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Record No. 1968 / 78

Dobbyn - Kamileroi Geophysical Survey, Queensland 1967

by

R.J. Smith

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ILLUSTRATIONS

Note. This Record supersedes Record No. 1968/46

SUMMARY

Between August and November 1967, a geophysical survey was made in the Dobbyn - Kamileroi area of North Queensland. The survey was directed at three areas: Area 1, near Kamileroi Homestead; Area 2, bwtween Dobbyn and Eight Mile Bore; and Area 3, at Dobbyn itself.

Induced polarisation, gravity, and magnetic methods were used in Area 1 to further investigate pronounced gravity and magnetic anomalies, and one drill hole has been recommended. Induced polarisation and gravity methods were used in Area 2 in a search for copper mineralisation, and two drill holes have been recommended. Turam and induced polarisation methods were used in Area 3 to make a detailed study of the area near the Dobbyn shaft and DDH 10 and DDH 11, but no further drilling is recommended. In addition, an investigation was made of the effect of variations in the primary source on the Turam response.

1. INTRODUCTION

A geophysical survey was made by the Bureau of Mineral Resources (BMR) in the Dobbyn-Kamileroi area of North Queensland from August to November 1967. The survey was a continuation of earlier work: in 1963, 1964, and 1966 by the BMR (Gardener 1964, 1965, 1968; Smith, 1966); and gravity and magnetic work by Eastern Prospectors Pty Ltd during 1965 and 1966.

The 1967 party consisted of R.J. Smith (party leader), B.B. Farrow and D.H. Quick (geophysicists), G. Blincoe (field assistant), a cook, mechanic, and two field-hands. The Department of the Interior, Canberra, supplied contract surveyors R.C. Todd and D. Ryder (interchanging during the survey) and two chainmen. In addition to the geophysical party, W. Dallwitz of the Geological Branch of the BMR spent approximately one week in the area collecting rock samples and mapping geology along traverses.

The survey was done in three main areas (see Plate 1): Area 1 near Kamileroi Homestead; Area 2 between Dobbyn and Eight Mile Bore; and Area 3 near the Dobbyn shaft.

In Area 1, BMR gravity work (Smith, 1966) had detected a pronounced gravity anomaly. This prompted Eastern Prospectors Pty Ltd to carry out further gravity and ground magnetic work and resulted in one exploratory hole being drilled. The 1967 survey was aimed at testing the IP method over the gravity anomaly and at extending gravity and magnetic work in the north-east corner of the area.

Smith (1966) had shown that Area 2 contained gravity anomalies that were continuations of anomalies known to be associated with suitable host rocks for mineralisation near Dobbyn. Part of the area had been explored during 1965 and 1966 by Australian Selection (Pty) Ltd using airborne INPUT, geochemistry, and IP. One hole was drilled (see Plate 10) and the area was later abandoned. The present plan was to explore the area systematically with IP in an attempt to locate any further mineralisation and to extend the gravity work to aid interpretation.

Area 3 had been studied previously (Gardener, 1964 & 1965) with IP and Turam using grounded cables. The Turam anomaly, coinciding with the Dobbyn mine, was to be resurveyed using a variety of loops as power sources. It was hoped that the additional results would assist in the interpretation of the Dobbyn anomaly and help explain the disappointing drilling results (Gardener, 1968). In addition, a comparison of the results with different sized loops was intended to test the effect of loop size on a Turam anomaly.

2. GEOLOGY

The geology of the Dobbyn-Kamileroi area has been studied in general by Carter, Brooks, and Walker (1961). Later, more detailed studies were made in the Dobbyn area by D.O. Zimmerman in 1963 and W.B. Dallwitz in 1964 and 1967. The results of these detailed studies have been included in earlier geophysical reports (Gardener, 1964, 1965, 1968; Smith, 1966) and some are included in this report.

Area 1 contained no outcrops of the Precambrian basement, but the rock types encountered around Dobbyn were expected to extend into this area beneath several hundred feet of Mesozoic sediments (Tambo Formation) and Recent sediments. The pronounced gravity anomaly near Kamileroi had been tested by one drill hole (Eastern Prospectors Pty Ltd) which encountered a medium to coarse-grained gabbro partly altered to amphibolite and biotite schist. Concentrations of pyroxene, with ilmenite and sulphides (pyrite and chalcopyrite) as accessory minerals, were present and raised the density of the mass. Some pyrite, chalcopyrite, and ilmenite were also observed in veinlets and occasional fractures. It was hoped that IP might reveal further concentrations of sulphides.

The drill hole of Eastern Prospectors Pty Ltd was a vertical hole in the centre of the gravity anomaly and it reached weathered bedrock at 405 ft and fresh bedrock at 460 ft. This placed the target for any IP response at a minimum depth of 400 ft, and the possibility of detecting anything at this depth would depend on the resistivity of the overlying sediments.

Area 2 covers part of the Kalkadoon Granite and Leichhardt Metamorphics (see Carter, Brooks, and Walker, 1961). The eastern part of the area is under a soil cover probably overlying Argylla Formation or Corella Formation.

W.B. Dallwitz prepared detailed lithological logs along several traverse lines, and a generalised picture of the information obtained from these logs is shown in Plate 10.

Topographic relief in the area is mostly very low and bedrock is usually concealed by transported and residual soil and shallow alluvium. In places, abundant rounded fragments of quartzite and quartz are contained in the soil and alluvium, but the source of these is generally not apparent.

The principal rock types in the area are acid to intermediate volcanics and amphibolite derived from dolerite; a few small lenses of quartzite and several much smaller bodies of aplite and pegmatitic aplite are also present. The amphibolite and the volcanics have commonly been metasomatically converted to biotite schist; all stages of these changes can be seen in the field, but they have not yet been studied in thin section. Conversion of volcanic rocks to biotite schist is much more common and much more extensive than in the area immediately north of Dobbyn (see Gardener, 1965). The most prominent outcrops consist of quartzite, volcanics, and biotite-enriched volcanics. However, even the volcanics are commonly completely concealed, and their existence is revealed only by fragments spread very sparsely over the surface. In such circumstances there is generally little or no trace of any amphibolite or biotite schist which may be associated with the volcanics.

The geological history of the area is closely analagous to that of the country closer to Dobbyn surveyed by Gardener (1964 & 1965). Dolerite appears to have been intruded as lenticular and branching sills into an approximately flat-lying sequence of acid to intermediate volcanics and very minor quartzite. After intrusion of the dolerite, the rocks were isoclinally folded, and the dolerite was converted to amphibolite.

At some later stage, possibly during mineralisation, much of the amphibolite and the volcanics was progressively enriched in biotite, commonly to the stage where the end product is pure or almost pure biotite schist.

Barren quartz veins, limonitic cupriferous quartz veins, and minor gossan are most commonly found in amphibolite and biotite schist derived from amphibolite, but they also occur, though on a lesser scale, in biotite schist formed from acid to intermediate volcanic rocks (e.g. the lode drilled by Australian Selection (Pty) Ltd north of traverse L51). Nearly all the lodes and quartz veins follow cleavage, which dips 70° to 75° east and which strikes between 320° and 040°. Disseminated copper mineralisation in biotite schist is exposed in pits in several places, especially where the schist was derived from volcanic rocks.

Small shafts, shallow open cuts, pits, and trenches generally on lodes consisting of quartz, limonite, and secondary copper minerals (malachite and chrysocolla), are scattered through the area, and the stronger IP anomalies were found where the workings are larger and more numerous.

Area 3 is completely within the Leichhardt Metamorphics and Kalkadoon Granite. The geology around the Dobbyn shaft was mapped in detail by W.B. Dallwitz in 1964 and the results (previously used by Gardener, 1968) are shown in Plate 2. The mineralisation in the Dobbyn Mine occurs in a north-trending shear dipping east at 75°. The mine was worked only in the oxidised zone where ore consisted of copper carbonates and oxides in quartz. The primary ore was chalcopyrite. The remaining ore should give rise to both Turam and IP anomalies and the shear, with or without mineralisation, could be expected to give a Turam anomaly.

3. METHODS AND INSTRUMENTATION

The main methods used during the Dobbyn-Kamileroi survey were Turam (Area 3) and induced polarisation (Areas 1 and 2). In addition, several traverses were surveyed with gravity and magnetic methods in Areas 1 and 2. The AFMAG equipment, purchased by the BMR during 1967, was tested in all three areas with the prime object of studying instrument operation. The AFMAG results are not included in this report. The Turam method has been described elsewhere (e.g. Parasnis, 1966) and consists essentially of a primary field source - an alternating current passed through a grounded cable or large loop - and search coils to measure the resultant field. Previous Turam work at Dobbyn (Gardener, 1964) used grounded cables, which increase the response over a conductor but make interpretation more difficult. The 1967 survey used mainly large horizontal loops as a primary field source but some measurements were made with grounded cables for comparison. ABEM 2S equipment was used with operating frequencies of 220 and 660 c/s, and measurements were made with 100-ft coil separation.

Induced polarisation, now widely used in Australia, has been described by several authors (e.g. Parasnis, 1966). It can be used to detect the presence of electronic conductors (e.g. metallic sulphides, graphite, etc.) and is not affected by ionic conductors which can give strong electromagnetic anomalies. In the Dobbyn-Kamileroi area a Geoscience IP unit was used with frequencies of 3.0 and 0.3 c/s.

The main electrode configuration was a dipole-dipole array with 200-ft dipoles but in some cases 50-ft, 100-ft, and 400-ft dipoles were used. One traverse was surveyed along the strike with a Schlumberger configuration. In Area 1, at Kamileroi, three resistivity depth probes were made with the IP equipment using expanding Wenner arrays. The electrode configurations are illustrated in Plate 3.

Gravity stations were read with a Worden gravity meter (No. 61). Stations were read at 100-ft intervals in Area 2 and 400-ft intervals in Area 1. Drift control was maintained by reading at a base approximately every hour. The instrument drift was generally satisfactory but some trouble was experienced with bulbs burning out on traverse. The new gravity stations in Areas 1 and 2 were tied in to the 1963 gravity grid (Smith, 1966); observed gravity was relative to station KO at Kajabbi. Elevation corrections assumed a density of 2.2 gm/cc and latitude corrections were made relative to traverse 0 at Dobbyn (Area 3).

Ground measurements of the vertical component of the Earth's magnetic field were made, mainly in Area 1, with a Sharpe MF1 fluxgate magnetometer. In order to tie in to previous work done by Eastern Prospectors Pty Ltd an attempt was made to re-locate a section of Traverse 4. Unfortunately most stations could not be accurately relocated and the new Traverse 4 did not correspond exactly with the previous Traverse 4. Magnetic readings were made relative to station 55 on Traverse 4 and an arbitrary base correction was added to make them consistent with previous work.

Electric and radiometric logging of the Eastern Prospectors' drill hole was carried out during 1966 by the BMR using a Widco porta-logger.

4. FIELD PROGRAMME

Area 1

The main work in Area 1 consisted of gravity and magnetic readings at 400-ft intervals along traverses 4, M, N, O, and P from station 50 to station 73. In addition, traverse F was surveyed with magnetometer but not with gravity meter.

Three IP spreads with 400-ft dipoles were surveyed: one centred on the hole drilled by Eastern Prospectors Pty Ltd, one centred on M63, and one centred on T8W. The IP equipment was also used to make three resistivity depth probes with expanding Wenner electrode configuration, two mutually perpendicular, centred on the diamond-drill hole drilled by Eastern Prospectors Pty Ltd, and one east-west probe centred on M63.

Area 2

Initially, IP was done with 200-ft dipoles along traverses L51, L53, L55, and L57. This was followed by some intermediate traverses in areas of interest (L55-5N, L55-5S, L53-10N, L52, L52-5S, L51-5S) with 200-ft dipoles and one spread each on L55 and L53 with 400-ft dipoles in an attempt to penetrate the soil cover. A north-south traverse was pegged along the strike and surveyed with a Schlumberger array. This was followed up by one spread with 200-ft dipoles along L53-10S corresponding to anomalies in the Schlumberger results.

Gravity readings were taken at 100-ft intervals along traverses L51, L53, and L55 and magnetic readings at 100-ft intervals were made along traverse L53.

W. B. Dallwitz mapped the geology of the most interesting parts of Area 2 and collected rock samples along several traverses.

Area 3

The grid consisted of eleven traverses (see Plate 14) 400 ft apart using the same coordinate system as Gardener (1964). All traverses were surveyed twice with Turam from 400E to 1600E, once with the transmitter connected to loop 1 and then to loop 2.

