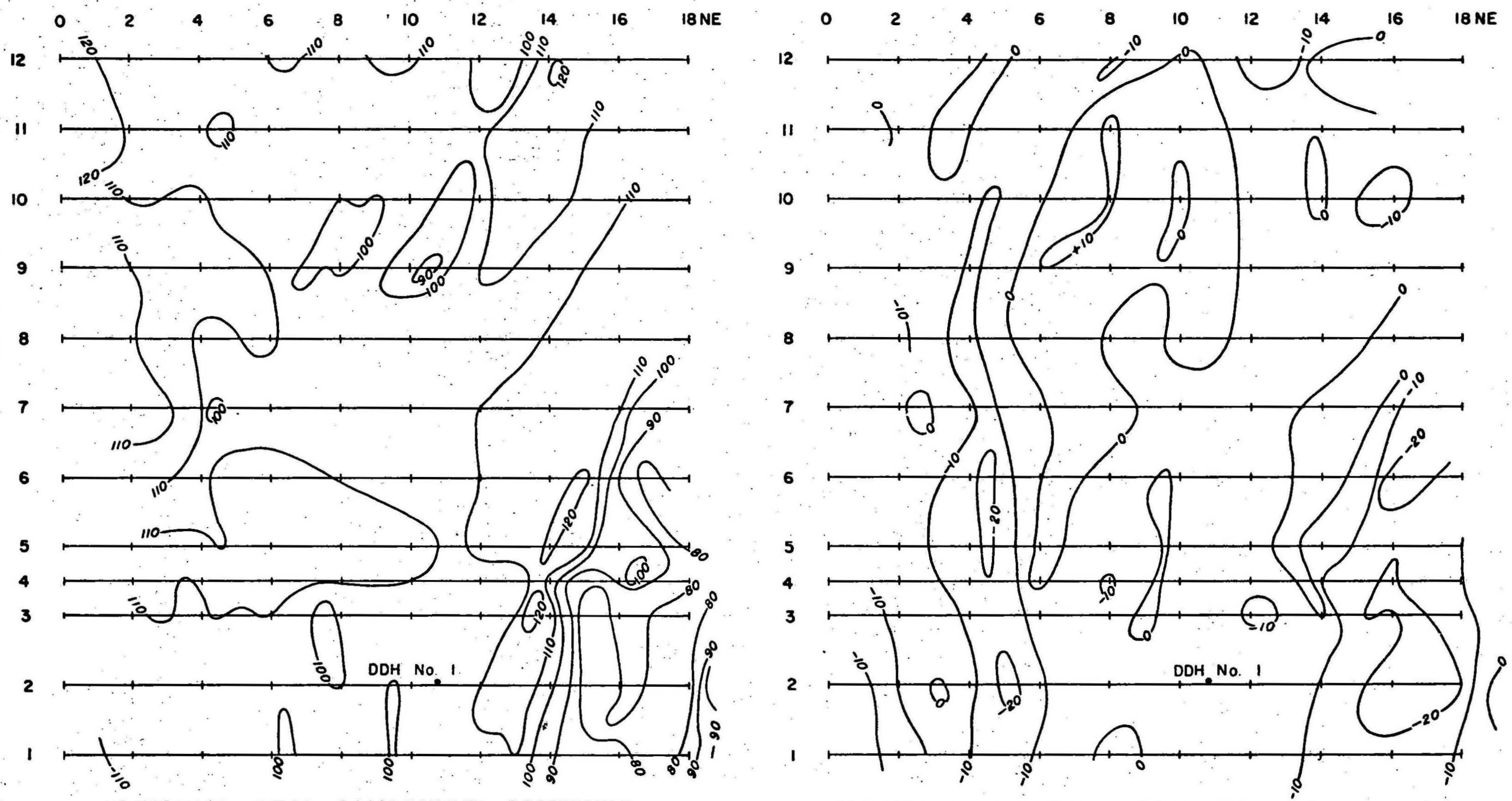

SLINGRAM REAL COMPONENT CONTOURS

SLINGRAM IMAGINARY COMPONENT CONTOURS

CONTOUR INTERVAL 10%

