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RECORD No. 1965/221

DOBBYN AREA GEOPHYSICAL SURVEY,

QUEENSLAND 1964

by

J.E.F. GARDENER

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ILLUSTRATIONS

Note. This Record supersedes Record No. 1965/12

SUMMARY

A geophysical survey was made from May to September 1964 in the Dobbyn area, about 70 miles north-west of Cloncurry, Queensland. The survey was a continuation of a survey made in 1963 to search for economic copper deposits.

The main method used was induced polarisation. Other methods used were electromagnetic (Turam), magnetic, and self-potential.

One area of strong anomalies was located as well as several areas of weaker anomalies. Drilling recommendations are made for initial testing of the anomalous areas.

1. INTRODUCTION

Between 18th May and 25th September 1964, the Bureau of Mineral Resources (BMR) made a geophysical survey in the Dobbyn area, about 70 miles north-west of Cloncurry, Queensland. The survey was a continuation of a survey made in 1963 to search for copper deposits, particularly in the primary zone (Gardener, 1964).

In 1935 a geophysical survey was made in the area around and between the Orphan and Kohinoor mines by the Aerial, Geological, and Geophysical Survey of Northern Australia (Rayner & Nye, 1936). This survey did not give very definite results as regards location of new orebodies, but indicated possible extensions of known orebodies.

In the 1963 geophysical survey, induced polarisation (IP) and Turam methods proved most useful. Five areas were found on the main grid (Plate 1) where further work appeared justified. These were :

(a) extension of the Dobbyn deposit,

(b) a zone of mineralisation about 1000 feet to the east of the Dobbyn mine and continuing north from about 1500N,

(c) extension of the Orphan deposit,

(d) the fault zone near 14,400E, and

(e) the alluvial area at about 45,000E.

In the 1964 survey, IP was the method most used; Turam was used only on selected IP anomalies to obtain further information on the size, position, and dip of the conductor. Self-potential and magnetic methods were also used on selected IP anomalies. The IP work consisted mainly of detailed traverses north and south of the Dobbyn mine to cover areas (a) and (b) above. This work was later extended further north to Traverse 22,500N, which is well north of the Kohinoor mine. A number of long reconnaissance lines, some of which covered areas (c) and (d), were also surveyed with the IP method (Plate 1), but these did not result in the location of any areas of interest. Further geophysical work was done in area (e) and at the Crusader and Dinkum Digger mines.

Permanent marks were put in, mainly in anomalous areas, so that the grid can be relocated. The coordinates of these permanent marks are given in the Appendix.

Geological mapping over the major anomalous areas was done by W.B. Dallwitz of the Geological Branch of the BMR.

Geophysicists who took part in the survey were J.E.F. Gardener (party leader), J.E. Haigh, and R.H. Andrews.

2. GEOLOGY

The geology of the surveyed area has been described by Carter, Brooks, and Walker (1961).

The geophysical grid (Plate 1) covers parts of the Leichhardt Metamorphics, the Argylla and the Corella Formations, and the Kalkadoon Granite (all Precambrian).

Geological mapping on the grid showed quartzite, siltstone, calc-silicate rock, acid volcanics, and tuff in the eastern part. Rhyolite, dacite, and sheared basic rocks (amphibolite) are dominant in the central and western parts. The regional strike is roughly north-south and the dip 85° east. Boundaries between the Corella Formation, Argylla Formation, and Leichhardt Metamorphics as marked on the Dobbyn 4-mile geological series sheet are somewhat questionable. The Corella Formation can be distinguished because it contains calc-silicate rocks and because of its relative paucity of acid and intermediate volcanics, but the Argylla Formation and the Leichhardt Metamorphics are not easily distinguishable. (Zimmerman, pers. comm.).

Kalkadoon Granite crops out in the extreme western part of Traverse O. The Kalkadoon Granite is mainly a granodiorite in a composite mass and is coarse-grained and commonly porphyritic (Carter et al, 1961, p 143).