Traverses 1000N, 1400N, and 1800N were resurveyed with the transmitter connected to loops 3, 4, 5, 6, and 7 in turn and with grounded cables at 200E and 1800E grounded at 1000S and 3000N. One additional cable, laid along 800E was grounded at 1000S/1250E and 3000N/1100E at the suspected position of the shear and traverses 1000N, 1400N, and 1800N were repeated.

Some IP work was done in Area 3 to give more information near DDH10 and DDH11. Two spreads (100-ft dipoles and 50-ft dipoles) were read on traverse 400N centred on 1000E and one spread with 100-ft dipoles was centred on 200N/1000E.

5. RESULTS AND INTERPRETATION

Area 1

Preliminary IP tests with 400-ft dipoles were disappointing. Three spreads were surveyed and the results are shown on Plate 4. The resistivities encountered were generally less than 10 ohm-metres and it seems extremely likely that the bedrock had influenced the measurements at all. The resistivity of the bedrock was expected to be much higher than 10 ohm-metres (later confirmed by resistivity depth probes). With 400-ft dipoles, the current was evidently not penetrating beyond the relatively conductive overburden.

The observed frequency effects were quite high but typical of electromagnetic coupling. The percent frequency effect expected due to coupling was calculated in each case using the tables computed by Millett (1967) and the results are included on Plate 4. These calculations assume a uniform earth, which is certainly not the case at Kamileroi. The higher resistivity of the bedrock would have the effect of decreasing observed frequency effects and, in many cases, the observed frequency effects were a few percent less than calculated coupling effects. Generally, the agreement between calculated coupling and observed frequency effect is good but discrepancies which do occur are at least as big as the type of anomalies which could be expected. Because of the apparently random nature of the discrepancies and the many approximations inherent in the computation of coupling effects there appeared to be no justification for subtracting calculated coupling from observed frequency effect and analysing the residual.

Some tests were made using 1.0 and 0.05 c/s as the operating frequencies in an attempt to reduce the effect of coupling. The weak signal was difficult to separate from noise at 0.05 c/s and frequency effects could not be read with any confidence. Readings were obtained at n = 2, 3, and 4, but only with difficulty; they are shown on Plate 4. The calculated coupling at 1 c/s was much less than at 3 c/s but it was still an important part of the observed frequency effect and was considered sufficient to mask any predictable anomalies.

Because the resistivity pattern (conducting overburden over a resistive bedrock) would reduce any genuine anomaly due to mineralisation in the bedrock, and coupling would mask the recognition of any but very pronounced anomalies, it was decided that little could be achieved by persevering with 400-ft dipoles. Larger dipoles or alternative electrode arrays would only increase coupling and make the situation worse. I.P. was discontinued for this survey but the possibility remains that measurements at lower frequencies or in the time domain, with more powerful equipment, could achieve useful results. Most of the measurements made in this survey were done with the Geoscience transmitter at maximum power (approximately 2.0 amps).

Three resistivity depth probes were made and the results and interpretation are shown in Plate 5. The results were interpreted using Mooney-Wetzel three-layer curves and Type and Help curves using the method outlined by Wiebenga (1955). Interpretation was very subjective and can only be used to indicate an order of magnitude for both resistivity and depth to an interface. The interpretation of the two probes over Eastern Prospectors' drill hole is in reasonable accordance with what could be expected from the geological log. Results using the single probe centred on M63 were less conclusive.

Although the resistivity results are difficult to interpret fully, one can reasonably conclude that several hundred feet of material with a resistivity of less than 10 ohm-metres covers bedrock with a resistivity of at least 500 ohm-metres where any orebodies would occur. With this resistivity distribution, the possibility of detecting mineralisation in the bedrock, with the Geoscience IP equipment, is remote.

The gravity and magnetic work in the north-east corner of Area 1 extended the work done by Eastern Prospectors Pty Ltd to cover the pronounced magnetic anomaly there. Magnetic and gravity contours are illustrated in Plates 6 and 7. Removal of a regional gravity gradient (obtained by manually smoothing contours) in the north-east corner revealed a residual gravity 'high' corresponding to the magnetic anomaly (see Plate 8). Magnetic and residual anomalies coincide and show corresponding double peaks.

An interpretation of the gravity and magnetic results is indicated in Plate 8. The residual gravity results were interpreted using a relation derived by Bott and Smith (1958). This gave a maximum depth to the top of the bodies (presumably the top of the crystalline bedrock) of 1725 ft (Anomaly 1) and 1200 ft (Anomaly 2) respectively.

The magnetic results were difficult to interpret fully as the peak of the anomaly lay between traverses M and N. An interpretation using the 'half slope method' of Peters (1949) gave depths of 1440 ft (Anomaly 1) and 1000 ft (Anomaly 2) respectively. Although this method is designed for use on anomalies with long strike it has been used in this case to give an estimate and the results obtained should be at least approximately correct.

The results indicate the presence of two magnetic concentrations, of higher density than the surrounding material, at a depth of between 1000 and 1500 ft. These magnetic centres lie on the flank of a large mass of gabbro (identified in the drill hole of Eastern Prospectors Pty Ltd) and may be the results of magmatic differentiation. One vertical drill hole is recommended in the centre of Anomaly 2 (see Plate 8). It should be drilled to at least 1500 ft and should intersect the crystalline basement at approximately 1000 ft. In the absence of successful IP results this appears to be the most favourable place to look for mineralisation.

The electric and radiometric logs of Eastern Prospectors' drill hole together with lithological and specific gravity data are shown in Plate 9. Results above 400 ft are not presented as they show no interesting features.

The electric logs indicate low resistance troughs at 500 ft, 558 ft, 660 to 680 ft, and 750 ft in good agreement with self-potential peaks, which suggests possible occurrence of mineralisation.

The radiometric log indicates strong radioactivity at 666 and 675 ft.

<u>Area 2</u>

The two main methods used in Area 2 were gravity and IP. Gravity supplemented earlier, less detailed work and helped outline areas of further interest; IP was intended to detect mineralisation directly.

Gravity results on traverses L51, L53, and L55 were contoured (see Plate 10) and revealed several areas of high gravity values, which presumably indicate host rocks for mineralisation. The gravity 'highs' tend to strike north-south and in some cases could be identified as continuations of features identified further south. In particular, the gravity anomaly centred near station 10000 E on traverse L51 is a continuation of a gravity 'high' extending from Dobbyn and containing several mines and areas of known mineralisation (e.g. Kohinoor Mine, Kohinoor North Mine, Copperless Mine, etc.). Several mines and a diamond-drill hole put down by Australian Selection (Pty) Ltd were located on the flank of this anomaly near 8500E on traverse L51 and BMR IP results on traverse L51 and L51-5S located anomalies consistent with mineralisation in the area.

Another gravity 'high' was detected near 4000E on L51 but was insignificant on traverses L53 and L55. This gravity 'high' again coincided with indications of mining activity (e.g. near 3500E on traverse L52) and was regarded as a promising area for further investigation with IP.

The eastern ends of all three traverses (L51, L53, and L55) are under a soil cover and are generally accompanied by lower gravity values. One gravity 'high' was detected near 19000E on traverse L53 coinciding with a small outcrop of basic rock. Although this was a suitable host rock, no evidence of mineralisation was detected over it and possibly its distance from the granite (presumed to be the source of mineralisation) was too great.

The IP work commenced on traverses L51, L53, and L55 with 200-ft dipoles. The eastern ends of the traverses gave low apparent resistivities (approximately 10 ohm-metres) and it appeared that the soil cover was not penetrated. The western ends of the traverses gave more favourable results and small anomalies were detected near 8800E on L51 and 2500E on L55. These anomalies were followed up by extra traverses at L55-5N, L55-5S, and L51-5S.

The anomaly on L51 was close to several old shafts and a diamond-drill hole put down by Australian Selection (Pty) Ltd. Although Australian Selection (Pty) Ltd chose to abandon the area after drilling, the anomaly persists for at least 1500 ft along strike (from the drill hole to L51-5S) and another drill hole has been recommended on traverse L51 (see Plate 11).

The anomaly on traverse L55 was close to some shallow exploratory trenches and one shallow shaft. Copper mineralisation was visible on the surface and could be expected to persist in depth. Although the IP anomaly decreased considerably on both L55-5N and L55-5S, it was still detectable and one drill hole is recommended on traverse L55 (see Plate 12).

A north-south line extending from 1863E on L55 to 3666E on L51 was surveyed with a Schlumberger configuration. This line coincides with a region of high gravity values (i.e. suitable host rocks for mineralisation) and the Schlumberger array along strike should be very sensitive to mineralisation. Another traverse, across strike, with a dipole-dipole array would be needed to locate the source of the anomaly with sufficient accuracy to site a drill hole.

The results of the north-south line indicated two areas of interest (i.e. high frequency effects and low resistivities), one near 4500N and one at 5500N (see Plate 13). The second area near 5500N is close to traverse L53, which did not show any significant anomalies and the first one at 4500N was further investigated by traverse L53-10S, which was put in after the north-south line but which failed to detect any anomalies.

Area 3

The Turam results over the grid in Area 3 (Plate 14) traced the anomaly mapped by Gardener (1964). Profiles on all traverses, at both frequencies (220 and 660 c/s) and with loops 1 and 2 are shown in Plates 15 and 16. These results illustrate the variation of response when the primary loop is exchanged from up dip to down dip and also made possible a further check on the locality and depth of the anomaly investigated by DDH 10 and DDH 11.

Real and imaginary components of the resultant field were computed on traverses 200N and 600N and used to determine location and depth of the secondary current concentration. If the conductor was assumed to be 'thin' in the sense defined by Bosschart (1964) it was also possible to compute an approximate ratio of resistivity to thickness (ρ/d). The results are summarised below:

Traverse	Location of current concentration	Depth to current concentration	$\frac{\rho}{d}$
600N	900E	200 ft	≈ 30
200N	1000E	112 ft	>90

The values given for position and depth are averaged from a number of profiles obtained using different frequencies and primary loops after discarding values derived from irregular curves. These values should therefore be reliable. The values computed for ρ/d were derived from the same data but are more sensitive to possible errors and can only be used to indicate an order of magnitude.

The Turam results on traverses 200N and 600N can be extrapolated to predict a target located 100 to 200 ft below approximately 950E on traverse 400N. IP results on traverse 400N with 100-ft and 50-ft dipoles (results not shown in this report) also indicate a maximum depth to the target of approximately 200 ft. This additional evidence suggests that drill holes DDH 10 and DDH 11 (Gardener, 1965 & 1968) may have passed beneath the main target. The small intersection with sulphides in DDH 10 suggests that significant mineralisation does not extend in depth although it may exist between 100 and 200 ft from the surface.

Additional Turam tests on traverses 1000N, 1400N, and 1800N showed the effect of various loop sizes on readings. The effect of loop width was negligible over the range investigated (1000 to 2000 ft) and variations in response with loop length (1000 to 4000 ft) were small but recognisable. Plates 17 and 18 show the results of these tests.

The same three traverses were also surveyed with grounded cables and results are shown in Plate 19. The responses were more pronounced and in many cases were off scale. In particular, the results obtained with a cable at 1800E, grounded near the suspected shear, were off scale over large sections of the profiles and were so distorted that interpretation was impossible. This result was not unexpected as current through the shear zone was introduced both conductively and inductively and normal interpretation theory is based on induction alone.

6. CONCLUSIONS AND RECOMMENDATIONS

Area 1

Tests with the Geoscience induced polarisation unit led to the conclusion that it was not sufficiently powerful to detect mineralisation in the bedrock. The presence of low resistivity overburden of considerable thickness and extent caused electromagnetic coupling effects. The resistivity values measured suggest that the bedrock did not influence the measurements.

Gravity and magnetic results outlined an anomalous area, possibly caused by mineralisation separated from the main body by magnetic differentiation. The results indicate the presence of two magnetic concentrations of higher density than the surrounding material at a depth of between 1000 and 1500 ft. The magnetic centres appear to lie on the flank of the large gabbro mass identified by Eastern Prospectors' drilling in 1966.

In the absence of successful IP results the most favourable place to look for mineralisation appears to be the area in which the double peaked magnetic and residual gravity anomalies were found. However, the chances of finding economic mineralisation rate low because of the considerable depth of sediments overlying the crystalline bedrock.

One vertical hole, DDH 1, is recommended to be drilled into the approximate centre of Anomaly 2, half way between M62 and N62. It should be drilled to at least 1500 ft and is expected to intersect the crystalline basement at approximately 1000 ft.