50 0 50 100 150 200 250 300 METRES

200 0 200 400 600 800 1000 FEET

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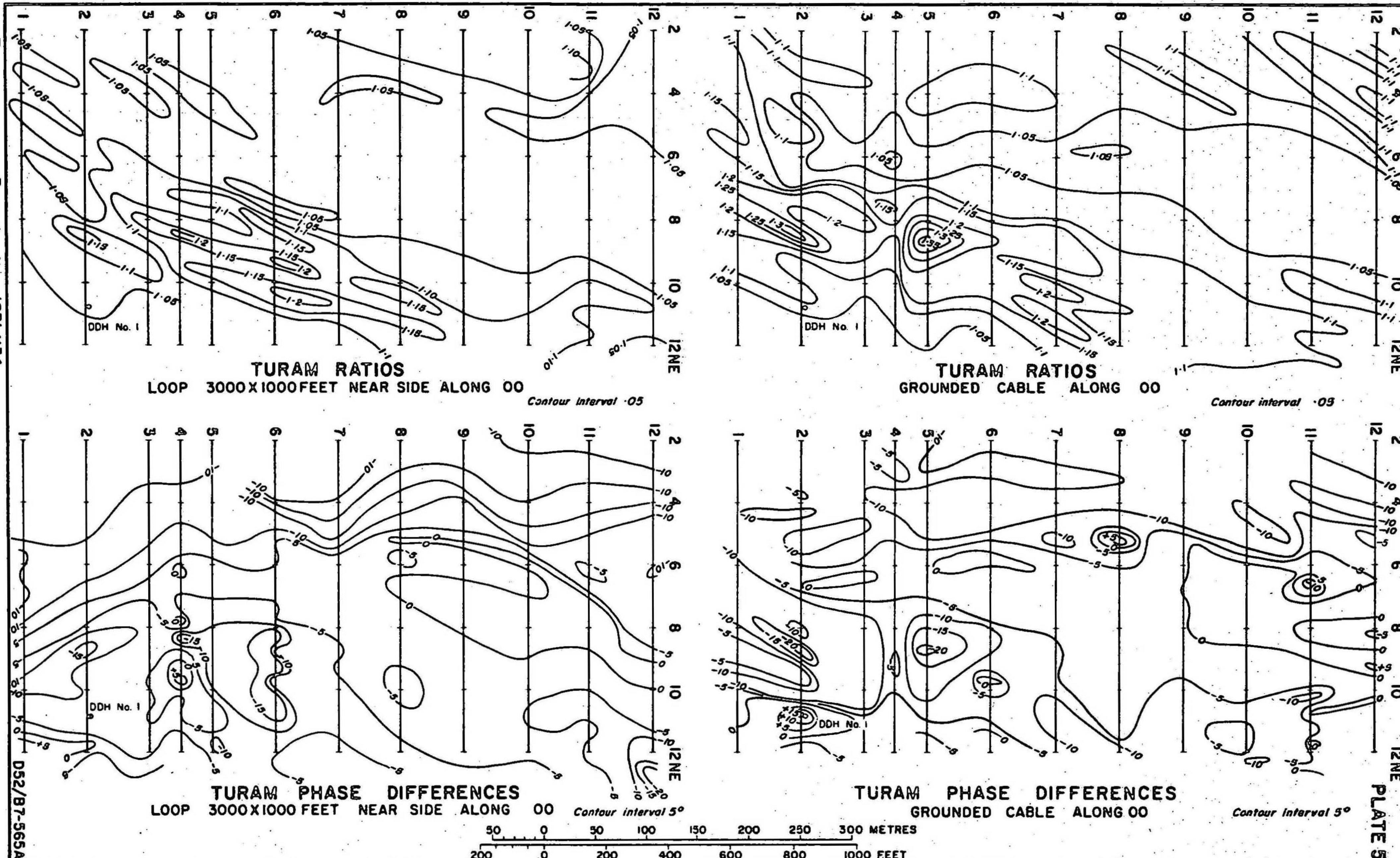
PLATE 4