Leichhardt Metamorphics crop out between Kalkadoon Granite in the west and the Argylla Formation in the east. They are essentially highly to moderately metamorphosed acid lavas, for the most part originally dacite and rhyolite. Associated metamorphics include migmatite, gneiss, mica schist, quartzite, calc-silicate rocks, and hornblende schists and amphibolite, which were probably originally mainly basic igneous intrusives. (Carter et al, 1961, p 60).

The Argylla Formation is described as metamorphosed rhyolite and metadacite, with smaller quantities of quartzite, arkose, calc-silicate rocks, conglomerate, slate, schist, and gneiss. (Carter et al, 1961, p 62).

The Corella Formation covers the eastern part of the grid. The rocks are described as characteristically thin-bedded. The formation appears to consist of fine- to coarse-grained calc-silicate hornfels, gneiss, and granulite, with thinly interbedded pelitic and psammitic rocks. In the Dobbyn 4-mile geological series sheet area, quartzite appears to form a greater proportion of the succession than is usual, especially in the eastern part of the surveyed area. (Carter et al, 1961, p 86-7)

Throughout the Cloncurry and Mount Isa mineral fields basic igneous rocks and copper mineralisation are closely associated. Sparse chalcopyrite and pyrite crystals are common in the basic rocks, but mineral deposits appear to be confined to zones of structural deformation. Almost without exception the copper deposits of the region are within, or very close to, fault zones or shears. (Carter et al, 1961, p 206-7).

In the Dobbyn mine, mineralisation is localised in a north-trending shear in schists on the contact with altered rhyolites. The shear dips east at 75°. The orebody was worked only in the oxidised zone and the ore consisted of copper carbonates and oxides with some chalcocite in a gangue of quartz. The primary ore mineral is chalcopyrite. The deposit was developed over a maximum length of 440 feet, a width of 3 to 13 feet, and a depth of 330 feet. At the time of closure the operating company estimated that 41,000 tons of 5% sulphide ore remained. The mine produced 16,581 tons of ore for a yield of 2820 tons of copper (17.0%). (Carter et al, 1961, p 214). Pyritic formations occur west of the lode.

The Kohinoor mine occurs in a schist belt enclosed on both sides by porphyry. The contact between the schist and the porphyry shows signs of contact metamorphism with contact minerals and hornfels. The orebody occurs in the zone of maximum shearing, which contains bands of ferruginous and of milky quartz. The gangue material is mainly crystalline calcite. (Rayner & Nye, p 5). The lode is generally narrow and the greatest recorded width of ore is only seven feet (Carter, 1959).

The Orphan mine is in a fault which bifurcates to the north-west of the mine. The fault dips to the south-west at 70° and the orebody pitches steeply south-east. The country rocks are hornblende schist and altered porphyritic rhyolite. The ore consisted of malachite, cuprite, chalcocite, and azurite in the oxidised zone and chalcopyrite and pyrite in the primary zone. The gangue consists of quartz and siderite. The deposit was mined over a length of 300 feet, a width of 5 to 9 feet, and a depth of 175 feet. The orebody widens to 15 feet at the junction of the fault branches. Production was 23,746 tons of ore for a yield of 2740 tons of copper (11.6%). The ore reserves were not exhausted at the time of closure, but have not been estimated. (Carter et al, 1961, p 214).

In the Crusader mine, the copper minerals of the oxidised zone are malachite, red oxides of copper, and native copper. The oxidised copper ore south of about 1000N on the geophysical grid occurs in weathered talc rocks; north of 1000N, where the mineralisation occurs in the central portion of the Crusader Fault, the copper minerals are associated mainly with crushed iron-stained quartzitic rocks of the fault zone. The minerals of the primary zone occur in talc and contain mainly chalcopyrite and pyrite with some pyrrhotite, bornite, and magnetite. The oxidised ore has been estimated to average 6% copper and the primary ore 2.4% copper though it is doubtful if the effects of secondary sulphide enrichment have been adequately considered in making this estimate of 2.4%. (Searl, 1952, p 6).