Area 2

Detailed gravity work in Area 2 confirmed earlier conclusions (Smith, 1966) that mineralisation was associated with gravity 'highs'.

Several IP anomalies were detected and two drill holes are recommended to test them:

(1) DDH 2 at L51/9230E, depression 60°, drilling west along the traverse, length 700 ft.

(2) DDH 3 at L55/2670E, depression 60°, drilling west along the traverse, length 700 ft.

Area 3

The additional Turam results on traverses 200N and 600N and IP on traverse 400N suggest that DDH 10 and DDH 11 (Gardener, 1965 & 1968) may have passed beneath the main concentration of mineralisation. In any case, if the mineralisation does not persist in depth it is unlikely to be economic and further drilling is not recommended.

A comparison of Turam results using large loops and grounded cables showed that results from large loops were more suitable for detailed interpretation but less sensitive to the many e.m. anomalies in the area. Variations in size of the loop, over the range tested, did not affect the results critically but could affect the ease of reading the instrument and the convenience of field operation. Loops 1 and 2, each 4000 ft by 2000 ft, were more convenient than shorter loops as more traverses could be surveyed without relaying the primary loop. Narrower loops (e.g. loop 3) reduced the strength of signal and made instrument reading more difficult.

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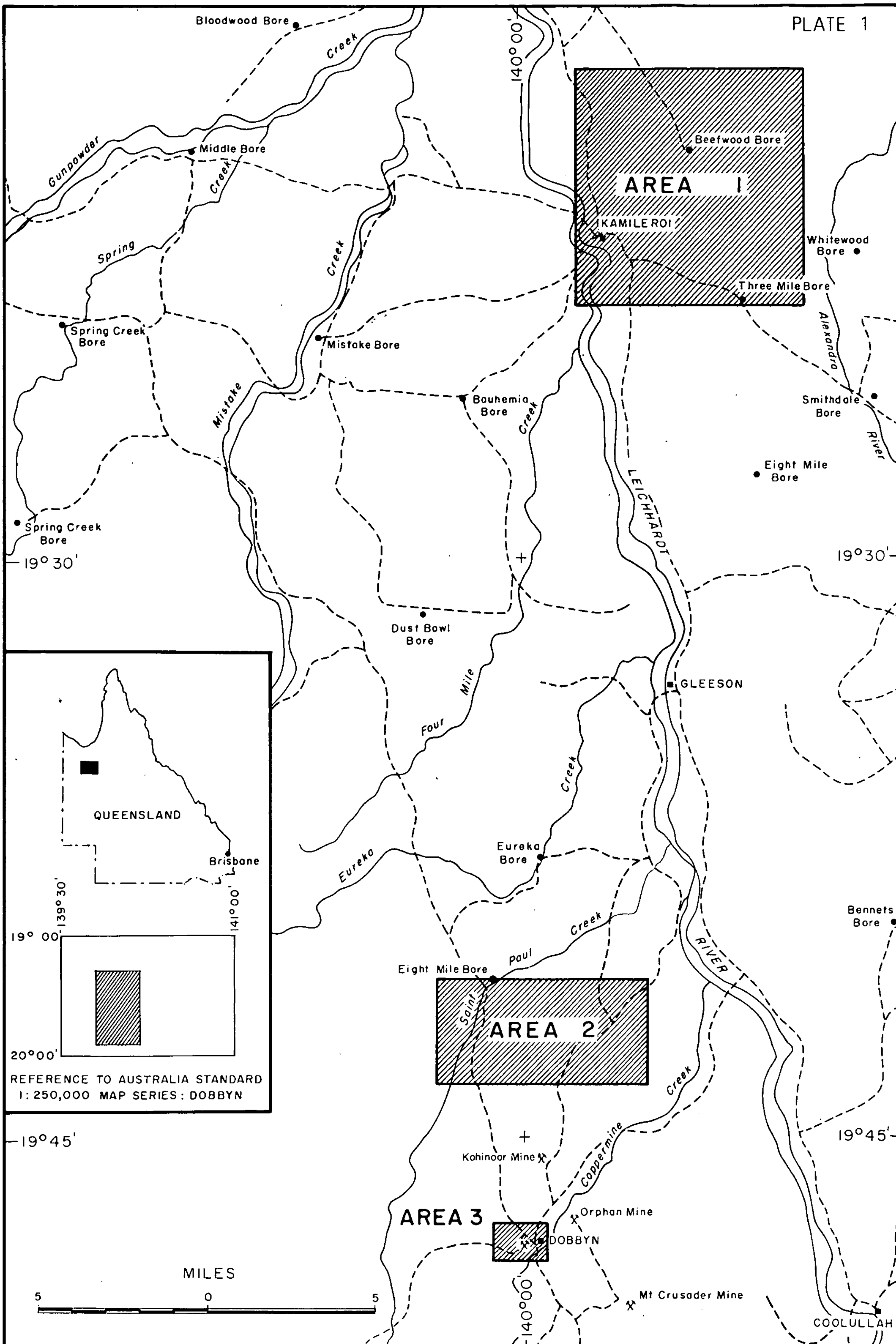
APPENDIX

List of permanent marks

Permanent marks consisting of star pickets or iron rods set in cement collars were erected at several positions in Areas 1, 2, and 3. The pickets or rods were driven approximately three feet into the ground so that about one foot remained above the surface. Cement collars were added and wooden posts three to four feet high were erected nearby and painted white to serve as 'finders'. On gravity traverses the level of the top of the picket or rod was also recorded. The following permanent marks were put in during the 1967 survey.

Area	Location	Reduced level (feet)
Area 1	258 feet east of N/51	260.01
Area 2	L51/00	477.3
	L51/4063E	492.5
	L51/8928E	458.8
	L51/14818E	456.1
	L51/23800E	431.4
	L53/00	430.9
	L53/5240E	500.1
	L53/8410E	470.8
	L53/16820E	429.5
	L53/24225E	401.8
	L55/00	418.0
	L55/4319.5E	446.5
	L55/7891E	443.0
	L55/12365E	416.5
	L55/21339E	408.8
	L57/00	-
Area 3	0/00	-

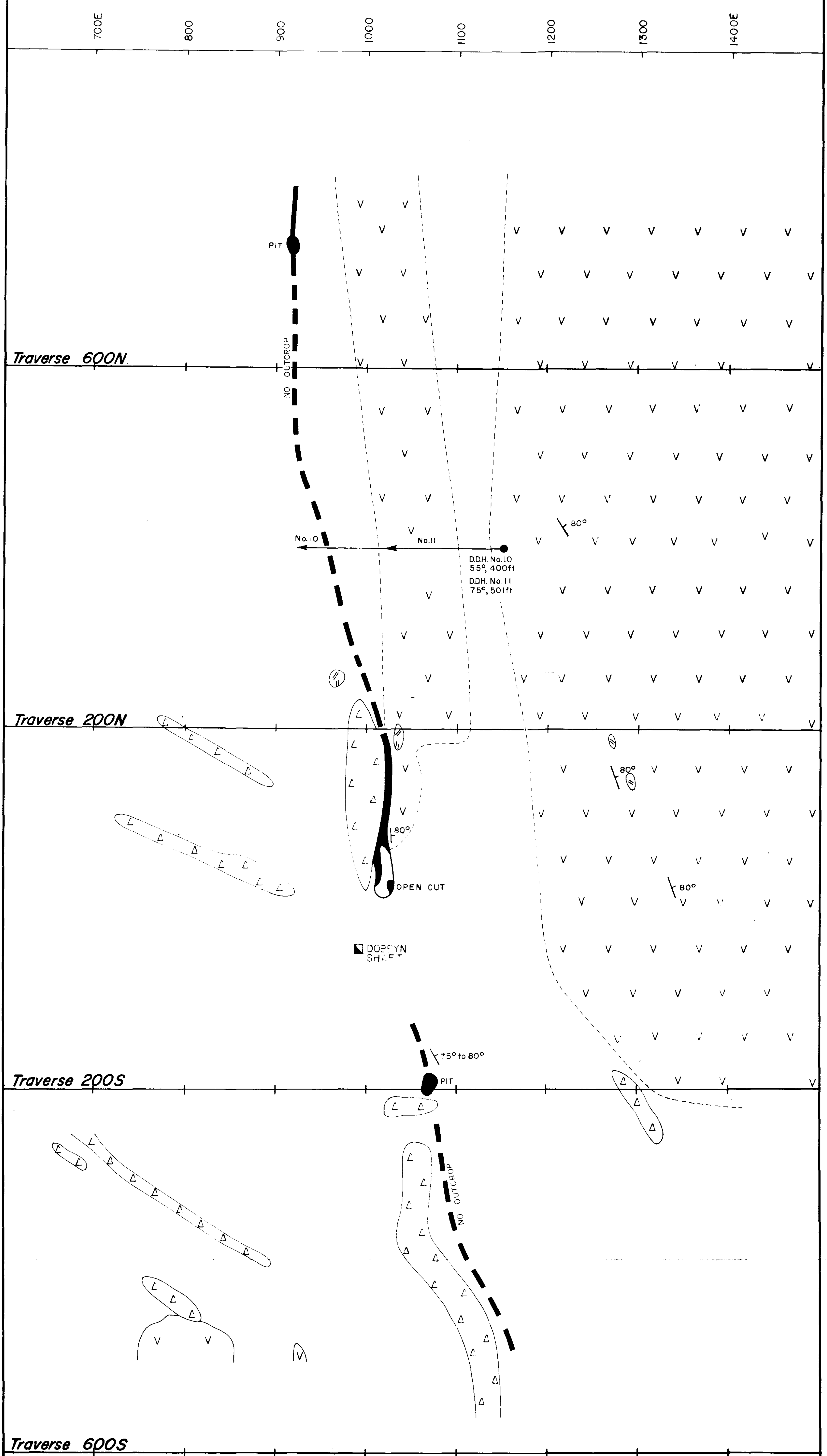


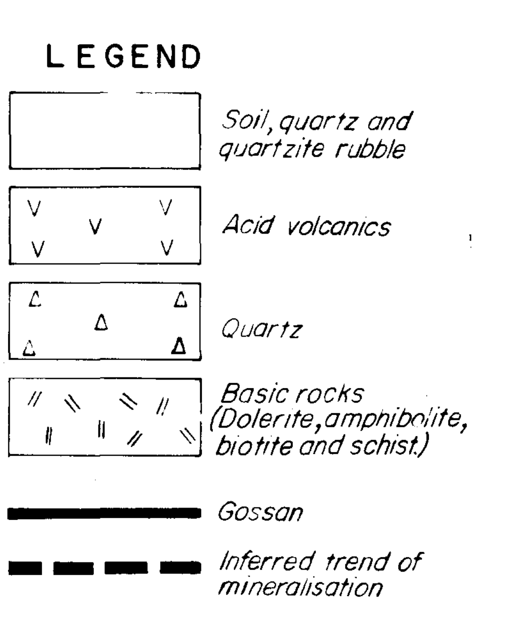
DOBBYN – KAMILEROI GEOPHYSICAL SURVEY 1967

LOCALITY MAP

TO ACCOMPANY RECORD No. 1968/78 E54/B7-67

PLATE 2



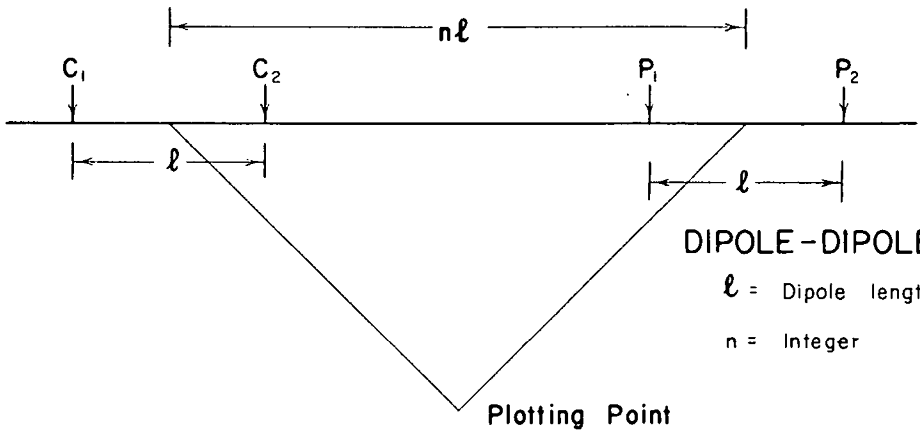


AREA 3, DOBBYN

GEOLOGY

Geology after W. B. Dallwitz

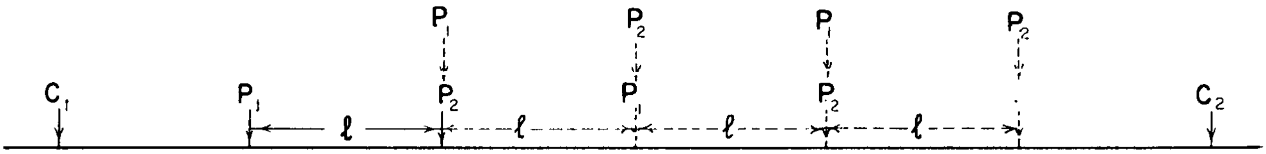
TO ACCOMPANY RECORD No. 1968/78 E54/B7-72



