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RECORD NO. 1968/20

MOUNT MINZA AREA, NT DRILLING RECOMMENDATION

by

K. DUCKWORTH

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SUMMARY

A study of the geophysical results and geology of the Mount Minza area has revealed similarities between the Mount Minza area and the South Alligator River area in which small high-grade uranium orebodies occur. A diamond-drill hole is recommended to test for possible uranium mineralisation at Mount Minza and to establish the cause of the anomalies detected by the electromagnetic, self-potential, and radiometric surveys.

1968/20

1. INTRODUCTION

Several geophysical surveys have been carried out in the general Mount Minza area situated about 6 miles south of the township of Batchelor, Northern Territory.

A special study has been made of the results of these surveys. A similarity was noted between the results here and elsewhere where uranium mineralisation is known to occur and where a similar geophysical environment exists. The study has resulted in the recommendation for a diamond-drill hole to test for possible uranium mineralisation. Specifications of the hole are as follows:

Collar	201S, 444.5E (Gould area grid)
Azimuth	Grid east
Depression	60°
Depth	450 feet

The location of the hole is indicated in Plate 1.

Details of the geophysical results and other considerations on which the recommendation is based are discussed in this report.

2. DETAILS OF INTERPRETATION

Geological evidence indicates that the graphitic shale and hematitic quartz breccia of the Mount Minza area are the same as found at the Waterhouse No. 2 Prospect, which is known to contain uranium mineralisation (Shatwell and Duckworth 1966; Ruxton, 1961).

In the South Alligator River area the contact zone between a graphitic shale and banded ironstone is a known host for uranium mineralisation. The geological sequence at Mount Minza of a highly graphitic black shale in contact with a hematitic quartz breccia is very similar to the sequence in the El Sherana North West and Scinto 5 North areas in the South Alligator Valley. The rocks in both the Mount Minza and South Alligator areas are of Lower Proterozoic age (Ashley, 1963). A further point of geological similarity is that the black shales in the South Alligator area bleach in weathering to a white rock, like pipe clay, and similar weathering of the Mount Minza shale is found in costeans. Geophysical evidence indicates further similarity, which is discussed below.

The profiles of geophysical data obtained with radiometric, self-potential, and Slingram equipment along line 201S are shown in Plate 2. A section of the body believed to be the origin of the anomalies in these profiles is also shown. It is notable that the centres of disturbance of all but the Slingram imaginary component profile are coincident at about 446.0E.

It is convenient to discuss the methods individually.

Slingram

A traverse with the A.B.E.M. Slingram (E.M. Gun) equipment using a frequency of 1760 c/s and a coil spacing of 200 feet produces a strong real component anomaly centred at 446.4E and a moderate imaginary component anomaly apparently centred at 448.2E. The real component anomaly is asymmetric in that the peak at 444.0E is much larger than that at 449.0E (which is to some extent affected by the adjacent anomaly at 453.0E) The imaginary component anomaly has a maximum at 448.0E which makes it appear to be displaced to the east of the real component anomaly.

This asymmetry in the real component and the displacement of the imaginary component to the low peak side of the real anomaly are consistent with a conducting body of tabular form striking perpendicular to the traverse and dipping towards the high peak side of the real anomaly. These features were exhibited in model tests carried out in the Darwin office of the Bureau of Mineral Resources.

The full Slingram survey of the Mount Minza area (Shatwell and Duckworth, 1966) indicates that this real component anomaly is persistent over 6000 feet along a general north-south trend, and is much more intense on some traverses to the south of 201S.

The relatively small imaginary component anomaly evident on line 201S and all other lines in this area indicates that the conductivity of the body producing these anomalies is unusually high. This conductivity appears to be uniform along the full length of the conductor (variations in anomaly magnitude being probably caused by variations in the geometry of the conductor).

Thus the Slingram results indicate the presence of a slab-shaped conducting body striking generally north-south and dipping to the west. It is not possible to estimate the angle of dip from the profiles. Model tests indicate that a thickness of not more than 150 feet would be possible for this conducting body, as double features characteristic of wide bodies are absent.

Radiometric

The profile shown in Plate 2 displays anomalously high values from 445.0E to 448.0E. These values are about 1.25 times the background level to the west but about 1.5 times the background to the east. This is not a large anomaly for the Rum Jungle area but it is consistently associated with the electromagnetic and self-potential anomalies which occur along the conducting body. The rocks to the west of 446.0E are shales which display no special conductive

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features but which are slightly more radiometric than shales generally in the Rum Jungle area. A normal background level is about 0.010 mR/hr, whereas these shales show a level of 0.015 mR/hr in surface readings. The slight dip in the profile at 442.0E is consistent with a small area of black soil cover.

