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Record 1971/73

STAPLETON AREA RECONNAISSANCE GEOPHYSICAL SURVEY, RUM JUNGLE AREA, NORTHERN TERRITORY 1970

by

P.W.B. Bullock

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ILLUSTRATIONS

SUMMARY

Electromagnetic (Slingram and VLF) and surface radiometric surveys were made in the Stapleton area as part of a uranium and base metal exploration program in the Rum Jungle area, Northern Territory.

A large Slingram anomaly was obtained over the Celia Dolomite. Radiometric profiles show higher backgrounds over the Waterhouse Granite and Golden Dyke Formation. Probing of auger drill holes showed that none of the radiometric anomalies persists with depth.

The Stapleton area is not considered to warrant further geophysical exploration for uranium or base metals. However, further work would be required to establish the cause of the Slingram anomaly over the Celia Dolomite.

1. INTRODUCTION

The area covered in this survey (Plate 1) is about 13 km south of Batchelor township and lies along the west side of the North Australian railway near Stapleton Siding, between Darwin and Adelaide River. The survey was made by the Darwin Uranium Group of the Bureau of Mineral Resources (BMR) as part of a uranium and base metal exploration program in the Rum Jungle area.

Geophysical and geological field work was carried out from May to August 1970. The geological mapping is described in a separate report by Lau (in preparation). The surveys were of a reconnaissance type on traverses 1200 ft apart and pegged every 100 ft.

The geophysical work consisted of an electromagnetic survey (using Slingram and VLF methods) and a surface radiometric survey. The field party consisted of P. Bullock (Geophysicist), N. Ashmore and W. Fraser (Technical Assistants), and R. Battersby and T. Arthur (Field Hands).

2. GEOLOGY

The rocks of the area are of the Proterozoic Batchelor, Goodparla, Finniss River, and Tolmer Groups. They trend north-northeast and dip easterly away from the Waterhouse Granite, (Plate 2).

The rock units of the Groups are described by Walpole, Crohn, Dunn and Randal (1968). The age of the Waterhouse Granite is unknown (Walpole et al., 1968, p. 145). Batchelor Group sediments dip off the granite in a domed structure. In the Stapleton area, these Batchelor Group sediments (Lower Proterozoic) are the Beestons Formation, Celia Dolomite, Crater Formation, and Coomalie Dolomite. The Coomalie Dolomite is mapped as being overlain by the Depot Creek Sandstone member of the Buldiva Sandstone of the Tolmer Group (Upper Proterozoic).

After Coomalie Dolomite are the Golden Dyke Formation (Goodparla Group) and the Noltenius Formation (Finniss River Group), both Lower Proterozoic.

3. DISCUSSION OF RESULTS

Slingram results

The Slingram results are shown as profiles of real and imaginary components in Plate 3. Readings were taken at 100-ft intervals using ABEM EM Gun equipment; coil separation was 200 ft and the frequency used was 1760 Hz. The grid spacing of 1200 ft would not permit contouring the Slingram or radiometric results. Slingram readings were made along Traverse 333S from 345E to 397E by K. Duckworth in 1964 (Shatwell & Duckworth, 1966) and these results tie in very closely with the 1970 results described here.

The most noticeable feature of the Slingram profiles is the large response, particularly the negative imaginary component, over the Celia Dolomite. To the east there is little disturbance over the Crater Formation and Depot Creek Sandstone. The presence of undisturbed profiles over the Depot Creek Sandstone is consistent with the assumption that, as elsewhere in the Rum Jungle area, this formation overlies Coomalie Dolomite, which has been found elsewhere to produce undisturbed Slingram results (Duckworth, 1966; Shatwell, 1966).

The boundaries between Coomalie Dolomite and the Golden Dyke and Noltenius Formations are not so clearly defined as the boundary of the Celia Dolomite, but the profiles over the Golden Dyke Formation are more irregular than over Coomalie Dolomite. Traverses 369S and 381S are particularly undisturbed over the Golden Dyke Formation. However, undisturbed zones were also found over this formation to the northeast in the Gould area (Shatwell & Duckworth, 1966).

The anomaly on the extreme east of Traverses 417S to 441S is consistent with a fairly narrow near-surface conductor dipping easterly. The cause of the anomaly is probably carbonaceous shale, which was mapped on the surface (Lau, in prep.); a radiometric anomaly coincides with the Slingram anomaly. Similar anomalies are known in the Gould area, where carbonaceous shale causes both electromagnetic and radiometric anomalies (Shatwell & Duckworth, 1966; Duckworth, 1968).