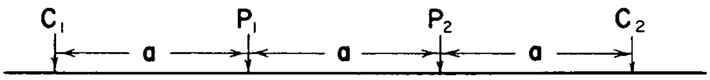
DIPOLE-DIPOLE ARRAY

ℓ = Dipole length

n = Integer



SCHLUMBERGER ARRAY



WENNER ARRAY

C_1, C_2 CURRENT ELECTRODES (STEEL SPIKES)

P_1, P_2 POTENTIAL ELECTRODES (POROUS POTS)

I P and RESISTIVITY ELECTRODE CONFIGURATIONS

OPERATING FREQUENCIES 3·0 and 0·3 c/s

3·6 MEASURED FREQUENCY EFFECT (%)

(4·3) CALCULATED ELECTROMAGNETIC COUPLING (%)

OPERATING FREQUENCIES 1·0 and 0·05 c/s

1·5 MEASURED FREQUENCY EFFECT (%)

(2·1) CALCULATED ELECTROMAGNETIC COUPLING (%)

AREA 1, KAMILEROI

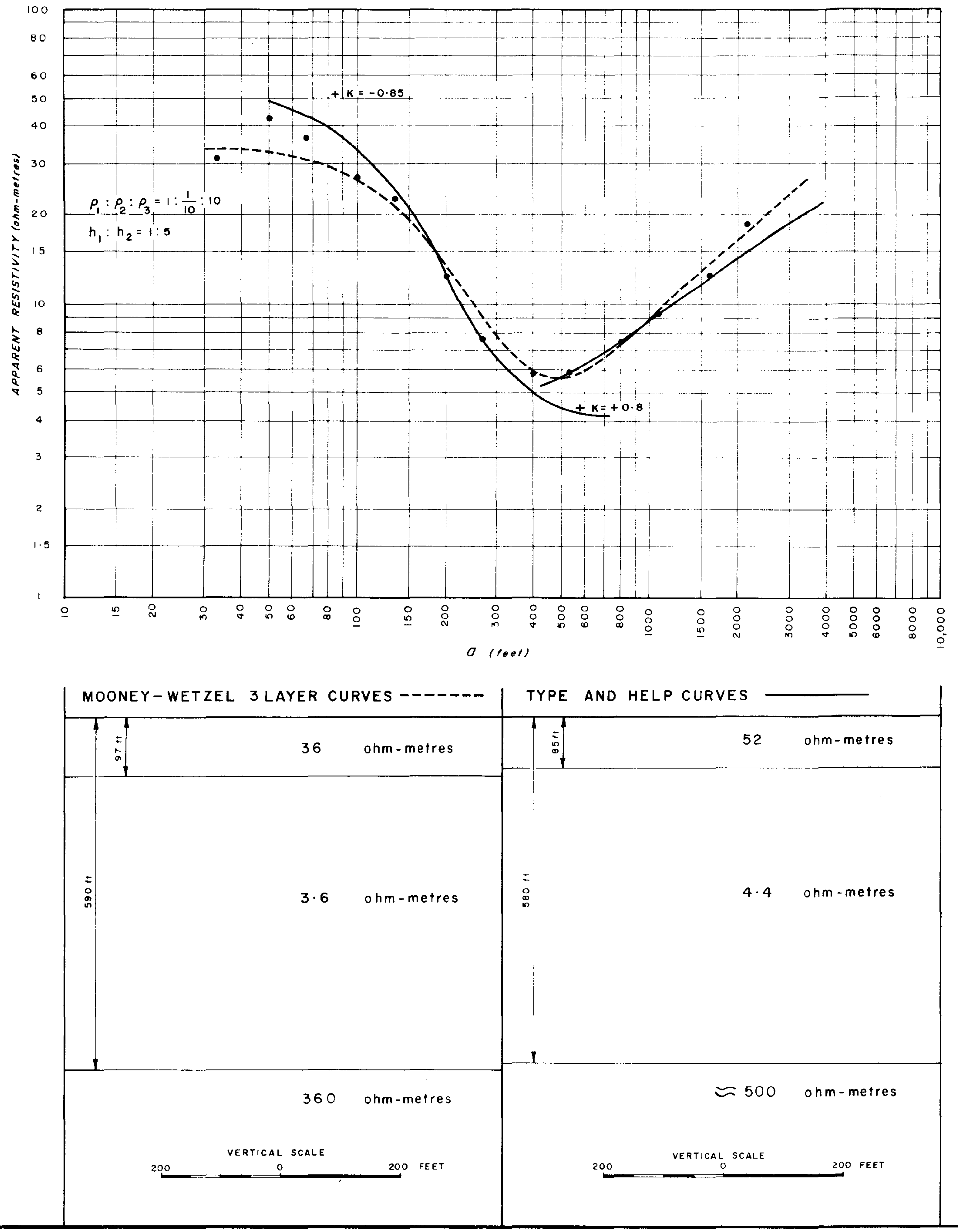
INDUCED POLARISATION RESULTS AND COMPUTED ELECTROMAGNETIC COUPLING TRAVERSES 8, M, T