The strong dip in the profile, at 450.0E, occurs directly over the outcrop of the hematitic quartz breccia. The rocks to the east are shown by the wider survey to give background levels nearer to the usual 0.01 mR/hr.

Thus it seems that the anomaly at 446.0E is associated directly with the conducting body and not the shales to the west or the hematitic quartz breccia just to the east.

Geological mapping indicates that a graphitic black shale crops out at 446.0E on 201S and that this outcrop coincides with the geophysical anomalies throughout the area.

It is therefore reasonable to assume that this black shale is the origin of all the anomalous geophysical data. In particular it appears that the shale is unusually radioactive.

Self-potential

As shown in Plate 2 the self-potential anomaly coincides well with the Slingram and radiometric anomalies. Its magnitude is about 550 mV in relation to levels outside the anomaly and this is a significantly large anomaly in any circumstances. It is consistent in its association with the conductor throughout the area but it displays strong localisation in some preferred zones of the conductor. Line 201S is the centre of one of these zones of localised S-P anomaly; the anomaly dies out rapidly to the north and south, yet the Slingram anomalies are very persistent throughout the area.

The square flat-bottomed shape of the S-P anomaly is found on other lines in the area.

Previous S-P work at Rum Jungle and the northern part of the Northern Territory in general indicates that graphitic black shales can produce S-P anomalies of the magnitude found here. It would be expected that the S-P anomalies would be as persistent as the Slingram anomalies, which are also caused by the graphitic shale. The fact that they display strong localisation indicates that some form of lateral differentiation exists within the black shale and this could possibly be evidence of mineralised zones within the shale.

Other geophysical methods

The Turam, magnetic, and induced polarisation methods have also been used in this area.

The Turam method confirms the Slingram findings but adds nothing new to the picture.

Traverses with Sharpe and Askania magnetometers reveal no magnetic effects associated with the conductor.

IP results on 217S (Farrow, 1967) failed to register any significant frequency effect over the Slingram anomalies. This was not expected as graphitic shales should give strong frequency effects. Later work on traverse 233S indicates that strong frequency effects are associated with the conductor. It is probable that poor contact conditions on line 217S caused this discrepancy.

Depth probing with the Slingram equipment

A series of model experiments with the Slingram equipment carried out by the author has led to the development of a depth sounding method, which proved applicable to the conductor at 201S and which was principally responsible for the selection of the exact site for the drill.

The results of probing produced the picture of the conductor shown in Plate 3. Using this and the geological map produced by Shatwell it is possible to construct the geological section shown in Plate 2.

The depth information obtained with the Slingram probe is based on the assumption that geometrical considerations applicable to model work can also be applied to field situations. Thus it is hoped that drilling will confirm the dimensions of the conductor as shown.

Based on the model shown in Plate 3 it is possible to predict that a diamond-drill hole situated as shown would encounter the following features:

The hole should pass through weathered rock for about 70 feet. This is based on the assumption that the top of the conductor represents the base of the weathering zone. At about 70 feet it should enter fresh undifferentiated shale, which should continue to about 125 feet. At this point the highly graphitic black shale should be encountered and persist to about 230 feet where hematitic quartz breccia should be found.

At this point the three geophysical anomalies will have been tested as far as possible with one hole. However, surface radiometric readings show high radioactivity to be associated with the contact between the quartzite and the second less-conducting black shale. Thus it seems advisable to continue the hole to cut this contact.

Therefore it might be expected that quartzite would be encountered at about 320 feet and black shale at about 390 feet.

Thus a total hole depth of 450 feet should permit investigation of this second shale contact.

The depth to the contact with the highly graphitic shale should be the most accurate of these various estimates as it is the one provided directly by the Slingram probe. All other estimates are derived from this depth and the known surface geology.

If these depth estimates in the first 200 feet of hole prove correct to within ten percent of the actual depth then the assumptionsregarding the probe method may be regarded as valid.

Previous drilling

A hole (BMR DDH 66-4) was drilled on traverse 237 S at Mount Minza in a zone of radiometric and Slingram anomalies associated with the same conductor as described above (Farrow, 1967). This intersected a steeply dipping bed of highly graphitic black shale, which was about 100 feet thick. Radiometric logging showed that the shale in general was more radioactive than the surrounding rocks. A zone of unusually high radioactivity was recorded within the shale close to the contact with the underlying hematitic quartz breccia.