Drilling results in 1928 indicated that the average grade of ore is higher in the central portion of the mineralised zone than at either end of the zone. The portion of the mineralised zone containing the highest grade ore probably extends over a length of 300 feet with an average width of 35 feet. The average grade may be 2.4% copper to the 200-ft level. No evidence exists to indicate the nature of the lode at depth. (Searl, 1952, p 8).

The Dinkum Digger mine is located on relatively flat country with poor exposures in an area mapped as Corella Formation. The ore occurs in a quartz-filled fracture in calc-silicate rocks adjacent to amphibolite. Sulphides occur within a few feet of the surface and consist mainly of chalcopyrite and pyrite. Sphalerite is present on the dumps. The mine is situated near a major north-south fault zone. The lode dips steeply east. (Zimmerman, pers. comm.).

3. METHODS

The methods used in the survey were induced polarisation (IP), electromagnetic, self-potential (S-P), and magnetic.

Induced polarisation, or overvoltage, occurs when an alternating or a transient current is forced to flow through naturally occurring electronic conductors. The principal characteristic is that, following the abrupt ending of a current flow in a rock containing an electronic conductor, a prolonged transient voltage is observed, and this phenomenon is called induced polarisation or overvoltage.

In the method used in this survey an alternating current was used, and the IP effect measured was the percentage change in apparent resistivity of the ground when the frequency of the alternating current was changed. This change in apparent resistivity with frequency is called the frequency effect and is a direct function of the induced polarisation effect. In the presence of electronic conductors the apparent resistivity increases when the frequency is decreased. The most commonly occurring electronic conductors are metallic sulphides and graphite. Parameters other than the frequency effect that are obtained from the survey results are the apparent resistivity and the metal factor, which is proportional to the ratio of the frequency effect and the apparent resistivity, and so proportional to the change in conductivity of the ground as the frequency of the applied current is varied.

Dipole-dipole electrode configuration was used throughout the survey; this set-up is shown diagrammatically in Plate 3. 300-ft dipoles were used generally; interesting anomalies were resurveyed with 100-ft dipoles.

The Turam electromagnetic method was used in the survey. The primary electromagnetic field was produced by passing an alternating current through a long straight cable grounded at each end. This primary field causes currents to flow in subsurface conductors and these currents in turn give rise to secondary electromagnetic fields. In general, the resultant field will differ from the primary field in intensity, phase, and direction and will reveal the presence of conductors.

Two search coils 100 feet apart were carried along traverses at right-angles to the primary cable and readings were made every 50 feet. The quantities measured were the ratio of the amplitudes of the vertical electromagnetic field at the two search coils and the phase difference of this field between the two coils. The ratios are corrected for the variation of the primary field with the distance from the cable. Corrected ratios greater than unity, together with negative phase differences, characterise conductors. The strengths of the ratio and phase anomalies depend upon the depth and conductivity of the body causing the anomaly.

In the S-P method, the natural potential differences between any two points on the ground are measured. Negative potentials are characteristic of sulphide bodies undergoing oxidation. In the survey area the S-P observations were somewhat erratic owing to surface influences that had no geological significance; this makes it difficult to obtain the true potentials caused by subsurface features, and not much importance can be attached to the S-P results.

The magnetic method used in the survey consisted of measuring variations in the vertical component of the Earth's magnetic field with an AB Electrisk Malmletning (ABEM) torsion magnetometer.

4. RESULTS

The survey results are presented as plans, and a few profiles are shown to illustrate typical anomalies.

Plate 2 shows the positions of the major anomalies located during the survey as well as the majority of lesser anomalies. Traverses surveyed with IP in the area of Plate 2 are distinguished from other traverses by heavy lines.

The main criterion used in assessing the geophysical results was the strength of the IP anomalies. Turam anomalies were used to obtain details on the position, dip, and size of the conductors causing the IP anomalies. The 1963 survey results showed that there are large numbers of Turam anomalies in the survey area, but that these anomalies have no significance in the search for orebodies unless they are accompanied by IP anomalies. The Turam anomalies are mainly caused by shear zones, unmineralised in the majority of cases.