FEET

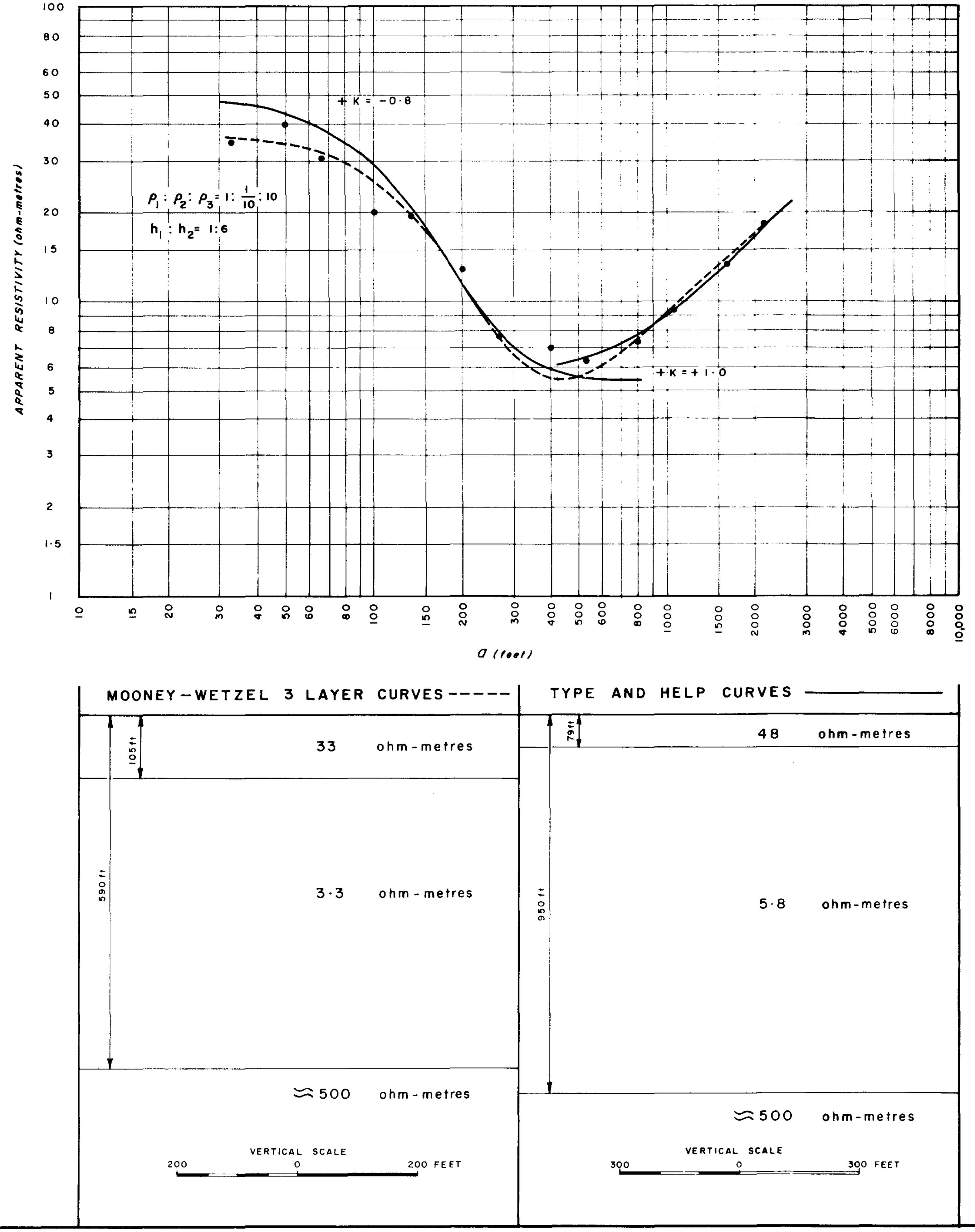
400 0 400 800 1200 1600

TO ACCOMPANY RECORD No. 1968/78 E 54/B7-63

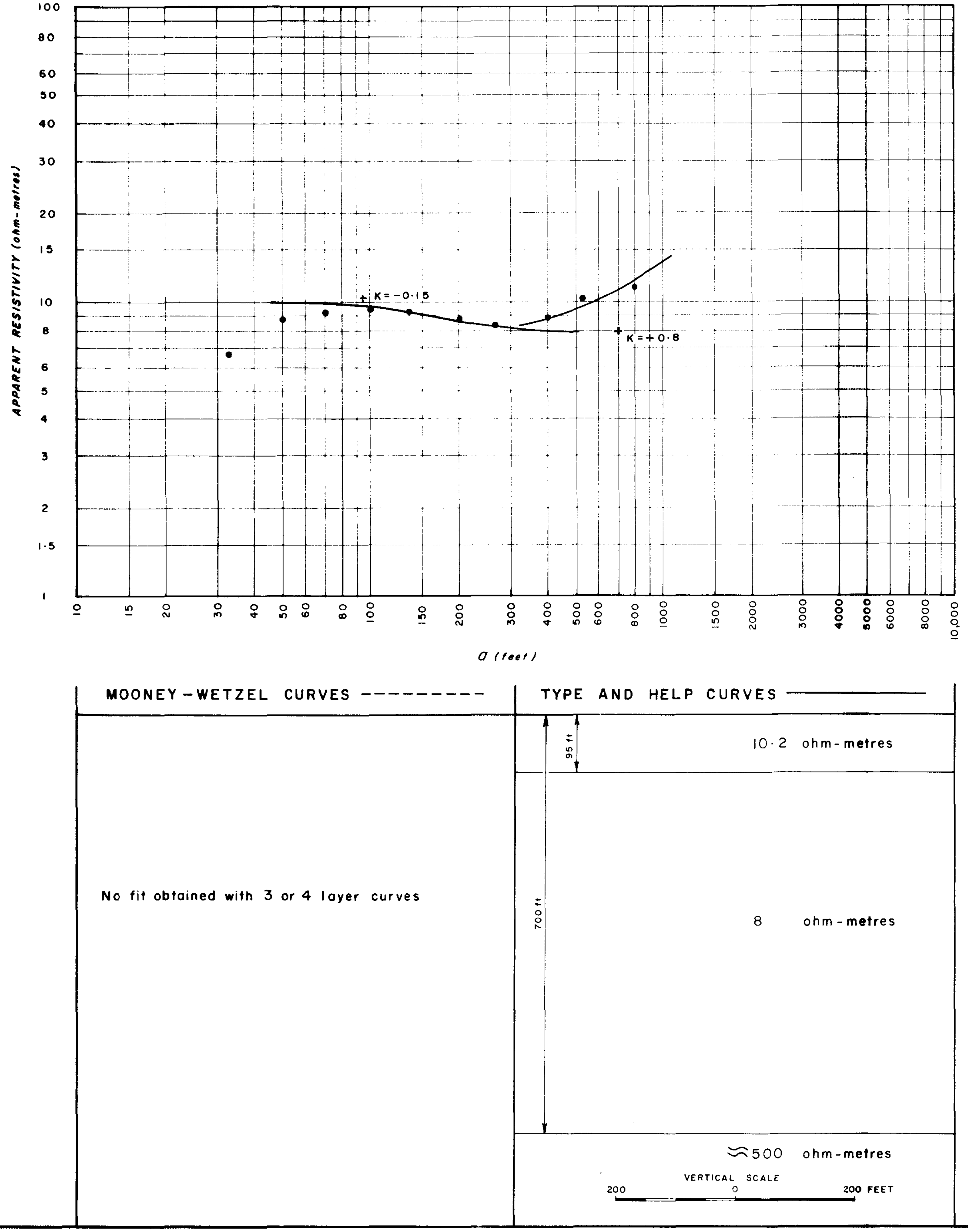
EASTERN PROSPECTORS DDH EAST-WEST



EASTERN PROSPECTORS DDH NORTH-SOUTH

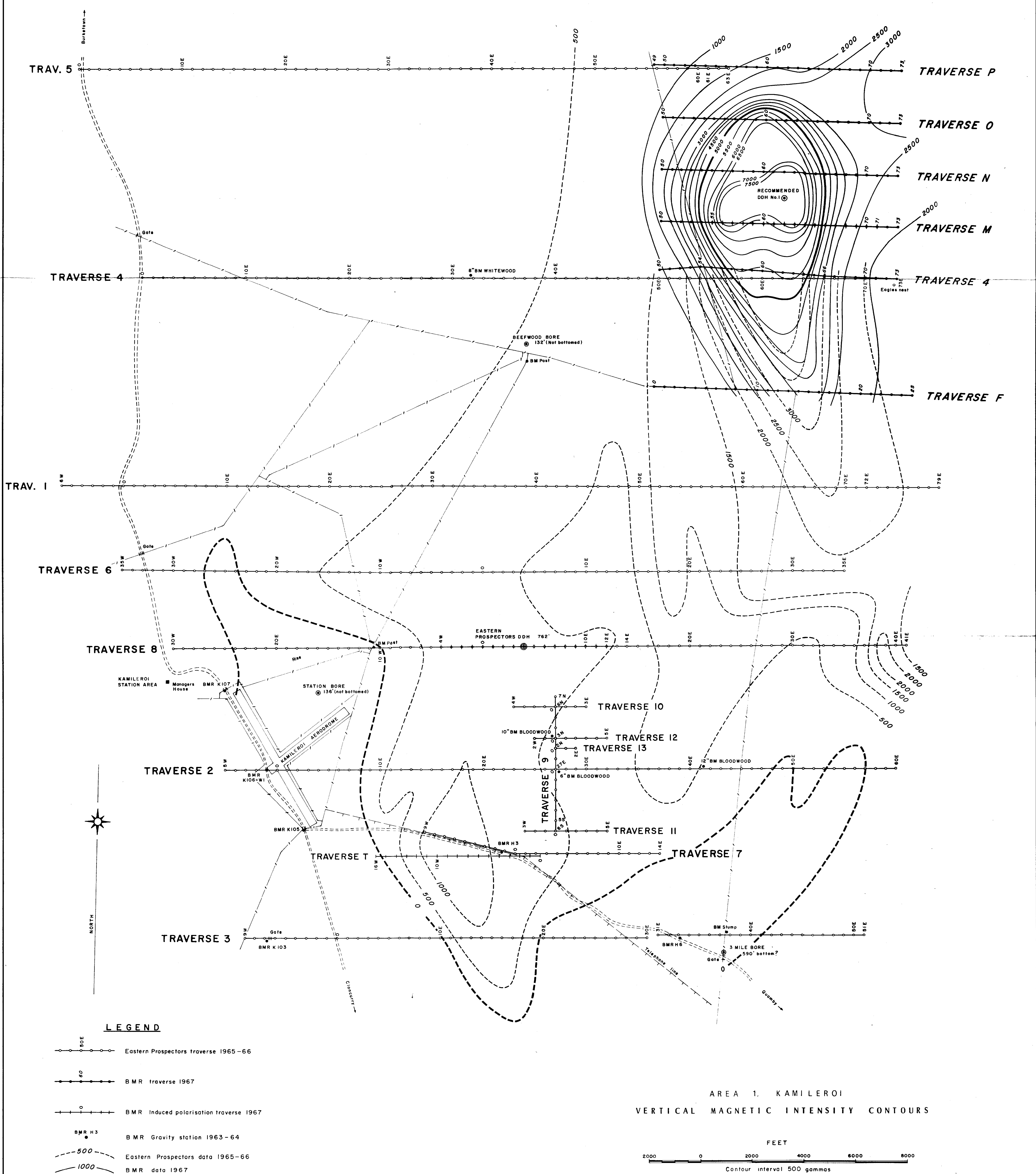


M 63 EAST-WEST TRAVERSE



AREA 1, KAMILEROI
RESISTIVITY DEPTH PROBE

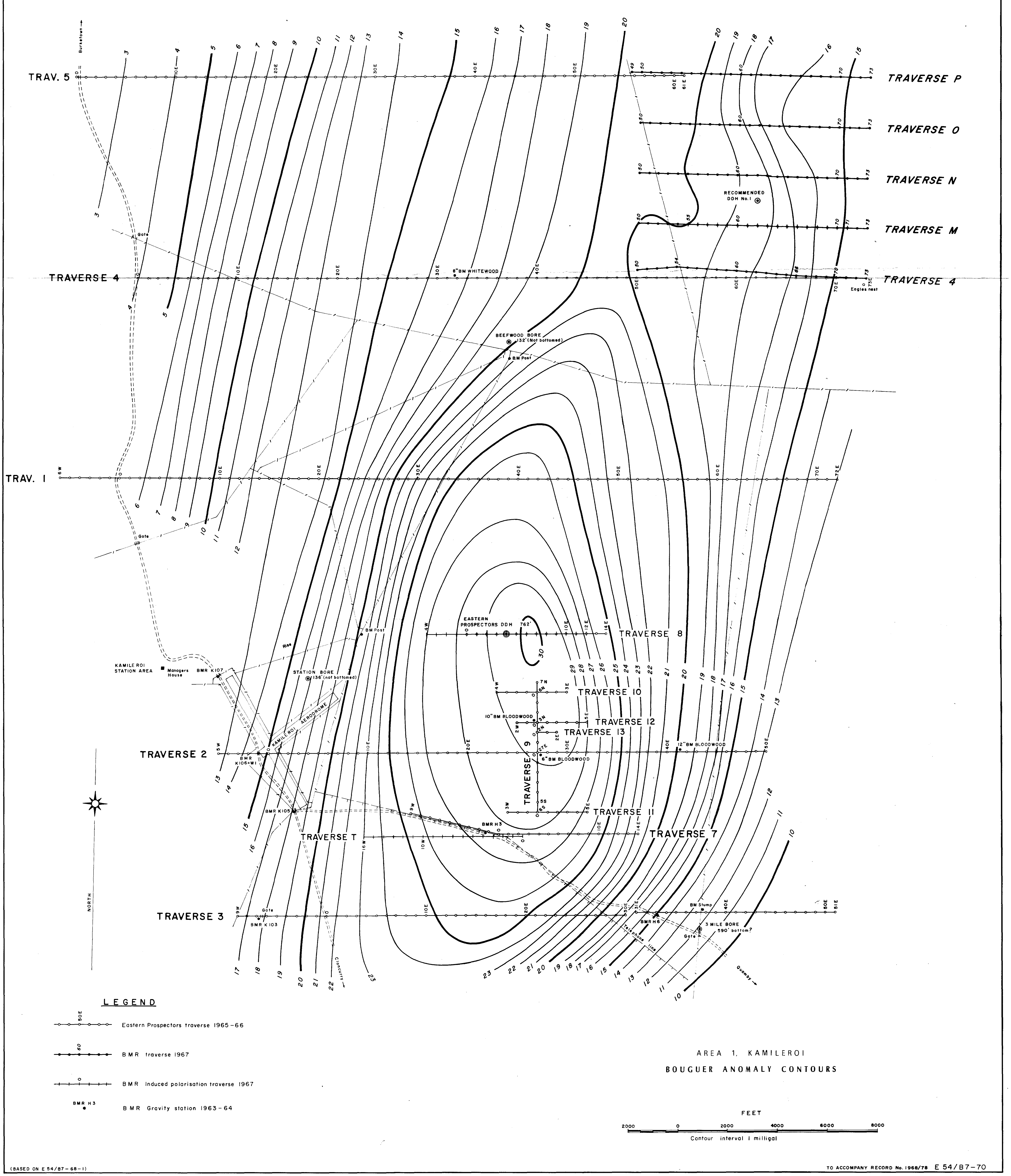
TO ACCOMPANY RECORD No. 1968/78 E54/B7-71



AREA 1. KAMILEROI
VERTICAL MAGNETIC INTENSITY CONTOURS

(BASED ON E54/B7-68)

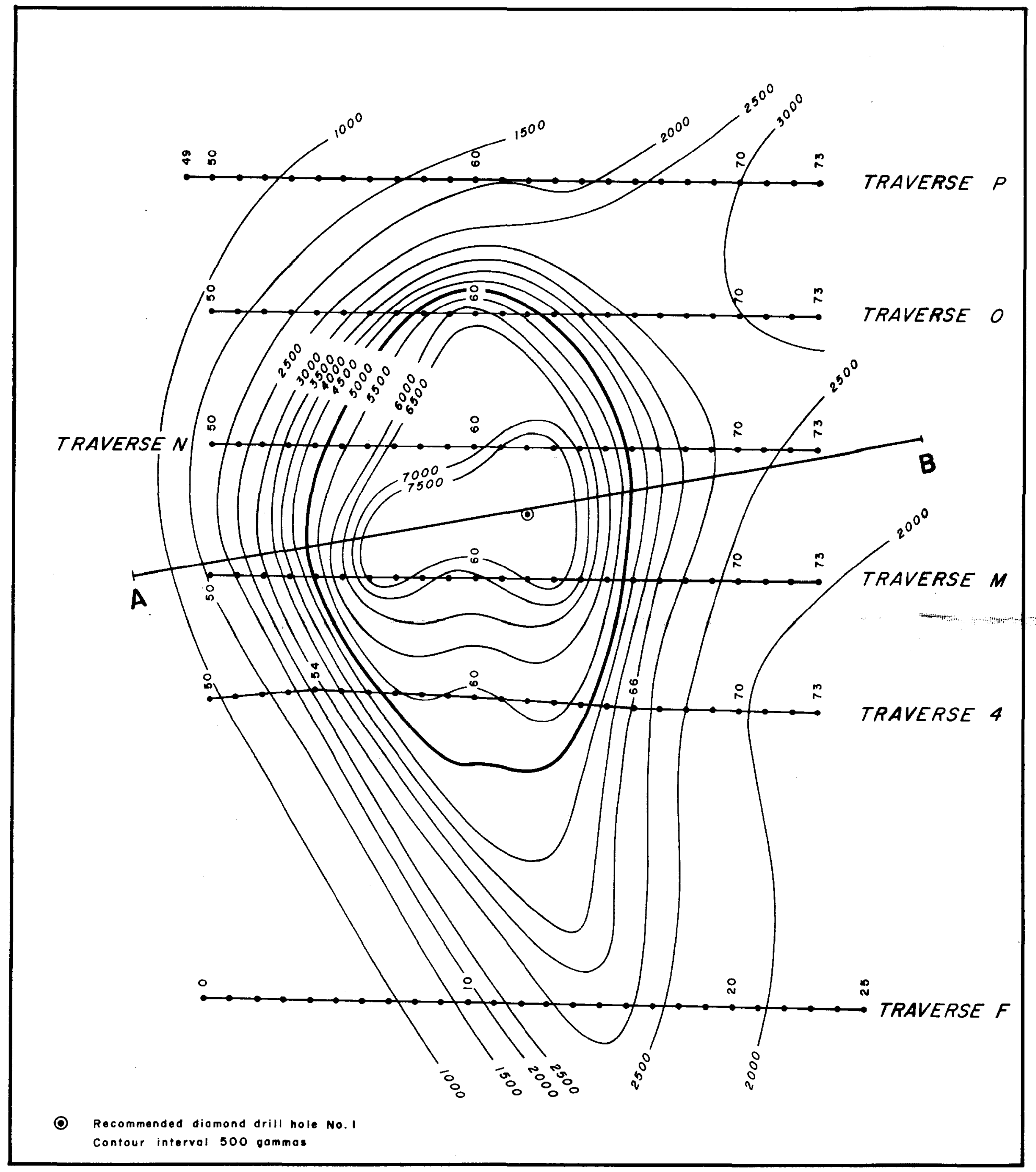
TO ACCOMPANY RECORD No. 1968/78 E 54/B7-69