Drilling in the Waterhouse No. 2 Prospect indicates an association between the known uranium mineralisation and the conducting zones found there (Daly & Tate, 1960; Ruxton, 1961). These conductors are closely related to the Mount Minza conductors as shown by geology.

Geophysical similarities with South Alligator area

Two geological sections through known uranium orebodies in the South Alligator area are shown in Plates 4 and 5. These are the El Sherana North West and Scinto 5 North bodies respectively. It can be seen that the geological sequence of shales in contact with ironstone is generally similar to the sequence of Mount Minza.

In both cases the orebodies are small but of very high grade and occur within the weathered black shale close to the shale-ironstone contact.

The self-potential anomalies are of similar magnitude to those in the Mount Minza area. Their sources were assumed by Ashley (1962, 1963) to be the black shales. The reason given by Ashley for the fact that of two apparently identical shales only one produces an S-P anomaly (Plate 4) was that an S-P anomaly is produced only if unweathered shale protrudes above the water table. Alternatively, the relative graphite content of these shales (on which, however, no information is available) might have had some effect as at Mount Minza. The S-P survey showed that the anomalies are centred where the mineralisation occurs and that they are localised along the strike of the shales, which extend well beyond the anomalies. Thus, as at Mount Minza, the anomalies are confined to one bed in a group of shale beds and localised along the outcrop of the bed.

The radiometric profile for El Sharana North West indicates that the central shale is more radioactive than the surrounding rocks and in this respect is similar to the conducting shale bed at Mount Minza. The profile also indicates that the anomaly is not principally due to the close approach of the orebodies to the surface. In fact this is one of the smallest radiometric anomalies in the area and it would not normally be regarded as significant. It appears therefore that a high-grade uranium orebody can exist within 30 feet of the surface without producing a significant radiometric anomaly.

The radiometric results for Scinto 5 North were rendered meaningless as open cutting occurred before the radiometric work was completed.

No Slingram work was done at El Sherana owing to the rugged topography.

To summarise the similarities of the South Alligator and Mount Minza areas:

(a) A similar geological sequence of black shales and iron-bearing rocks all of Lower Proterozoic age.

(b) Characteristic weathering of shales in both areas to a white rock, like pipe clay.

(c) One shale bed more radioactive than the others in the sequence.

(d) Self-potential anomalies associated almost exclusively with this radioactive shale and confined to certain parts of the shale bed along the strike.

(e) Self-potential anomalies having similar magnitudes in both areas.

(f) Orebodies are situated close to a shale-ironstone contact in the South Alligator River area. At Mount Minza a zone of higher than average radioactivity occurs in the shale close to its contact with hematitic quartz breccia.

The absence of outstanding radiometric anomalies over known high-grade bodies at moderate depth suggests that similar orebodies could exist at Mount Minza without producing significant anomalies.

The localisation of the S-P anomalies in the Mount Minza area appears to bear no relation to topography and thus it seems the water table control proposed in the El Sherana area does not operate here. In fact it may be observed that the orebodies of the El Sherana North West and Scinto 5 North areas are situated close to the centres of two such localised S-P anomalies. Thus it may be that the mineralisation rather than the graphite content (which appears to be constant throughout the Mount Minza conductor) is the cause of the S-P anomalies associated with these orebodies.

It is notable that the S-P anomaly on line 201S is very wide in relation to the conducting shale as compared with the anomalies in Plates 4 and 5. It seems that the dip of the body causes the greater width. This is supported by the fact that the S-P anomalies over the more steeply dipping sections of the conductor to the south are much narrower.

The S-P and Slingram anomalies occurring on line 201S are not the strongest to be found in this area, for on line 235S at about 473.0E an 800-mV S-P anomaly coincides with a Slingram real component anomaly which falls as low as 44%. Again this is a localised S-P anomaly. The reasons for preferring line 201S for the drill site are better depth control by probing (which is difficult on 235S because of the terrain) and better access in the wet season.

The site is on ground which will remain firm throughout the wet season. It can be approached from Batchelor on well established tracks to within half a mile. Two creeks could cut these tracks when in full flood but in moderate flood they would be passable to a four-wheel-drive vehicle as in both cases the track is hard at the creek crossings. It would be possible to make an all weather track for the last half mile by following an elevated lateritic ridge. Tracks at present in use become impassable in the wet season as they follow black soil flats.