Geological mapping during the 1963 and 1964 surveys showed that, with the possible exception of the area around 45,000E, there are no graphitic rocks in the surveyed area and so the frequency effect anomalies can be reasonably assumed to be due to mineralisation.

In evaluating IP field results, the resistivity, frequency effect, and metal factor were all considered. Although the frequency effect anomaly is the actual IP anomaly, the amplitude of the frequency effect is no criterion of mineralisation because it is known that in a medium containing polarisable metallic mineralisation, the effects measured at the surface will be directly influenced by the absolute resistivity of the surrounding rocks. Hence, for example, a small amount of polarisation due to weakly disseminated mineralisation in a high resistivity rock will give rise to much larger frequency effects than the same mineralisation in a lower resistivity rock.

The metal factor is proportional to the change in apparent conductivity of the ground as the frequency of the applied current is varied, and in many cases it is a truer measure of mineralisation than the frequency effect. However, resistivity anomalies have a tendency to influence unduly the metal factor results, and this fact must be considered.

The values of apparent resistivity, frequency effect, and metal factor are plotted as two dimensional graphs and then contoured; these plots are not true vertical sections of the electrical properties of the ground because many parameters other than the distances between electrodes affect the values obtained. Contour patterns for anomalies caused by simple sources have been developed theoretically and these basic patterns, and combinations of patterns, can be recognized in the complex patterns of field results.

The strongest IP anomalies found during the survey are the line of anomalies 2200E/5200N, 2350E/6000N, 2350E/6500N, 2350E/7000N, 2400E/7500N, and 2425E/8000N (Plate 2). Profiles on Traverses 7000N and 5200N are shown in Plates 3 and 4. Only the IP results using 100-ft dipoles are shown, though 300-ft dipoles were also used. No differentiation is made between these six strong IP anomalies. However, the Turam anomalies at 2400E/7500N and 2425E/8000N are much weaker than at the other IP anomalies.

At 2200E/5200N the Turam results indicate the presence of a strong conductor dipping east. On Traverse 6000N, the Turam anomaly splits into two narrower ones at 2350E and 2200E. The conductors appear to dip steeply east, but the conductor at 2200E is probably west of the IP anomaly and so may not be mineralised. A gossan trending north-north-east occurs on the anomaly at 2350E/6000N, and some old mine workings are on the gossan. A fault trending north-west occurs between the IP anomalies on Traverses 5200N and 6000N, and another between the anomalies on 6000N and 6500N (Dallwitz, pers. comm.).

The IP anomalies at 2350E/6500N and 2350E/7000N are both associated with Turam anomalies caused by strong conductors dipping steeply east. A shallow pit exists on the anomaly line just south of Traverse 7000N.

The IP anomalies at 2400E/7500N and 2425E/8000N have only weak, narrow Turam anomalies associated with them. The anomalies are not due to very strong conductors and there is a possibility that the IP anomalies are due mainly to disseminated mineralisation.

On Traverse 8400N, the IP anomaly is only of medium strength and is at 2425E. The Turam results show a strong though rather narrow conductor here. The line of IP anomalies disappears at Traverse 8900N, though a weak anomaly appears at 2100E, west of the main anomaly line.

Gossans have been mapped both east and west of the main line of IP anomalies (Dallwitz pers. comm.), but only two of these are definitely associated with IP anomalies. One is immediately south of 3200E/6000N, and the other immediately north of 3100E/8000N. These are both associated with weak anomalies. Much of the area here is covered by quartzite rubble and it is possible that other anomalies are also associated with gossans, not mapped. A line of weak IP anomalies runs from 3200E/6000N to 3700E/8900N (Plate 2) and other anomalies also occur in the area. The positions of these anomalies were, in most cases, estimated from IP work with 300-ft dipoles. The eastern end of the IP profile (100-ft dipoles) in Plate 3 shows a part of an anomaly; the complete anomaly was delineated with the 300-ft dipole.