The large anomaly over the Celia Dolomite is rather surprising. Two Slingram profiles crossing the regional strike of the Celia Dolomite at right angles a few kilometres east of Batchelor (K. Duckworth, 1965, file note) were undisturbed apart from slight imaginary component troughs none of which fell below -10% in intensity and were mostly above -5%.

To investigate the anomaly further, a McPhar M700 vertical field fluxgate magnetometer was read over Traverse 381S from 303E to 333E. The resultant profile showed no significant variations and is not shown here.

Possible causes of the Slingram anomaly over the Celia Dolomite are: a conductive water-table, a conductive lithology, or a shear zone. Shallow auger drilling established the presence of water over most of the Celia Dolomite within 9 m of the surface at the time of the survey, but failed to reach any water in the neighbouring Crater Formation; thus the water-table may contribute to the anomaly.

In November 1970, after further auger drilling, the following water samples were obtained:

Traverse	Station	Conductivity (micromho/cm) at 25°C.
333S	323E	510
381S	316E	300
405S	300E	740

The conductivities were measured by the Northern Territory Administration's Mines and Water Resources Branch Laboratory at East Point, Darwin, and are not unusual for normal groundwater. Auger cuttings from the Celia Dolomite were examined by G. Lau, geologist of the Darwin Uranium Group; they contain 5 to 10 percent (eye) opaques, and have copper, zinc, and nickel values about five times those found in the Crater Formation and Depot Creek Sandstone. It is possible that the shallow water-table and a conductive lithology contribute to the anomaly but further work would be required to establish this.

VLF results

Four traverses were covered with a Ronka EM16 VLF instrument which employs radio frequency methods; these are described by Haigh (1970). The transmitter used was North-West Cape (22.3 Hz). The geological strike in the survey area is thus about thirty degrees from the most preferred orientation.

The resultant profiles (Plate 4) appear to be more complex than the Slingram profiles and are probably affected by variations in conductivity near the surface and also by topography; this is apparent on the steep sides of some of the creeks in the Golden Dyke and Noltenius Formations. Readings were taken facing north. Thus, in interpretation of results, positive cross-overs of the in-phase component are considered to indicate presence of conductors or boundaries between geological formations.

The VLF results were filtered using a method described by Fraser (1969) and profiles of the filtered values are shown in Plate 5. The filtering process uses a difference operator which transforms the points of inflexion into peaks. The difference operator also attenuates features of very small or large wavelength and thus the contours of the filtered results indicate the conductor pattern with a reduced interference from noise and topographical effects. The filtered VLF profiles appear to delineate the boundary between Waterhouse Granite and Celia Dolomite. Likewise the boundary between Celia Dolomite and the Crater Formation is indicated. However, correlation of filtered results with geology in the eastern portion of profiles is not so obvious.

Radiometric results

The traverses were read at 100-ft intervals with a Harwell type 1368A ratemeter and an EMI type 239 ratemeter and scintillation detector. The resultant profiles are essentially the same and those obtained with the Harwell ratemeter are shown in Plate 6.

The increase in background on the extreme western ends of the traverses is due to the Waterhouse Granite. The Celia Dolomite and Depot Creek Sandstone both have low backgrounds; the Golden Dyke and Noltenius Formations have slightly higher and more disturbed backgrounds than the Celia Dolomite and Depot Creek Sandstone.

Auger holes 200 ft apart were drilled and logged by the Geological Branch, BMR, but none of the holes showed increasing radioactivity with depth. The narrow surface radiometric anomaly on the western parts of Traverses 417S to 441S, near the boundary between the Celia Dolomite and the Crater Formation, was between auger drill holes. Further auger drilling was carried out in November. This drilling, although only able to penetrate a few feet, showed that the radioactivity did not increase with depth. Old costeans are situated 500 ft south of the anomaly on Traverse 441S. The anomaly on the east of Traverses 417S to 441S is discussed above with the Slingram results.

4. CONCLUSIONS

The Stapleton area is not considered to warrant further investigation for uranium or base metal mineralization on the basis of both the geophysical survey described here and the geological and geochemical survey also made in 1970 and described by Lau (in preparation).

Further work would be required to establish the cause of the Slingram anomaly over the Celia Dolomite.

5. REFERENCES

DUCKWORTH, K., 1966 - Rum Jungle East area electromagnetic and radiometric surveys, Northern Territory, 1964. Bur. Miner. Resour. Aust. Rec. 1966/98 (unpubl.).