3. CONCLUSIONS

Similarities between the Mount Minza and South Alligator River areas both in the geophysical results and geological environment suggest that the drill hole recommended at Mount Minza may encounter uranium mineralisation. In addition the hole would provide valuable information as to the origins of the anomalies detected by the electromagnetic, self-potential, and radiometric surveys and in particular would test the accuracy of a new method of obtaining depth information by use of the Slingram method.

The sections shown in Plates 2,4, and 5 are all at the same scale of 200 feet to an inch and it can be seen that orebodies of the size of those in the South Alligator River area can easily be missed by a single drill hole. The orebodies shown in section were discovered by intensive non-core drilling. In the El Sherana North West area, the drilling was to investigate the self-potential anomaly. Hence it is also recommended that intensive non-core drilling of the top of the Mount Minza conducting shale bed should be undertaken to depths of about 200 feet.

4. REFERENCES

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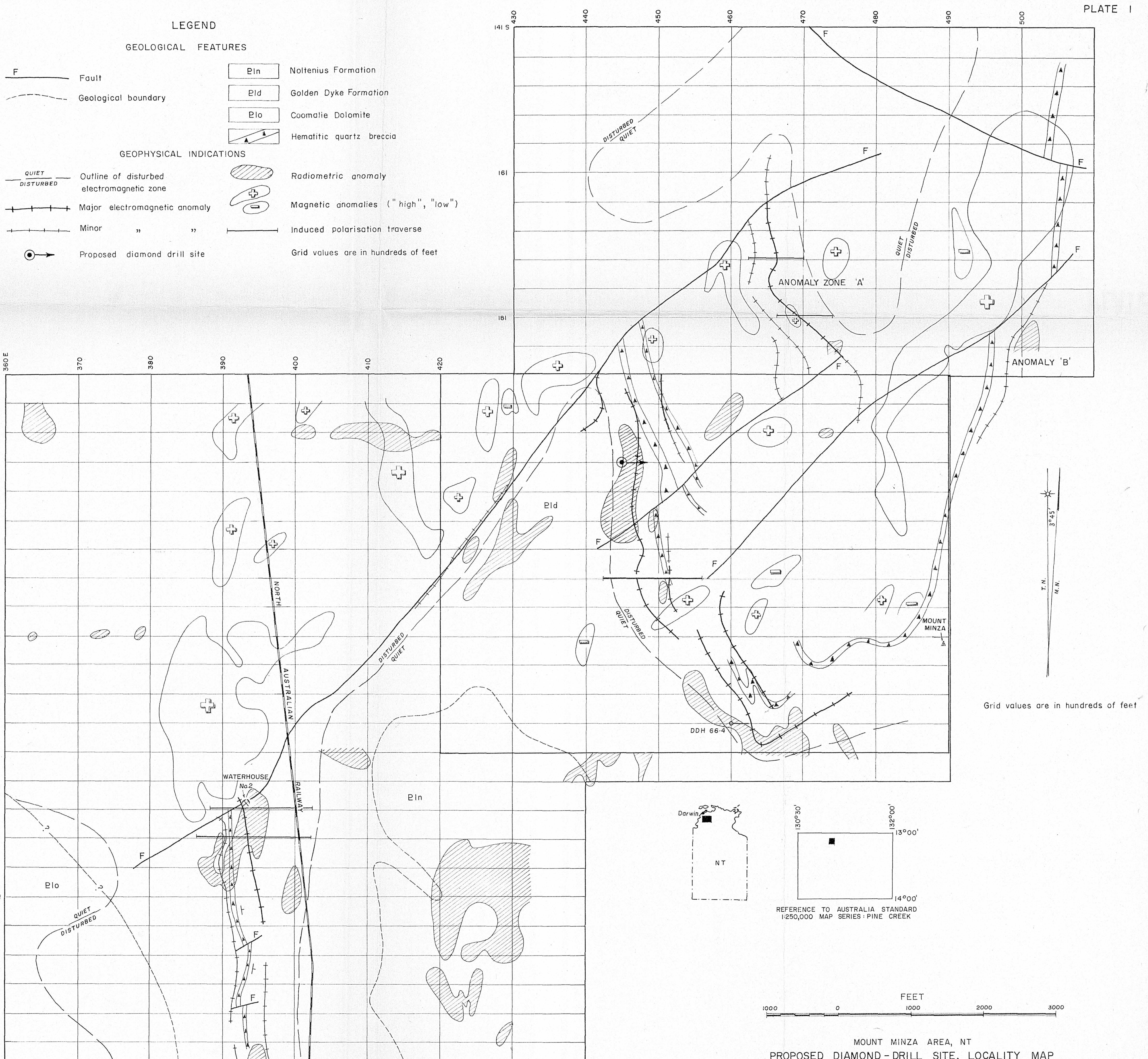