Plate 2 shows strong IP anomalies at the Dobbyn mine on Traverses 200N, 0, and 250S. The anomalies continue south of the mine as medium strength anomalies to 1000S, and north of the mine to 800N. The anomalies continue north as weak anomalies to 2500N and south to 2000S. The Dobbyn main shaft is a few feet south of Traverse 0 at 1000E.

Turam anomalies caused by moderate conductors are associated with the IP anomalies north and south of the mine. The IP and Turam results show the north-trending mineralised shear in which the Dobbyn mine is located. The results suggest that the mineralisation in the shear is strongest at the mine, but may extend to a greater depth north of the mine. The mine was evidently worked only as a small but rich deposit (17% copper). However, the IP results suggest the mine may be a fairly large, low-grade deposit.

East of the Dobbyn mine there are three lines of IP anomalies, from 1650E/1000S to 1950E/3500N, from 2300E/400N to 2400E/800N, and from 3100E/1000S to 3050E/1500N. These anomalies have associated Turam anomalies and are probably due to weakly mineralised shears. The IP anomalies at 2000E/800N and 1900E/1500N are of medium strength, whereas the other anomalies are all weak; the results thus indicate that the mineralisation probably increases in strength here.

At the Kohinoor mine (Plate 2) the Turam anomaly is very strong, but the IP anomaly is weak. The Turam anomalies associated with the IP anomalies at 3300E/14,070N (the Kohinoor mine), 3250E/14,500N, 3025E/15,500N, and 2800E/16,500N are almost identical: they are all very strong, wide, 'off-scale' anomalies. These Turam anomalies are probably caused by the zone of shearing in which the Kohinoor orebody occurs. The weak IP results are probably due to a narrow zone of mineralisation.

North of the Kohinoor mine, medium strength IP anomalies occur at 2850E/17,500N, 2850E/18,000N, 2800E/18,500N, and 2750E/19,000N. The associated Turam anomalies are all strong except for the one at 2850E/18,000N, which is of medium strength. An old shaft and some shallow diggings known as the Copperless mine are on this line of anomalies. The IP anomalies become weak north of the Copperless mine and eventually die out between Traverses 21,500N and 22,500N. Profiles for Traverse 18,500N are shown in Plate 5. There is evidently an increase in the strength or width of mineralisation at the Copperless mine.

In the extreme north-eastern corner of Plate 2, two fairly long lines of weak IP anomalies lie in an area where there are a number of old workings and shafts known locally as the 'Bull Creek shows'. The anomalies appear to continue north of the surveyed area, but it is doubtful if the anomalies would become stronger.

In the extreme western part of Plate 2, two lines of weak IP anomalies are shown from 850W/4500N to 850W/5200N and from 2500W/7500N to 2100W/10,400N; this second line has shallow workings all along it. These anomalies are not considered significant.

Geophysical results in the Orphan mine area are shown in Plate 2 and, in more detail, in Plate 6. The Turam anomaly in the centre of Plate 6, from 9600E/3700N to 9250E/5200N, corresponds to the fault in which the Orphan lode is situated. The IP results show that only a short length of the lode is mineralised; the IP anomaly disappears between 4500N and 4600N.

Traverse 4100N is on the junction of the east and west lodes. The very wide Turam anomaly on Traverse 4200N is due to the fact that the anomaly is caused by two conductors, the east and west lodes. The west lode was the first to be found and worked, and more development has been done on this than on the east lode. The Turam results show that the west lode ends abruptly between Traverses 4200N and 4280N at about 9300E. The main ore-shoot is at the junction of the two lodes (approximately 9600E/4100N). The east lode has been worked for only about 100 feet north of the junction of the two lodes, the stopes ending abruptly on what might be a minor fault. As the IP and Turam anomalies continue north, further prospecting in this direction on the east lode as far north as Traverse 4500N may be warranted. However, the short length of the line of IP anomalies on the Orphan mine compared with the length of some of the lines of IP anomalies elsewhere in Plate 2 suggests that the Orphan mine has only very limited ore reserves.