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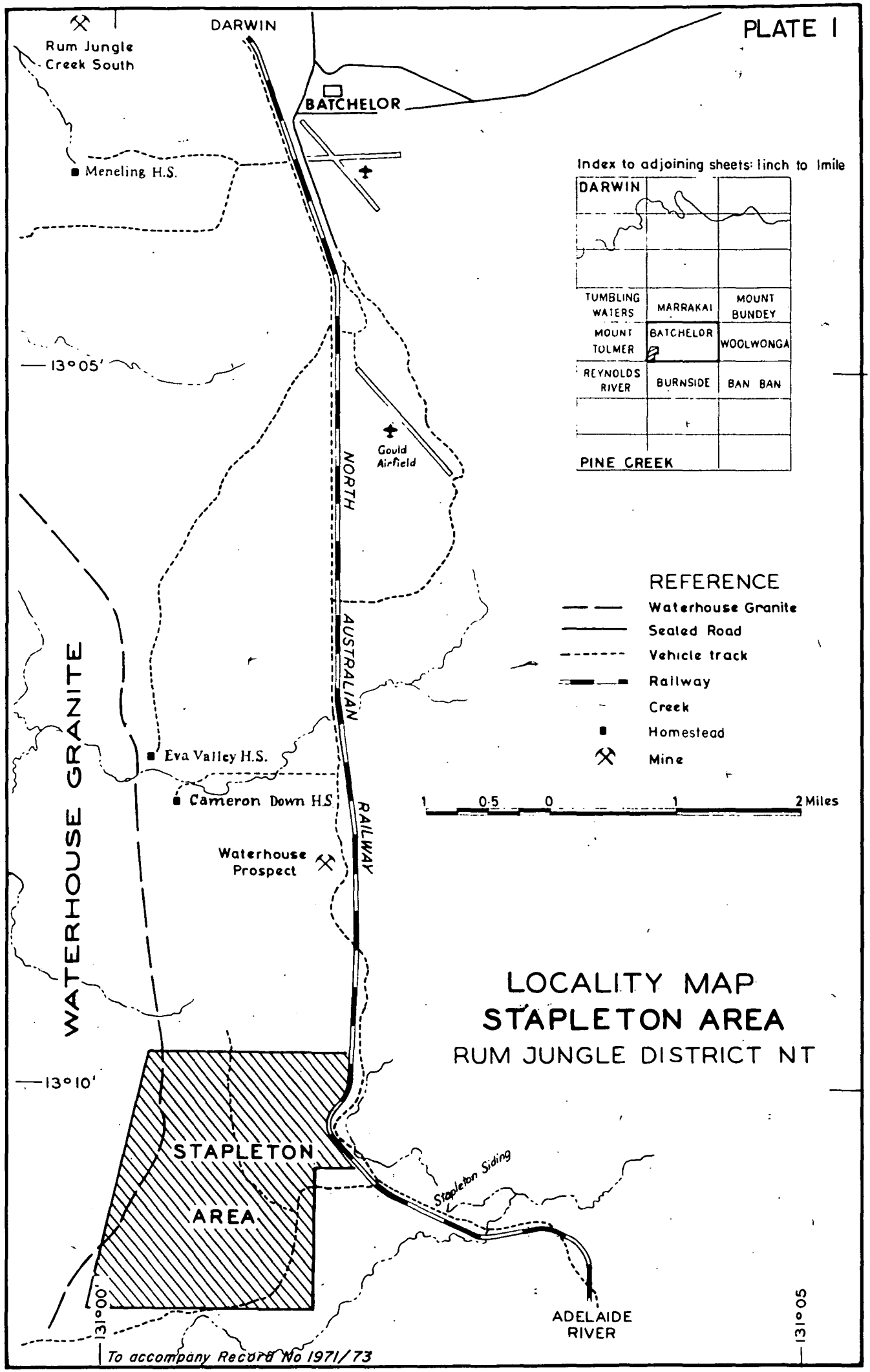
PLATE I



B.M.R. DARWIN DEC. 70

D52/B7-580A 8

PLATE 2

REFERENCE

- LATERITIC SURFACE
- Puo — DEPOT CREEK SANDSTONE — Medium grained pink sandstone
- Pln — NOLTENIUS FORMATION — Quartz greywacke
- Pld — GOLDEN DYKE FORMATION — Shale hematite-quartzite breccia
- Pld — Tremolite dolomite rock
- Plr — CRATER FORMATION — Hematite quartzite breccia, sandstone, siltstone
- Pll — CELIA DOLOMITE — Quartz actinolite rock
- Ple — BEESTONS FORMATION — Friable quarzite
- Agt — WATERHOUSE GRANITE — Granite, mica schist