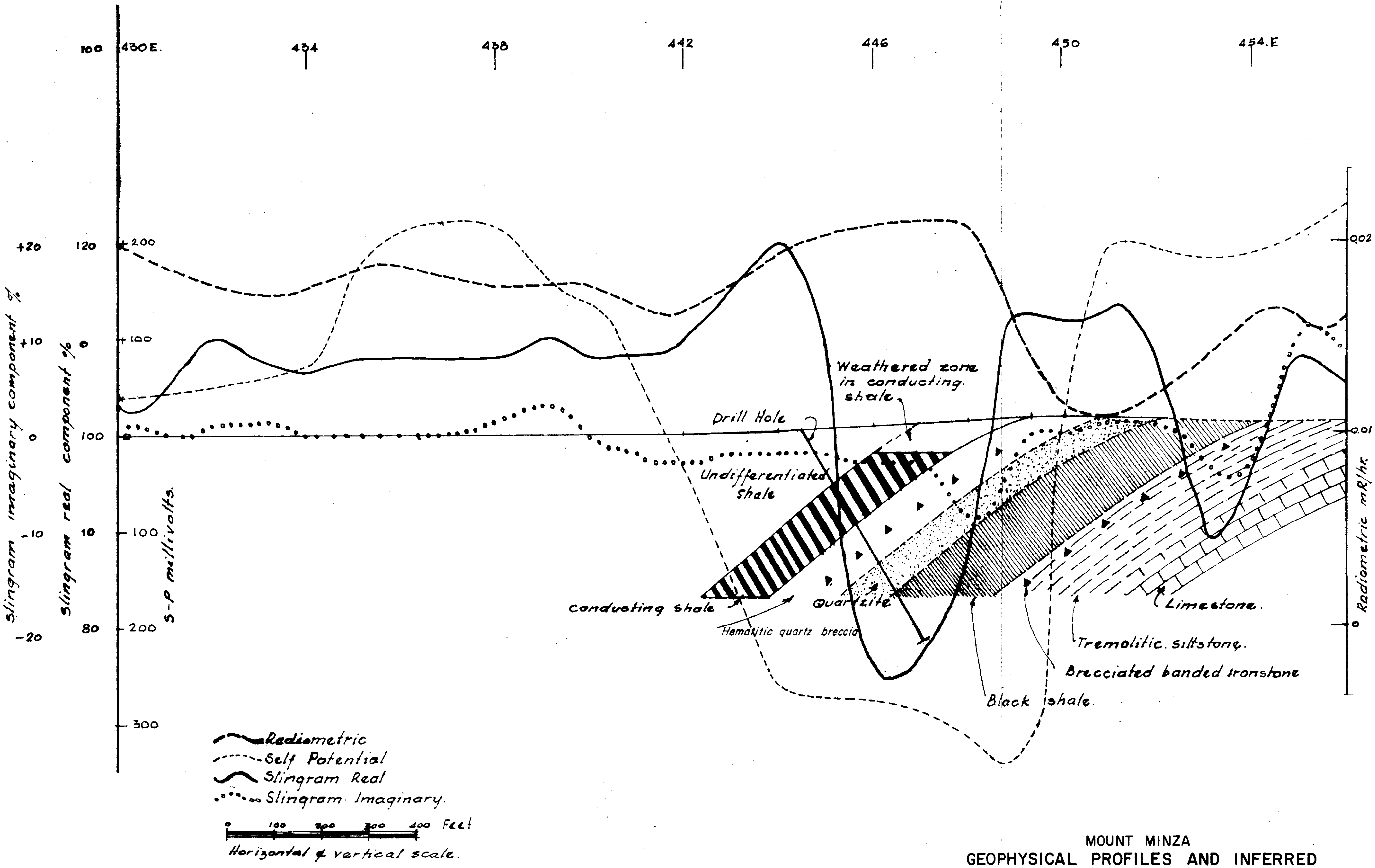
MOUNT MINZA AREA, NT
PROPOSED DIAMOND-DRILL SITE, LOCALITY MAP AND SUMMARY OF GEOPHYSICAL INDICATIONS