To accompany Record No. 1971/134



TURAM RATIOS
LOOP 3000 X 1000 FEET NEAR SIDE ALONG 00

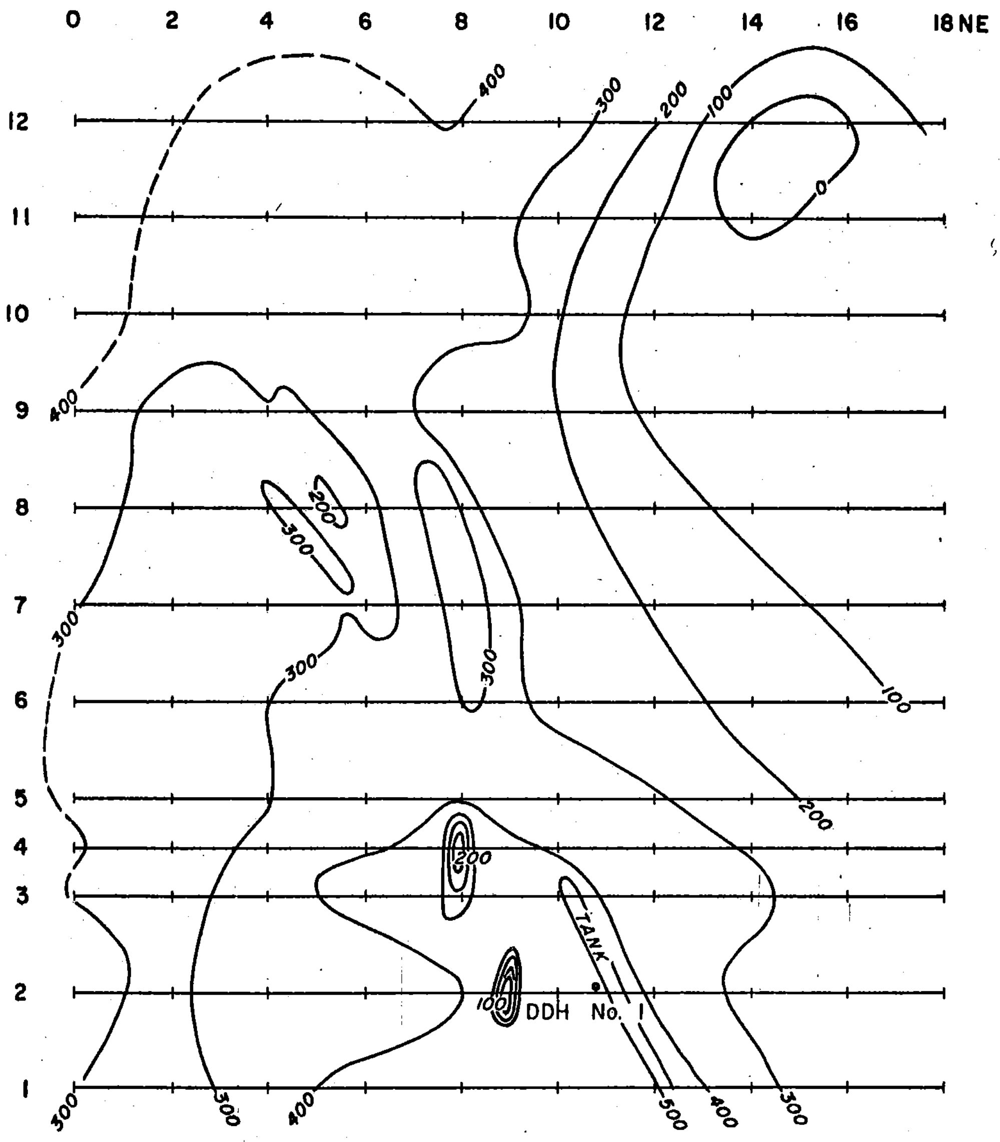
TURAM RATIOS
GROUNDED CABLE ALONG 00

TURAM PHASE DIFFERENCES
LOOP 3000 X 1000 FEET NEAR SIDE ALONG 00

TURAM PHASE DIFFERENCES
GROUNDED CABLE ALONG 00

D52/B7-565A

PLATE 5



MAGNETIC CONTOURS

(VERTICAL COMPONENT)

50 0 50 100 150 200 250 300 METRES

200 0 200 400 600 800 1000 FEET

CONTOUR INTERVAL 100 GAMMAS