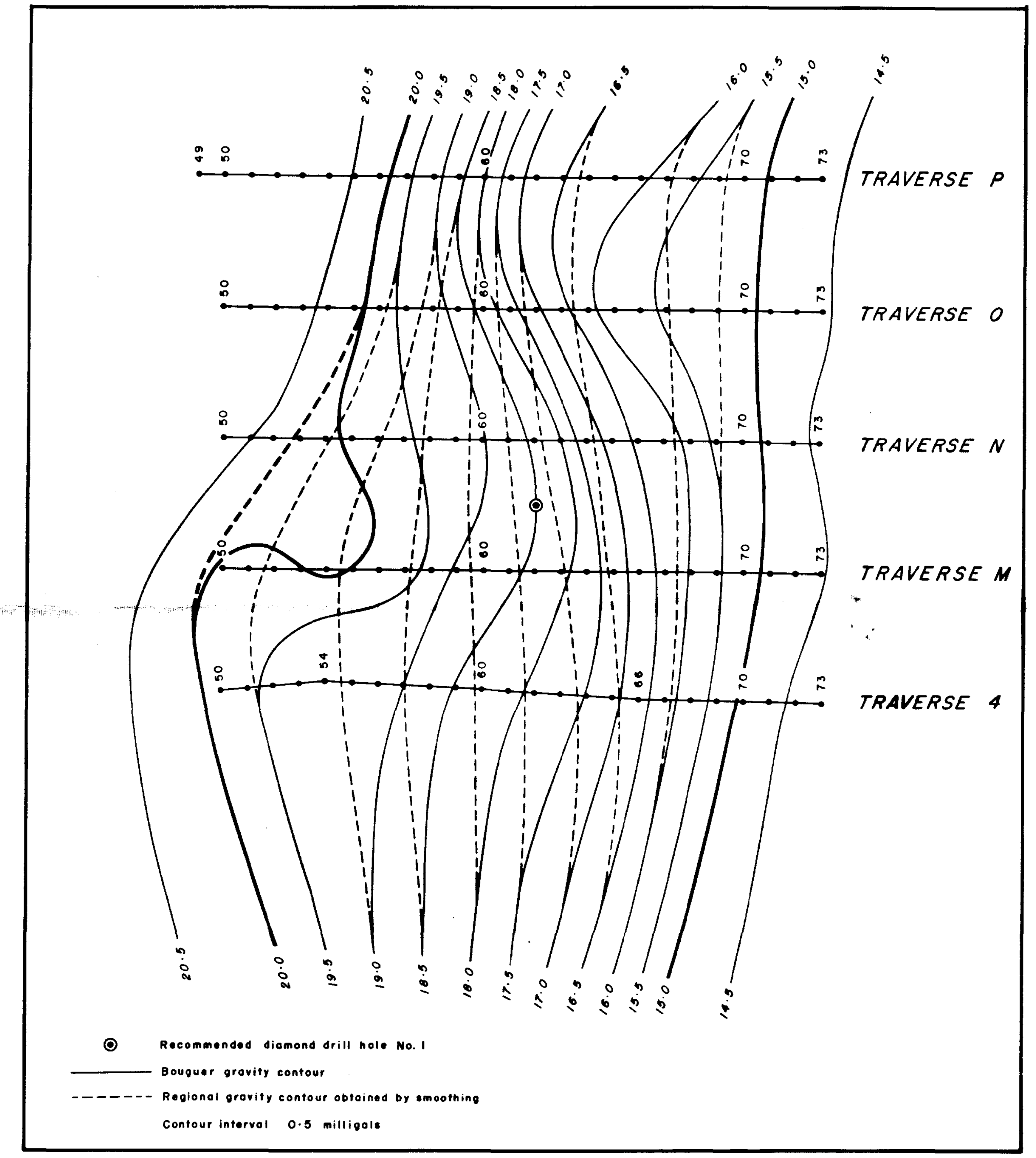
AREA 1, KAMILEROI

BOUGUER ANOMALY CONTOURS

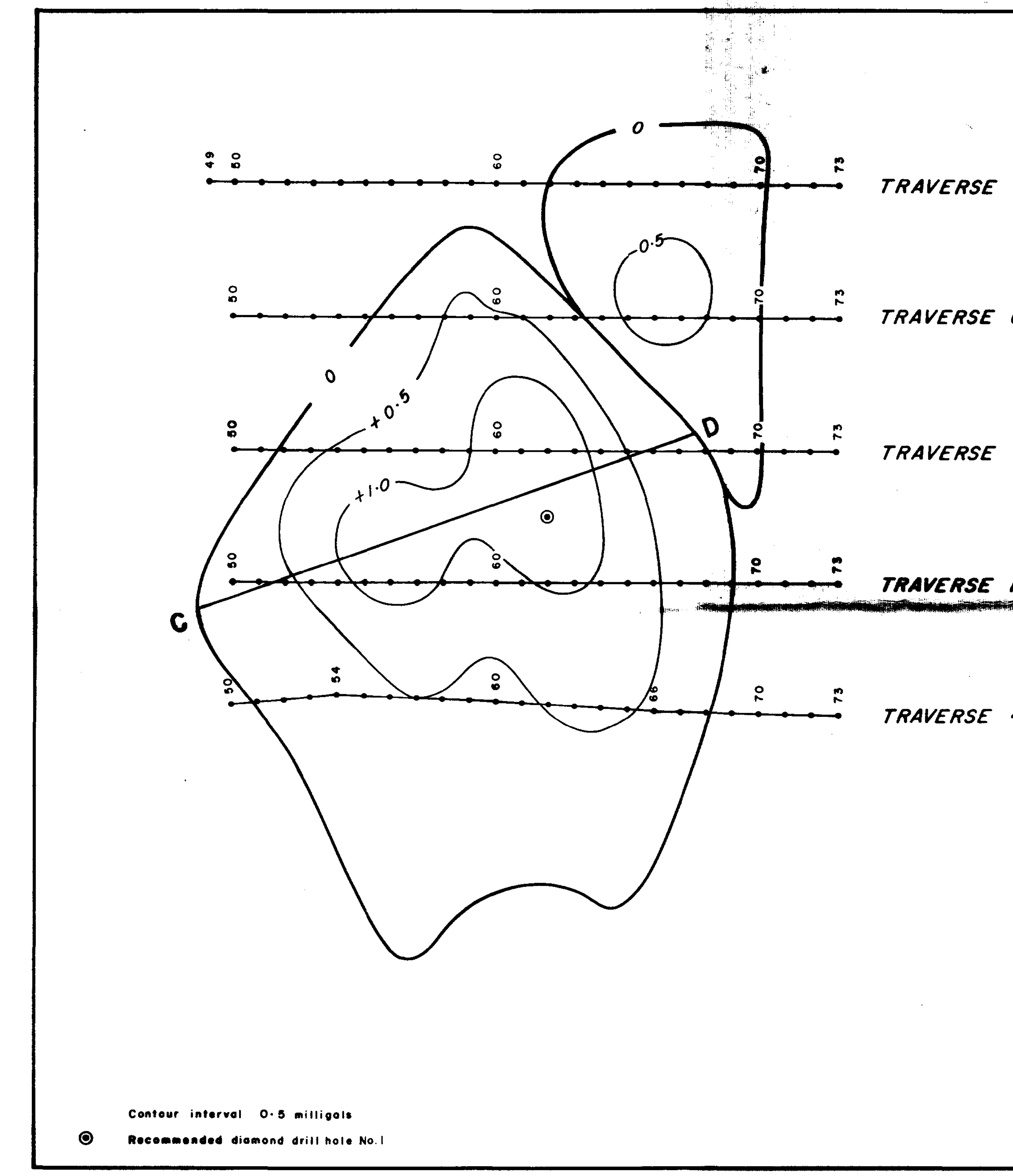
VERTICAL MAGNETIC INTENSITY CONTOURS



BOUGUER AND REGIONAL GRAVITY CONTOURS

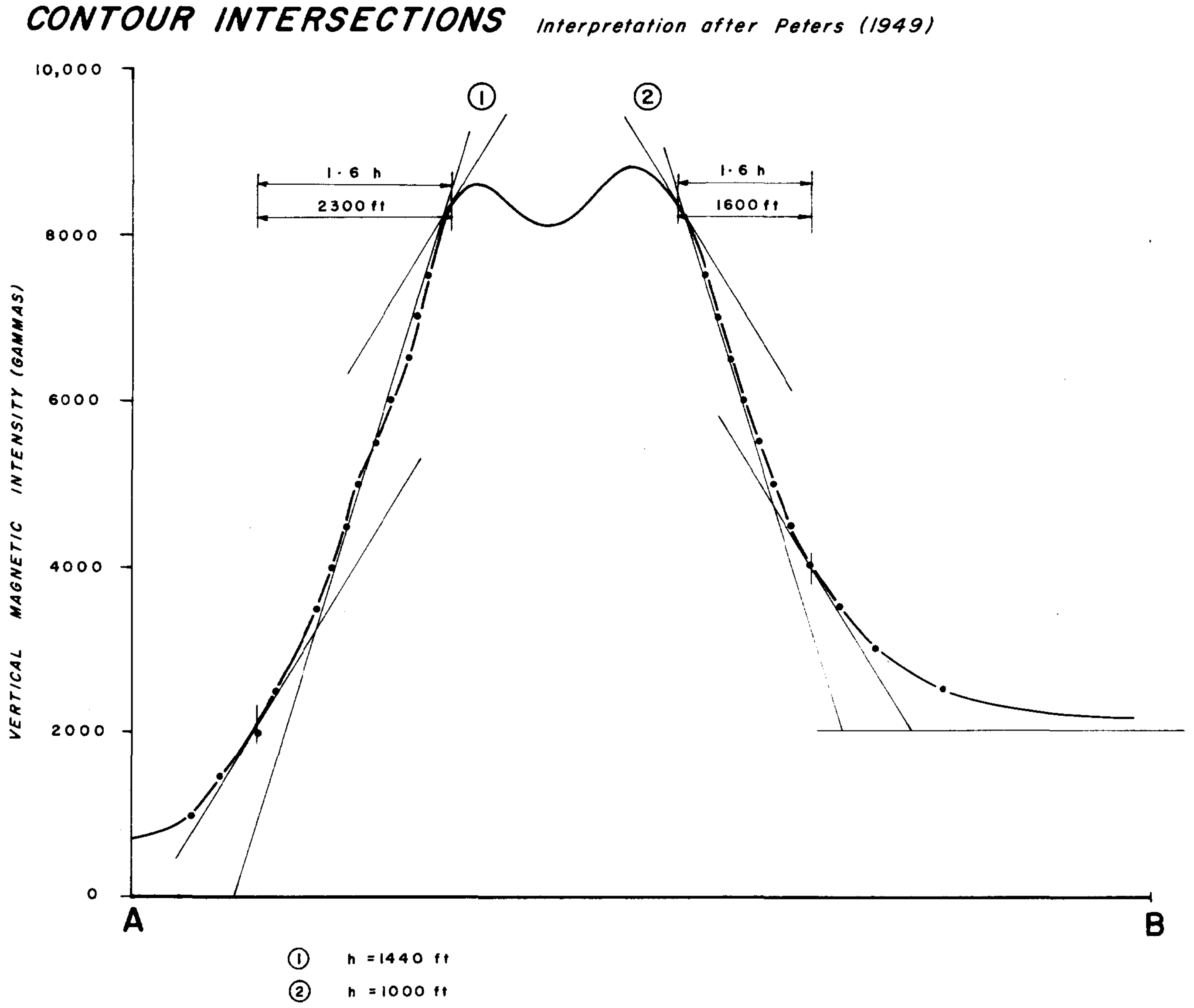


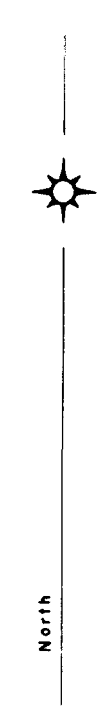
RESIDUAL GRAVITY CONTOURS



VERTICAL MAGNETIC INTENSITY PROFILE A–B CONSTRUCTED FROM CONTOUR INTERSECTIONS

Interpretation after Peters (1949)