To Accompany Record No. 1968/20

D52/B7-223-1

MT MINZA-GUILD AREA N.T. 1966

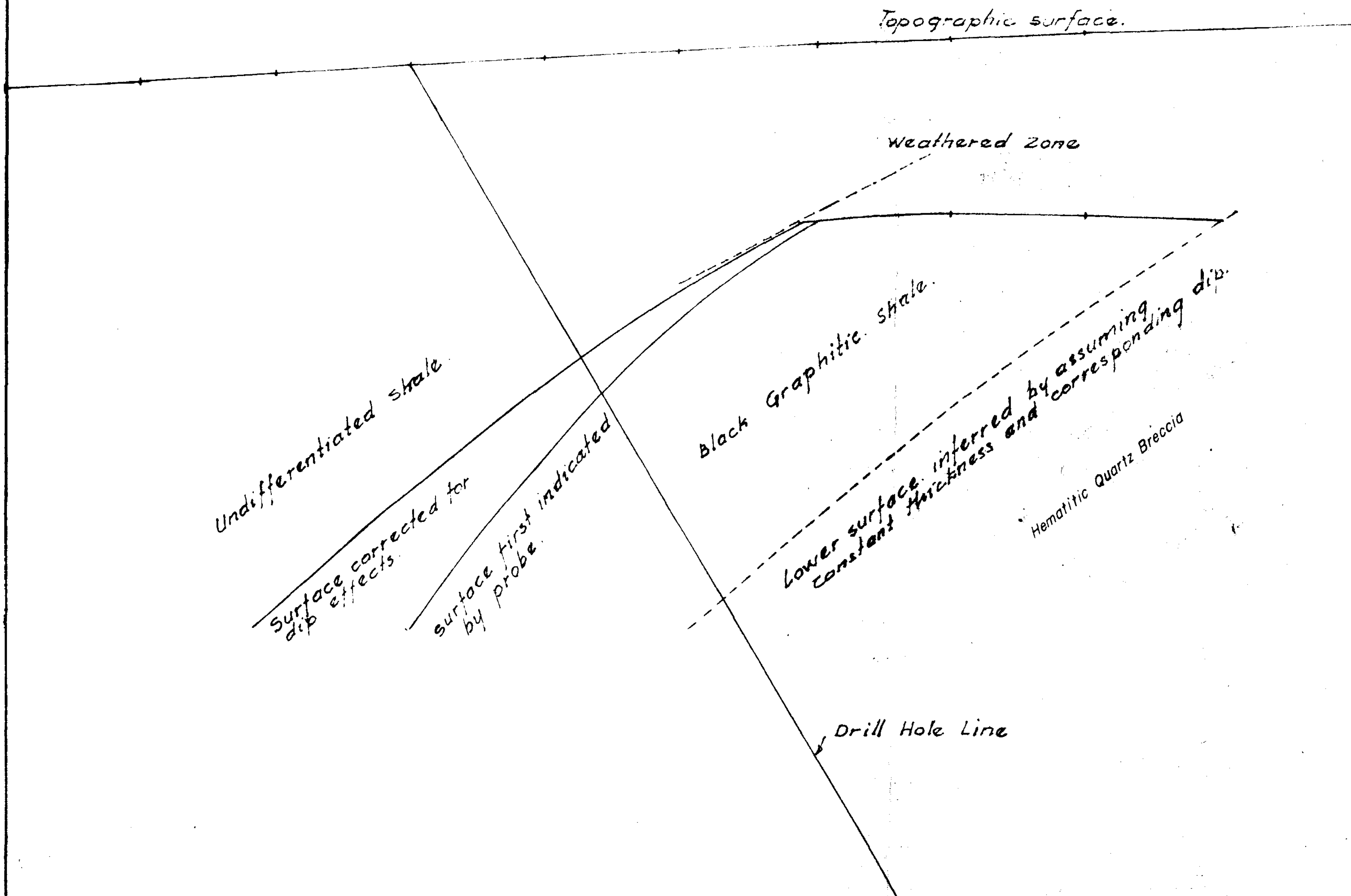
PLATE 2



MOUNT MINZA
GEOPHYSICAL PROFILES AND INFERRED
GEOLOGICAL SECTION ALONG TRAVERSE 201S