The line of Turan anomalies running from 9025E/3700N to 9000E/5200N (Plate 6) coincides with a branch of an anomaly which was found in the 1935 geophysical survey and which was interpreted by Horvath as a tectonic feature, probably a crush zone in porphyry (Rayner & Nye, 1936, p 7). Isolated patches of gossan can be found along this line of Turam anomalies, but there are no copper indications. The absence of IP anomalies makes this line of Turam anomalies of little importance. The line of Turam anomalies running from 10,150E/3700N to 10,025E/5200N is probably due to an unmineralised shear.

A number of high metal-factor anomalies due to slight frequency effects and low resistivity values were located. The positions of five of these anomalies are shown in Plate 7. Other anomalies of this type are along the eastern edge of Plate 2 (excluding the Orphan mine and Bull Creek area anomalies) and also at

550W/13,000N and 6000E/4500N (Plate 2). It is doubtful if these anomalies are of any significance in the search for orebodies, though in some cases they may represent weakly disseminated mineralisation. They are more likely to be due to areas of thick conductive overburden.

In the 1963 geophysical survey an area of possible mineralisation was found around 45,000E and further IP work was done there in 1964. Plate 8 shows geophysical results and also a typical IP profile (Traverse 1000S). These anomalies occur on an alluvial plain with no outcrop. The IP profiles show that the main effects are the resistivity anomalies. The Turam anomalies may be due to horizontal or near-horizontal conductors. The S-P method gave no anomalies.

The anomalies may possibly be due to weakly disseminated mineralisation, but on the other hand they could be caused either by carbonaceous sediments similar to those observed in outcrop on a ridge to the north or by thick conductive overburden. There are no outcrops in the area and the cause of the anomalies could only be determined by drilling. Because of the considerable distance over which the strong Turam anomalies persist, it is considered that at least one test drill hole in the area would be justified.

Four IP traverses were surveyed at the Crusader mine (Plates 1 and 9). IP anomalies extend over a length of 1200 feet (Plate 9), but are strong only on the two middle traverses.

The IP results merely confirmed the findings of a geological survey (Searl, 1952) that the central part of the lode is the richest, and no further information can be deduced from the results. The area is one of mainly quartzite outcrop, which makes good electrode contacts almost impossible to achieve. IP, Turam, and S-P methods are very difficult to use effectively under these conditions. However, the Crusader mine may be a reasonable prospect if the lode should continue at depth. The only way to test this would be by drilling.

Turam and IP results at the Dinkum Digger mine are shown in Plate 10. The results are not very encouraging. The main Turam anomaly is south of the mine shafts. The IP anomalies suggest shallow mineralisation only, and the IP anomalies associated with the mine workings have little north-south extent. There is a set of IP and Turam anomalies west of the mine workings. From surface geological mapping these do not appear to be due to copper mineralisation. The Dinkum Digger mine appears to be only a small copper prospect.

5. CONCLUSIONS AND RECOMMENDATIONS

The aim of the geophysical survey was to search for economic copper deposits, particularly in the primary zone.

The most important anomalous area found was between 2200E/5200N and 2425E/8000N. The Turam results suggest that the anomalies at 2200E/5200N, 2350E/6500N, and 2350E/7000N are stronger than the anomalies at 2350E/6000N, 2400E/7500N, and 2425E/8000N, but the IP anomalies show no distinction.

Other anomalies of importance were found in the following localities :

a) the Dobbyn mine area,
b) the Copperless mine area,
c) between 2000E/800N and 1900E/1500N,
d) the Crusader mine,
e) the northern extension of the east lode of the Orphan mine, and
f) the area of weak anomalies immediately east of the main anomalous area.

Geological mapping showed no graphitic rocks in these areas and the anomalies are assumed to be due to mineralisation.

The Crusader and Orphan mines are in the area mapped as Argylla Formation on the Dobbyn 4-mile series geological map. The other important anomalous areas are mapped as being in the Leichhardt Metamorphics.