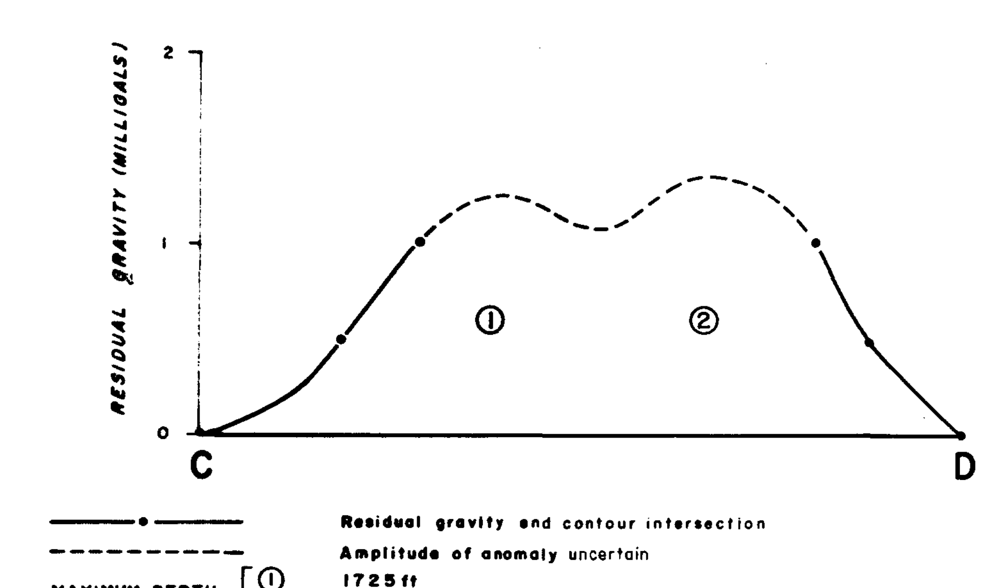


N–E CORNER AREA 1, KAMILEROI

MAGNETIC AND GRAVITY RESULTS AND INTERPRETATION

RESIDUAL GRAVITY PROFILE C–D CONSTRUCTED FROM CONTOUR INTERSECTIONS

Interpretation after Bott and Smith (1958)



ELECTRIC AND RADIOMETRIC LOG
EASTERN PROSPECTORS DDH. AREA 1

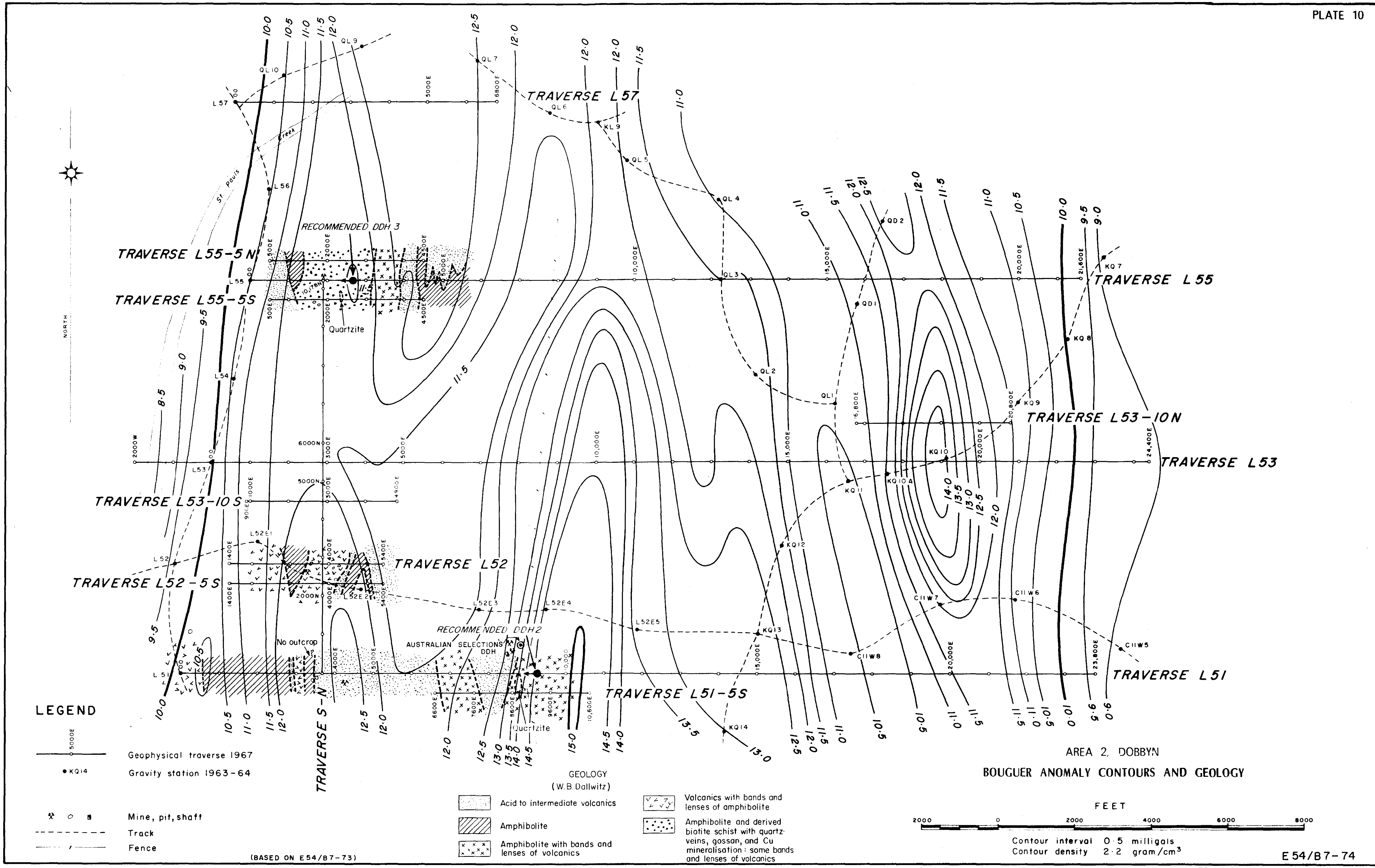


PLATE 10
TRAVERSE L57
TRAVERSE L55-5N
TRAVERSE L55
TRAVERSE L55-5S
RECOMMENDED DDH 3
Quartzite
TRAVERSE L53-10N
TRAVERSE L53
TRAVERSE L53-10S
TRAVERSE L52
TRAVERSE L52-5S
RECOMMENDED DDH 2
AUSTRALIAN SELECTIONS DDH
No outcrop
TRAVERSE L51
TRAVERSE L51-5S
TRAVERSE 5-N
St Pauls Creek
NORTH
LEGEND
Geophysical traverse 1967
Gravity station 1963-64
Mine, pit, shaft
Track
Fence
(BASED ON E54/B7-73)
GEOLOGY
(W.B. Dallwitz)
Acid to intermediate volcanics
Amphibolite
Amphibolite with bands and lenses of volcanics
Volcanics with bands and lenses of amphibolite
Amphibolite and derived biotite schist with quartz veins, gossan, and Cu mineralisation : some bands and lenses of volcanics
AREA 2, DOBBYN
BOUGUER ANOMALY CONTOURS AND GEOLOGY
FEET
2000 0 2000 4000 6000 8000
Contour interval 0·5 milligals
Contour density 2·2 gram/cm³
E54/B7-74
TO ACCOMPANY RECORD No. 1968/78

AREA 2, DOBBYN
INDUCED POLARISATION RESULTS AND
DRILLING RECOMMENDATION
TRAVERSES L51, L51-5S

FEET
200 0 200 400 600 800

TO ACCOMPANY RECORD No. 1968/78

E54/B7-65

PLATE 11

AREA 2, DOBBYN
INDUCED POLARISATION RESULTS AND
DRILLING RECOMMENDATION
TRAVERSES L55-5N, L55, L55-5S

FEET
200 0 200 400 600 800

PLATE 12

TO ACCOMPANY RECORD No. 1966/79

E54/B7-66

PLATE 13

AREA 2, DOBBYN

INDUCED POLARISATION RESULTS

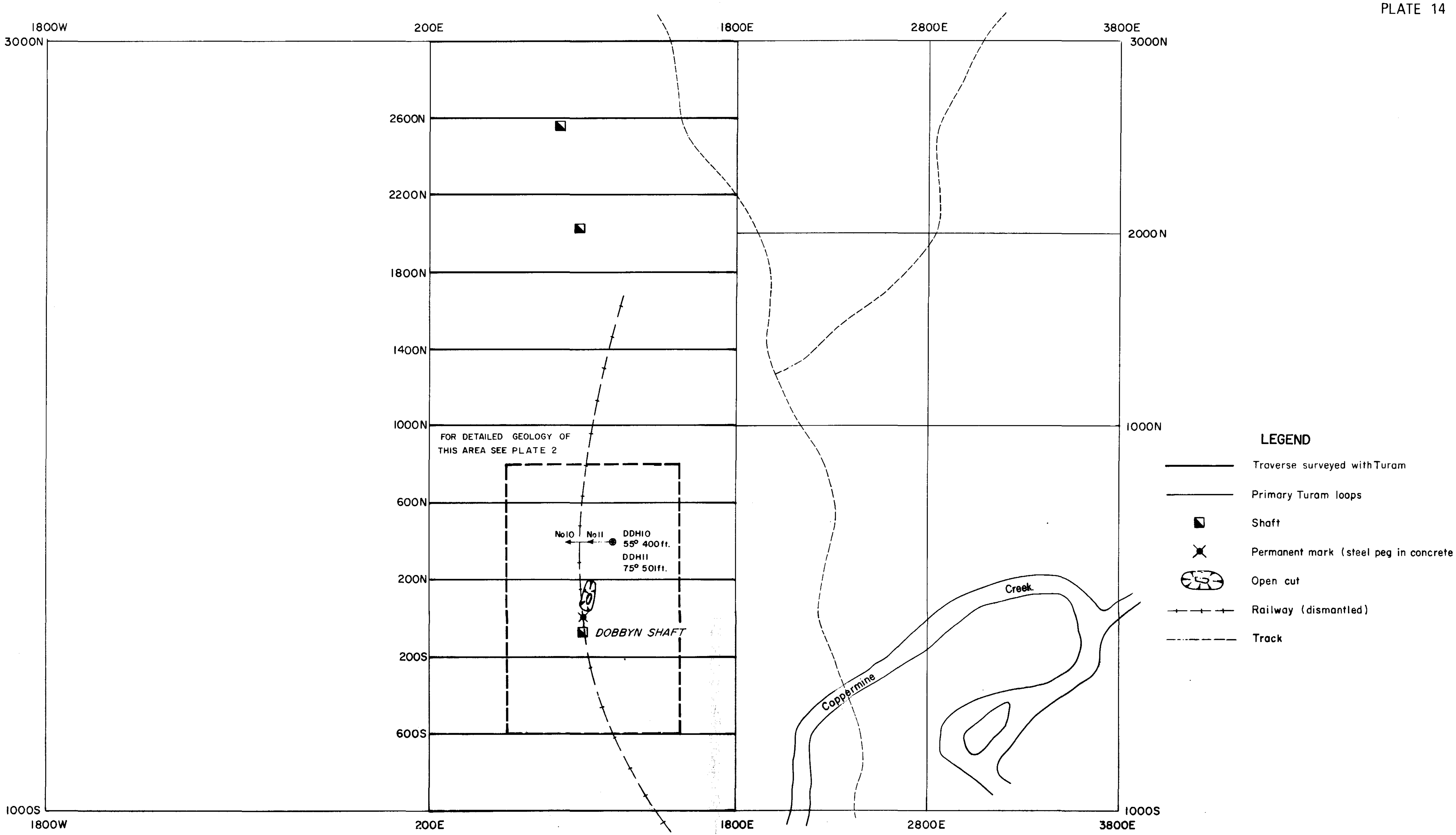
(SCHLUMBERGER CONFIGURATION)