To Accompany Record No.1968/20

D52/B7-354



MOUNT MINZA
INFERRED GEOLOGICAL BOUNDARIES
FROM SLINGRAM DEPTH PROBE,
TRAVERSE 201S

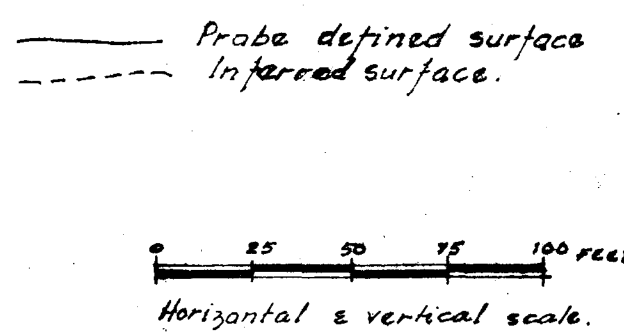
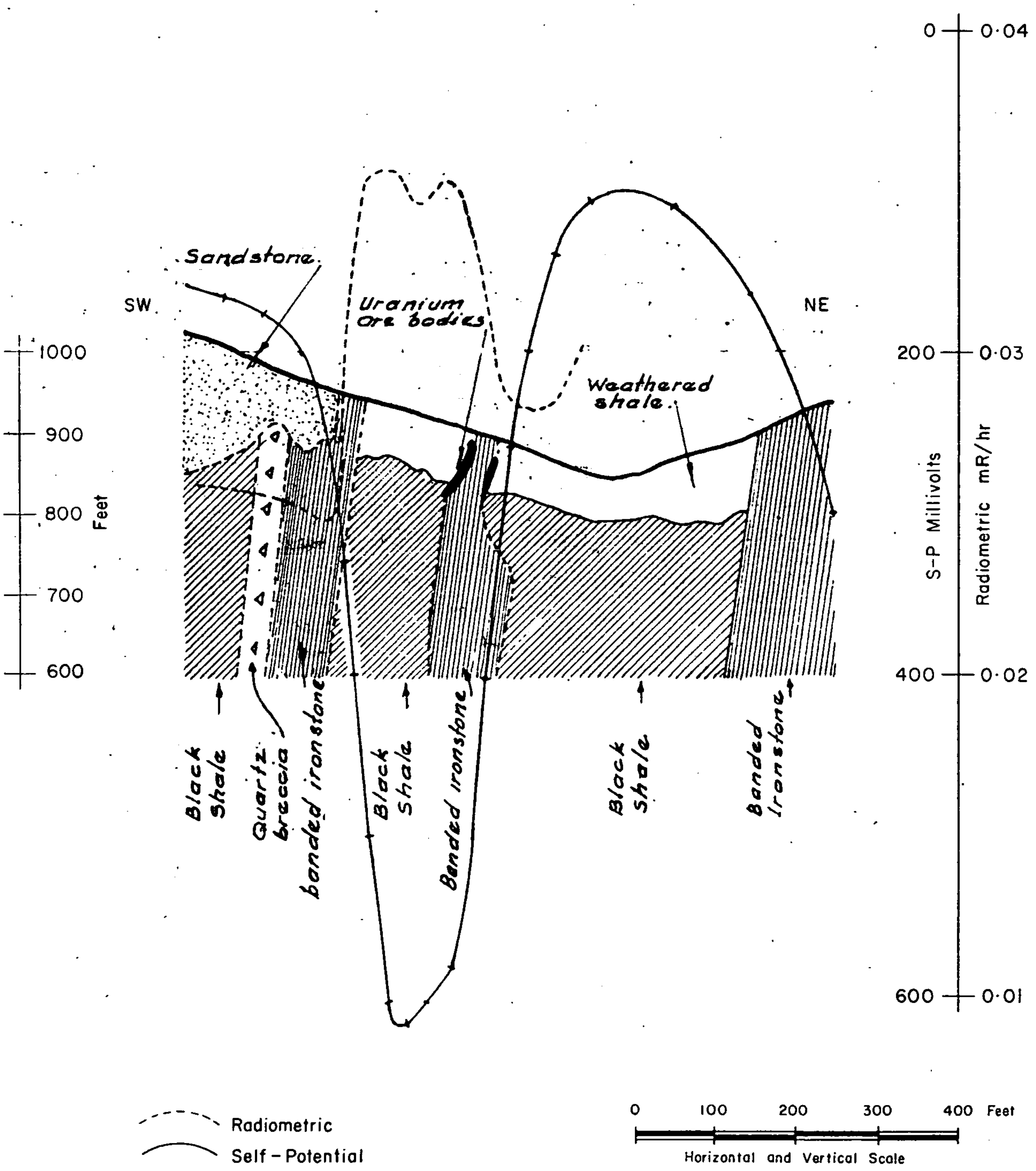