The only way to test the anomalies is by drilling. Besides the drilling of anomalies expected to be due to mineralisation with economic potential, it is considered that certain other anomalies should be drilled, not necessarily with regard to the economic prospects, but primarily to obtain information on the physical properties of the conductors causing them. Such information would assist the interpretation of the IP and Turam methods and should allow a critical assessment to be made of the applicability of these methods in the region.

The following drilling recommendations are designed only as a preliminary testing programme. Should any hole prove economic copper mineralisation, a revised, more detailed drilling programme would have to be arranged.

Three drill holes are recommended for initial testing of the major anomalous area:

(1) At 2600E/7000N, depression 50°, direction west along the traverse, length 400 feet.

(2) At 2500E/6000N, depression 50°, direction west along the traverse, length 400 feet.

(3) At 2350E/5200N, depression 50°, direction west along the traverse, length 400 feet.

Drill holes recommended for initial testing of other areas are :

(4) At 3200E/6000N, vertical hole, length 300 feet. This is to test the area of weak IP anomalies immediately east of the main anomalous area. The weak IP anomaly at 3200E/6000N is on a concretionary gossan (Dallwitz, pers. comm.)

(5) At 3050E/17,500N, depression 45°, direction west along the traverse, length 400 feet.

(6) At 3050E/18,500N, depression 45°, direction west along the traverse, length 400 feet.

Holes (5) and (6) are to test the Copperless mine area.

(7) At 2200E/1500N, depression 50°, direction west along the traverse, length 400 feet. This is to test the medium strength IP anomaly at 1900E/1500N.

(8) At 2200E/2000N, depression 50°, direction west along the traverse, length 400 feet. This is to test the northern continuation of the IP anomaly to be tested by hole (7). The IP anomaly has here become weak and the Turam anomaly has become strong and wide.

The two holes (7) and (8) are intended to show the course of the changes in character of the Turam and IP anomalies between Traverses 1500N and 2000N.

(9) At 9550E/4600N, depression 45°, direction west along the traverse, length 400 feet. This is to test the strong Turam anomaly extending north from the Orphan east lode, at a point where there is no IP anomaly. The hole would check the interpretation, based on the IP results, that

the fault is unmineralised here.

(10) At 1150E/400N, depression 55°, direction west along the traverse, length 400 feet.

(11) At 1150E/400N, depression 75°, direction west along the traverse, length 500 feet.

Holes (10) and (11) are to test the Dobbyn shear north of the mine. Hole (11) is a deeper hole at the same site as (10) and would be required only if (10) intersects mineralisation. It is mainly to check the IP results, which suggest that the mineralisation persists to greater depth than below the Dobbyn mine.

(12) At 45,000E/0, vertical hole, length 300 feet. This is to test one of the anomalies in the area around 45,000E.

Although no holes have been suggested on the probably mineralised part of the northern extension of the Orphan east lode as far north as 4500N, or on the Crusader mine, these are two areas which may warrant testing. However, the present interpretation suggests that they are areas of limited ore reserves.

No further work is recommended at the Kohinoor and Dinkum Digger mines.