FEET

200 0 200 400 600 800

TO ACCOMPANY RECORD No. 1968/78

E54/B7-64



LOOP No.	NORTH BOUNDARY	EAST BOUNDARY	SOUTH BOUNDARY	WEST BOUNDARY
1	3000N	200E	1000S	1800W
2	3000N	3800E	1000S	1800E
3	3000N	2800E	1000S	1800E
4	3000N	3800E	1000N	1800E
5	3000N	2800E	1000N	1800E
6	2000N	2800E	1000N	1800E
7	2000N	3800E	1000N	1800E

SCALE

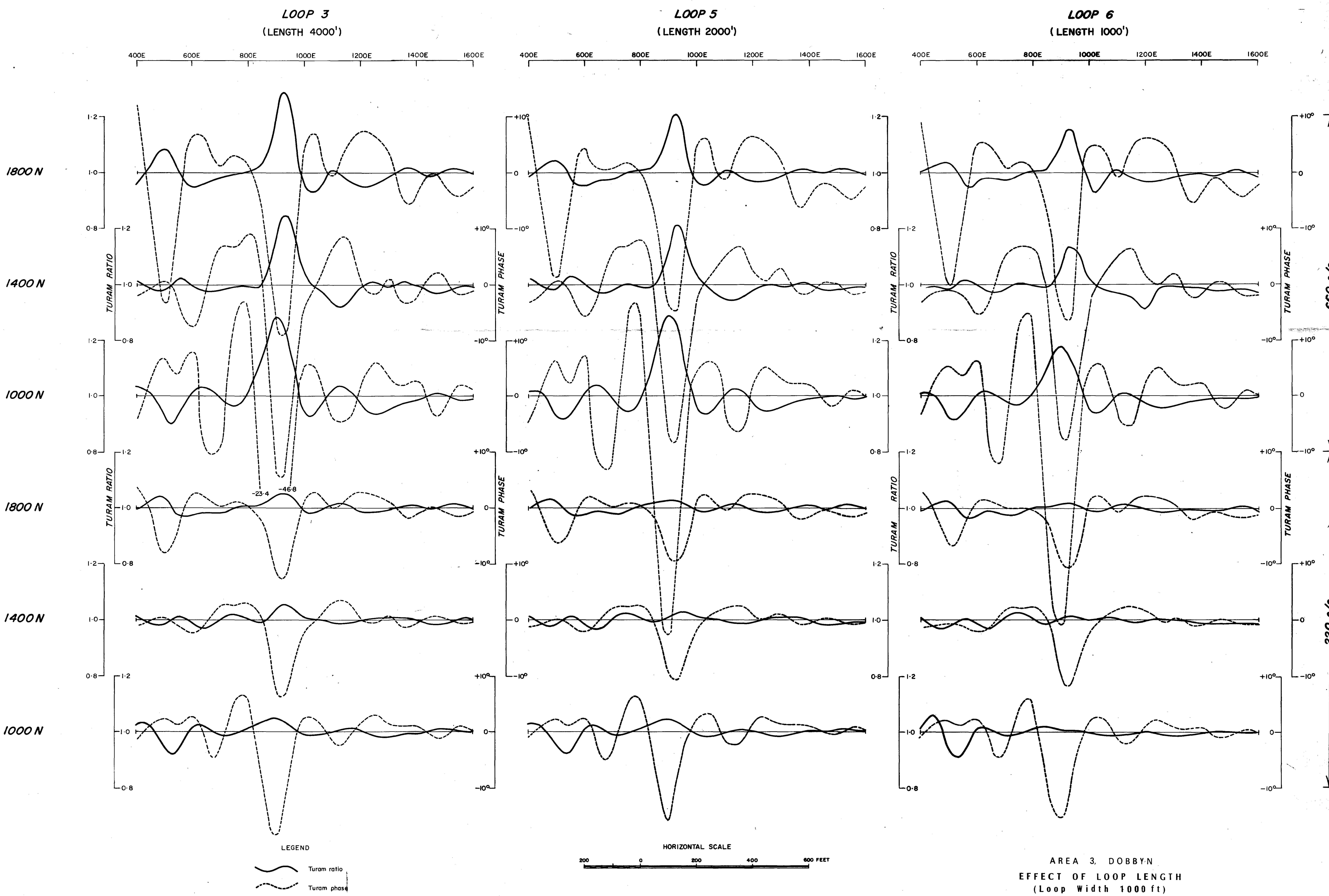
500 0 500 1000 1500 FEET

AREA 3, DOBBYN

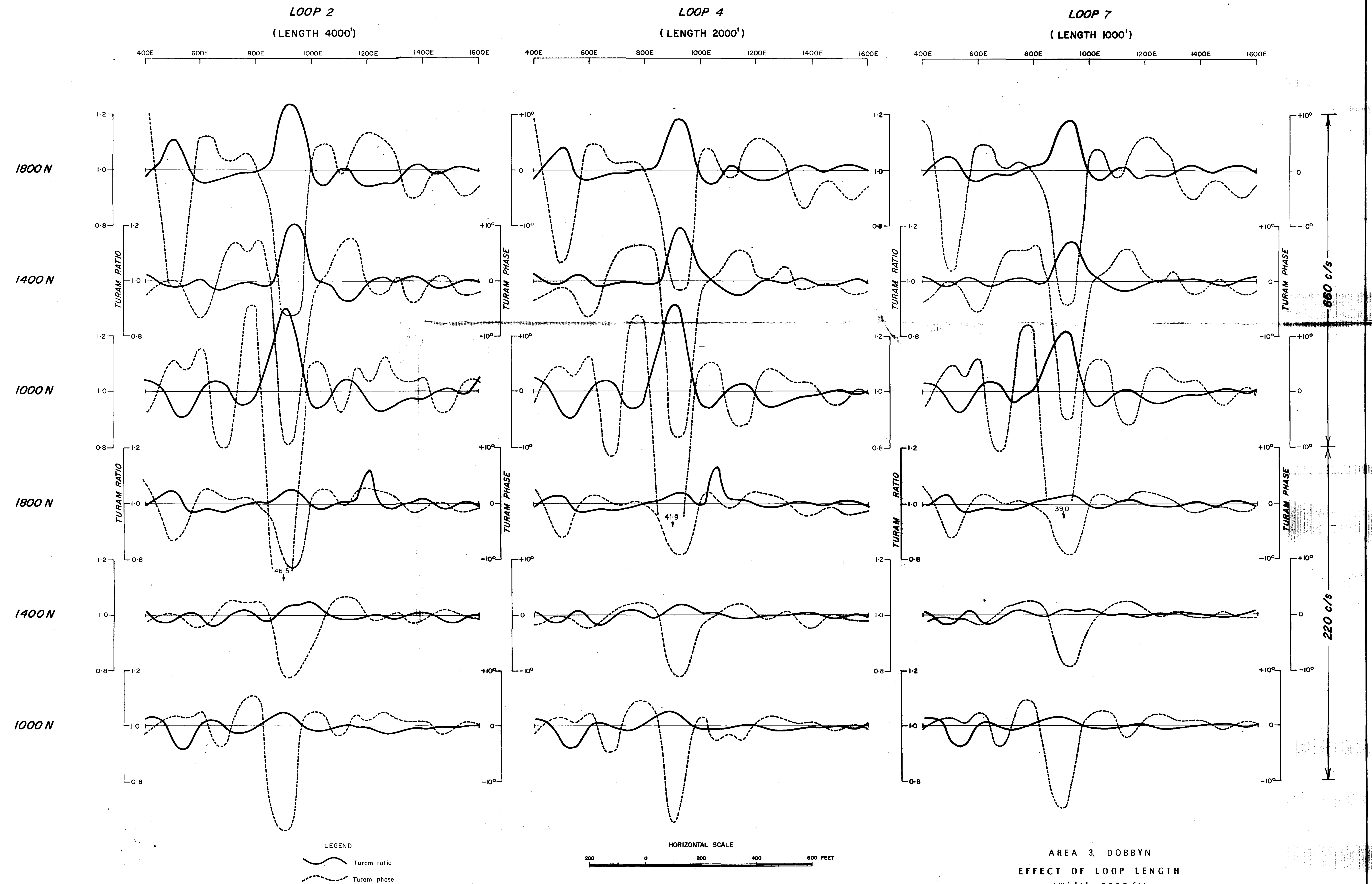
TRAVERSE PLAN AND TURAM LOOPS

AREA 3, DOBBYN
TURAM PROFILES
(220 c/s)

AREA 3, DOBBYN
TURAM PROFILES
(660 c/s)



AREA 3, DOBBYN
EFFECT OF LOOP LENGTH
(Loop Width 1000 ft)

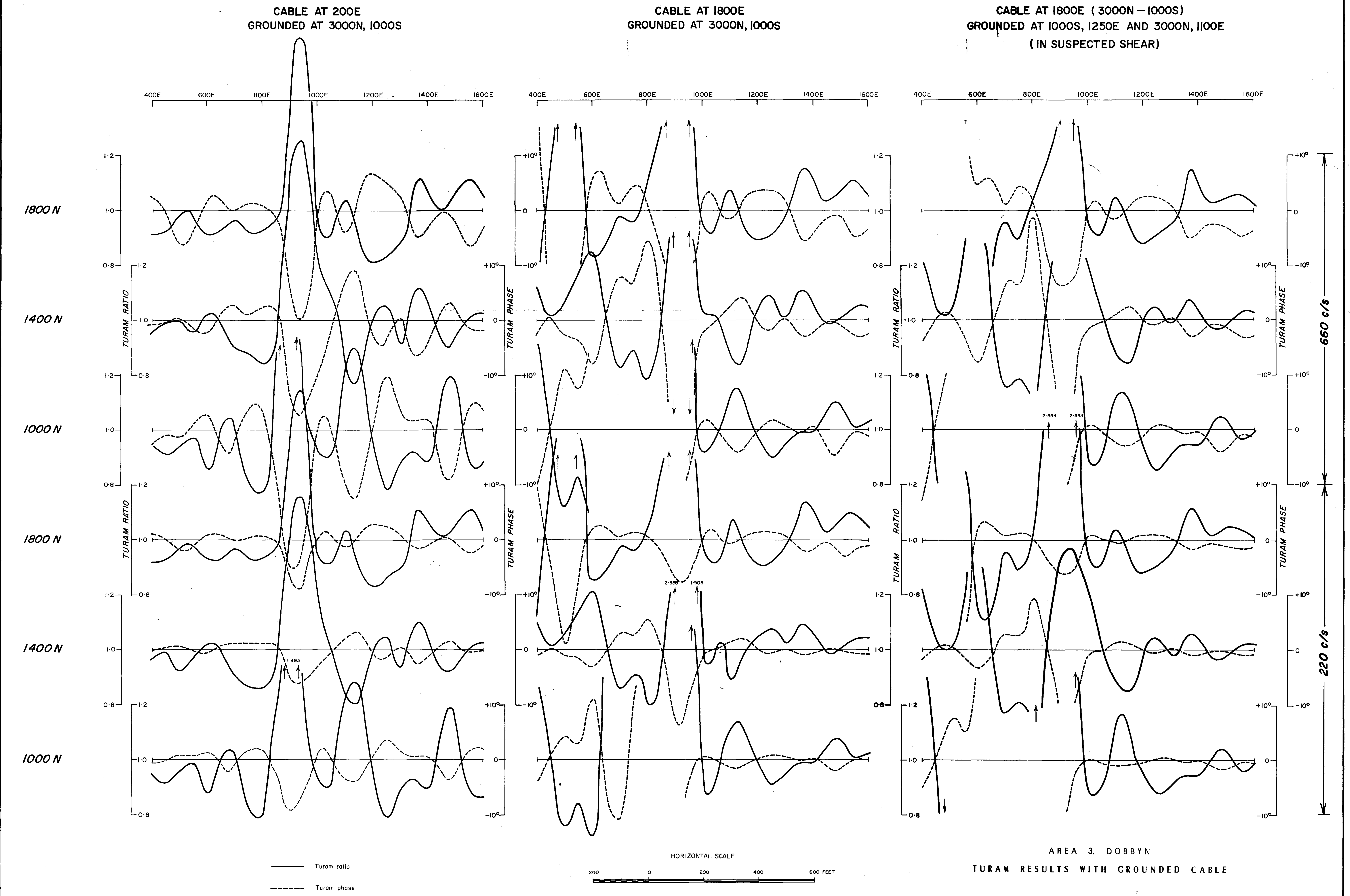


AREA 3, DOBBYN

EFFECT OF LOOP LENGTH

(Width 2000 ft)

PLATE 19



AREA 3, DOBBYN

TURAM RESULTS WITH GROUNDED CABLE

TO ACCOMPANY RECORD No. 1968/78 E54 / B7-62