Geological boundaries:
- Position approximate
- Position concealed
- Position inferred, concealed

- Paperbark swamp
- Dip and strike of bedding
- Dip and strike of cleavage
- Lines surveyed and pegged every 200'
- Limits of sampling
- Vehicle track
- Railway
- Fence
- Creek

280 E 290 E 300 E 310 E 320 E 330 E 340 E 350 E 360 E 370 E 380 E 390 E 400 E

333 S 345 S 357 S 369 S 381 S 393 S 405 S 417 S 429 S 441 S

To Darwin

To Batchelor

North Australian Railway

To Adelaide River

Cottage

Quartzite

Quartz and Amethyst

Quartz Mica Schist

Quartzite outcrop

Costeans

GEOLOGY

GEOCHEMICAL SURVEY 1970

STAPLETON AREA

RUM JUNGLE DISTRICT NT

T.E.P. MINE GRID
GRID NORTH 359° 58' TRUE

1000 0 1000 2000 3000 Feet

300 0 500 1000 Metres

(Based on D52/A8-469)

To accompany Record 1971/98, 1971/73

D52/B7-585

PLATE 3

280 E | 290 E | 300 E | 310 E | 320 E | 330 E | 340 E | 350 E | 360 E | 370 E | 380 E | 390 E | 400 E

333 S
345 S
357 S
369 S
381 S
393 S
405 S
417 S
429 S
441 S

Road
To Darwin
To Batchelor
North Australian Railway
To Adelaide River

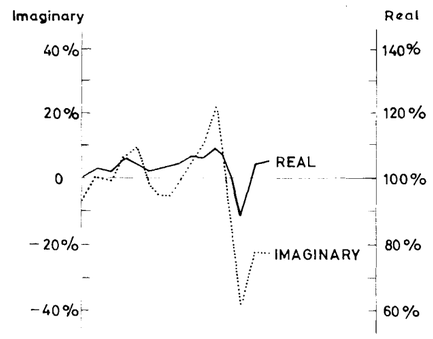
REFERENCE:

REAL

IMAGINARY

FREQUENCY 1760 Hz
COIL SEPARATION 200 Ft

VERTICAL SCALE:



SLINGRAM REAL AND IMAGINARY COMPONENT PROFILES

STAPLETON AREA

RUM JUNGLE DISTRICT N T

T. E.P. MINE GRID
GRID NORTH 359° 58 TRUE

1000 0 1000 2000 3000 Feet

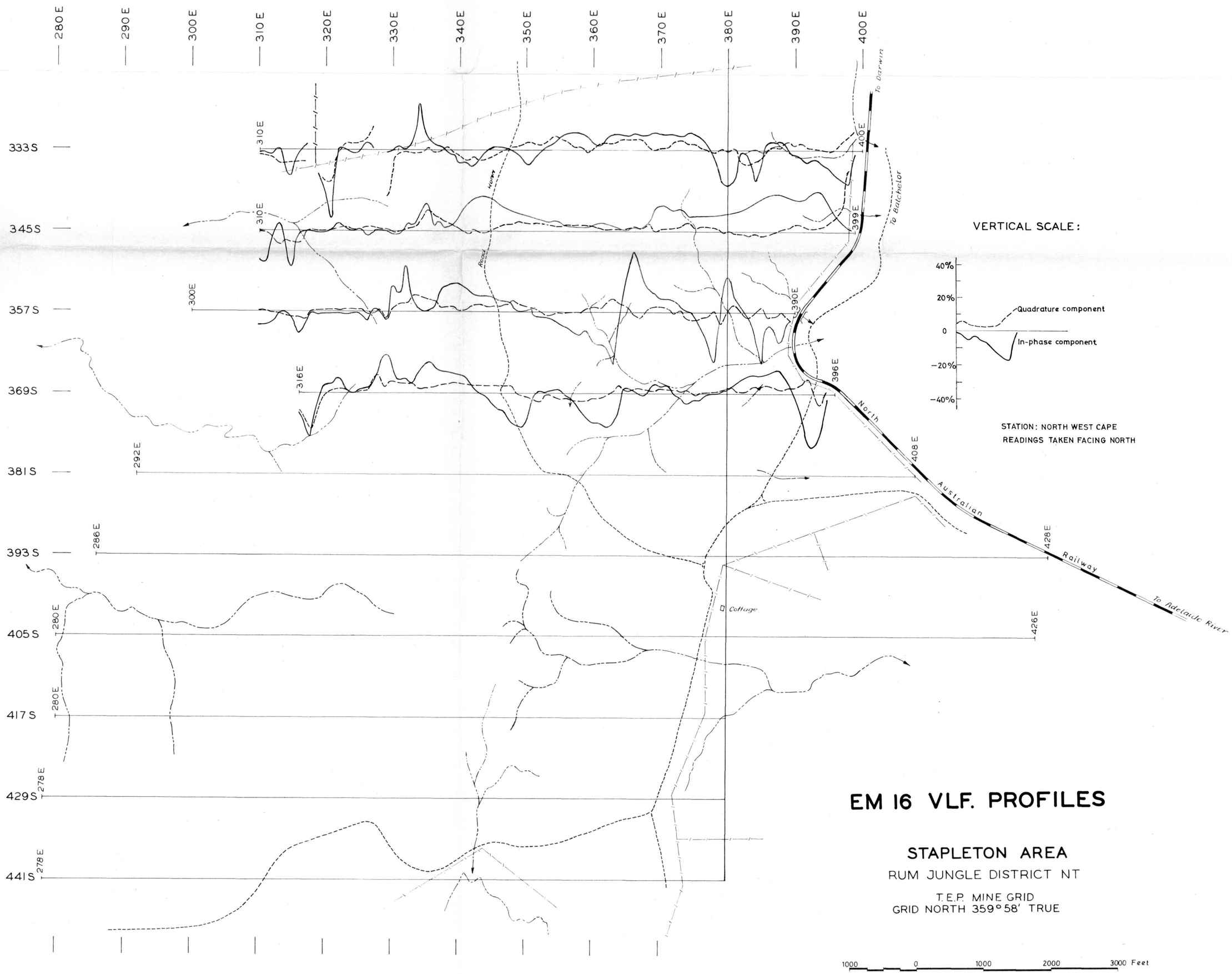
300 0 500 1000 Metres

To accompany Record No 1971/73

B.M.R. DARWIN N.T. NOV. 1970

D52/B7-582

PLATE 4



VERTICAL SCALE:

STATION: NORTH WEST CAPE
READINGS TAKEN FACING NORTH

EM 16 VLF. PROFILES

STAPLETON AREA

RUM JUNGLE DISTRICT NT

T.E.P. MINE GRID
GRID NORTH 359° 58' TRUE

1000 0 1000 2000 3000 Feet

300 0 500 1000 Metres

D52/B7-583

To accompany Record No 1971/73

B.M.R. DARWIN N.T. NOV. 1970

PLATE 5

280 E — 290 E — 300 E — 310 E — 320 E — 330 E — 340 E — 350 E — 360 E — 370 E — 380 E — 390 E — 400 E

333 S — 310 E — 400 E

345 S — 310 E — 399 E

357 S — 300 E — 390 E

369 S — 316 E — 396 E

381 S — 292 E — 408 E

393 S — 286 E — 428 E

405 S — 280 E — 426 E

417 S — 280 E

429 S — 278 E

441 S — 278 E

Road

To Darwin

To Batchelor

North Australian Railway

To Adelaide River

Cottage

VERTICAL SCALE:

60%
40%
20%
0
20%
40%
60%

EM 16 VLF PROFILES

AFTER FILTERING USING METHOD OF FRASER (1969)

STAPLETON AREA

RUM JUNGLE DISTRICT NT

T.E.P. MINE GRID
GRID NORTH 359° 58' TRUE

1000 0 1000 2000 3000 Feet

300 0 500 1000 Metres

To accompany Record No 1971/73

D52/B7-584

B.M.R. DARWIN N.T. NOV. 1970

PLATE 6

280 E — 290 E — 300 E — 310 E — 320 E — 330 E — 340E — 350 E — 360 E — 370 E — 380 E — 390 E — 400 E

333 S
345 S
357 S
369 S
381 S
393 S
405 S
417 S
429 S
441 S

Road

To Darwin

To Batchelor

North Australian Railway

To Adelaide River

REFERENCE :

HARWELL TYPE 1368 A RATEMETER
STATIONS 100 FEET APART

VERTICAL SCALE:

369 S

0·03 mR/Hr
0·02 mR/Hr
0·01 mR/Hr
0·00 mR/Hr

RADIOMETRIC PROFILES

STAPLETON AREA

RUM JUNGLE DISTRICT N T

T. E.P. MINE GRID
GRID NORTH 359° 58 TRUE

1000 0 1000 2000 3000 Feet

300 0 500 1000 Metres

To accompany Record No 1971/73

D52/B7-581

B.M.R. DARWIN N.T. NOV. 1970