PLATE 4



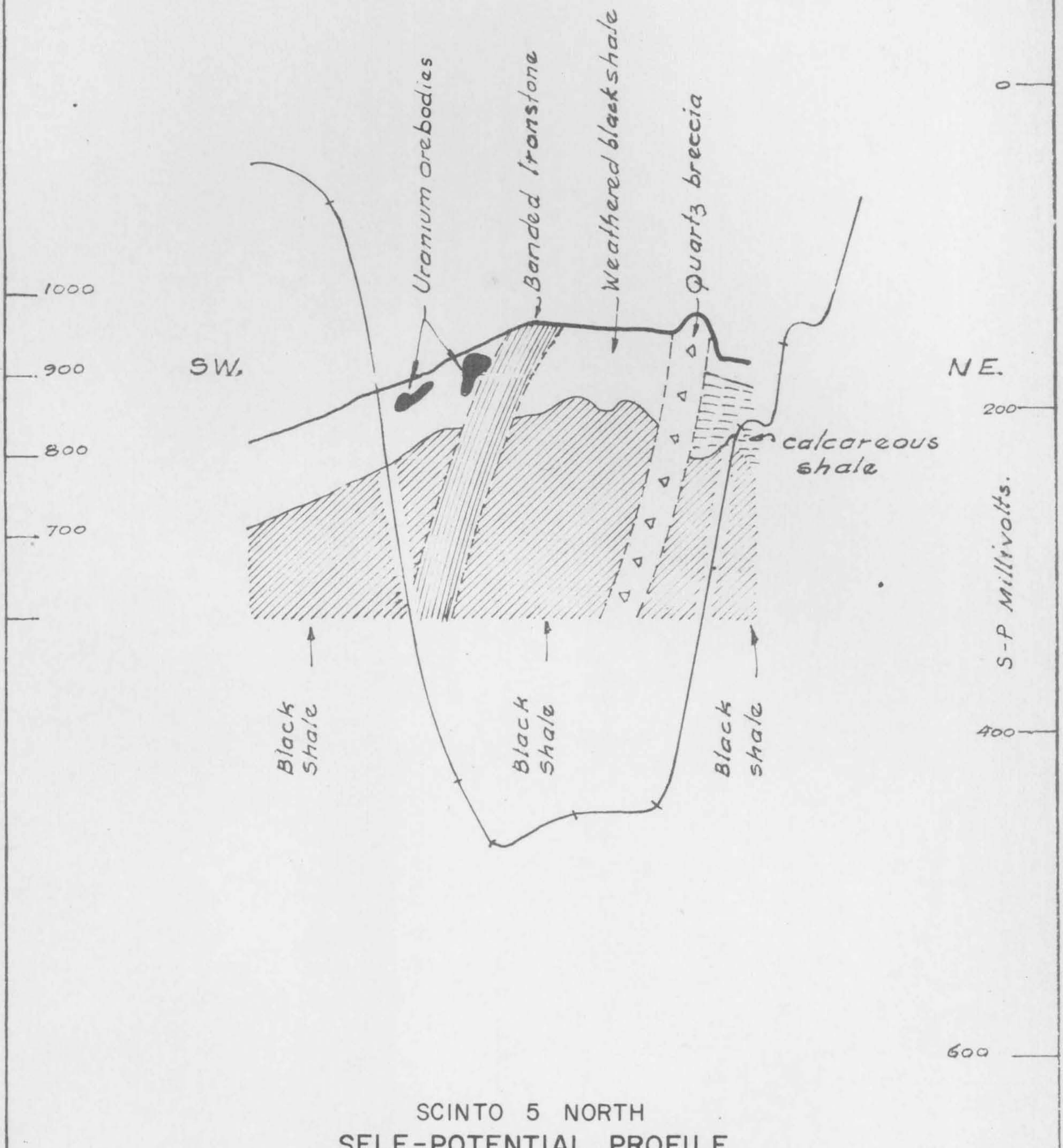
EL SHERANA NORTH-WEST

GEOPHYSICAL PROFILES AND GEOLOGICAL SECTION

To Accompany Record No. 1968/20

D52/B7-357

(12)



SCINTO 5 NORTH
SELF-POTENTIAL PROFILE
AND GEOLOGICAL SECTION

Self-Potential

0 100 200 300 400 Feet
Horizontal and Vertical Scale