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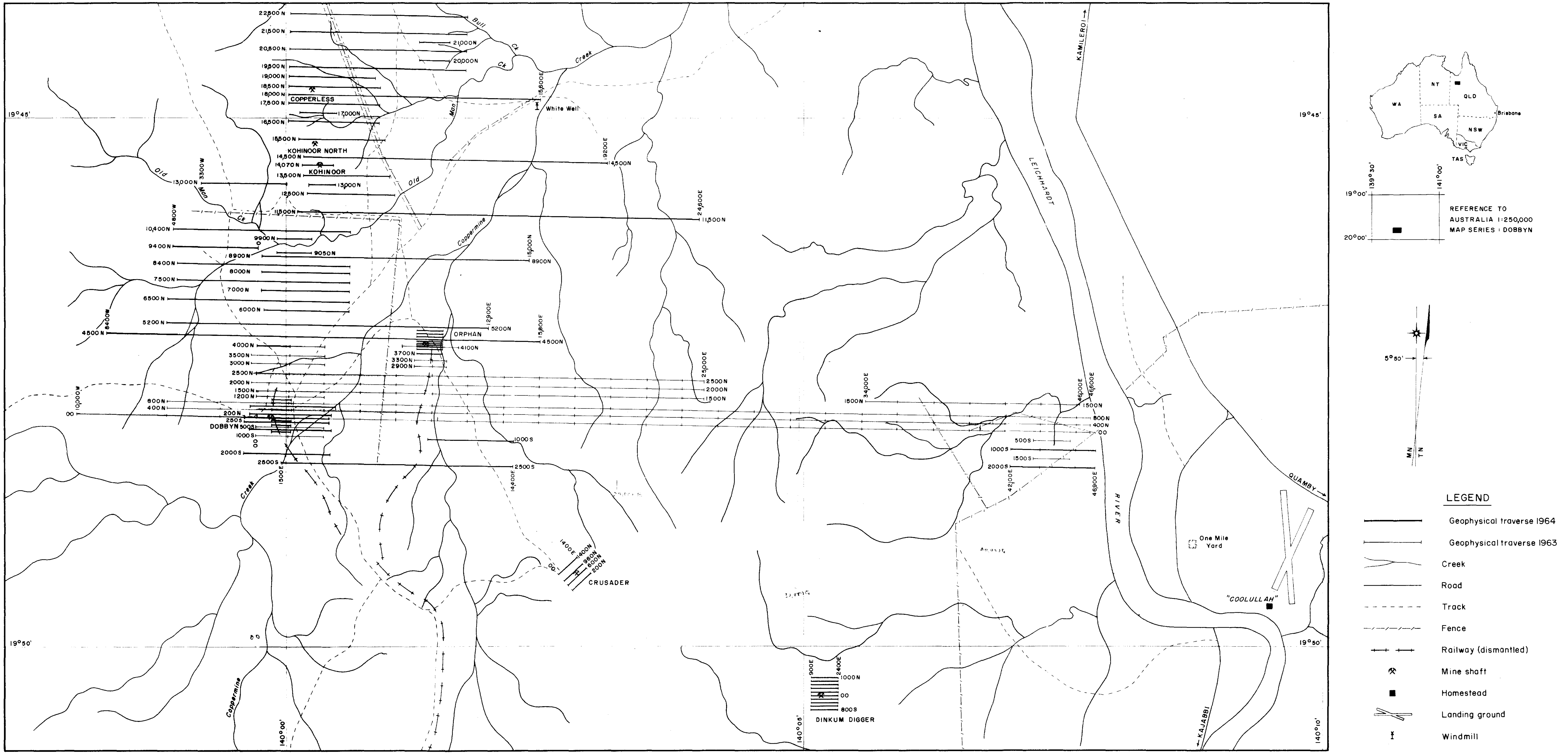
APPENDIX

List of permanent marks

Permanent marks consisting of one-inch diameter steel rods about two feet high set in concrete with grid co-ordinates marked in the concrete were set at the following positions on the grid so that the grid can be relocated, especially in anomalous areas.

1000E/0	3200E/6000N	2800E/17,500N
1000E/400N	3200E/6500N	2800E/18,500N
2000E/1500N	3200E/7000N	2800E/19,500N
2400E/5200N	3200E/7500N	6300E/17,500N
2400E/6000N	4400E/5200N	5700E/18,500N
2400E/6500N	4900E/6000N	5300E/19,500N
2400E/7000N	9400E/4600N	8100E/20,500N
2400E/7500N		9400E/20,500N
2400E/8000N		
2400E/8400N		

A permanent mark was also set at 800E/960N on the Crusader grid.



FEET
4000 0 4000 8000
1 0 1 2
MILES

DOBBYN AREA GEOPHYSICAL SURVEY, QUEENSLAND, 1964

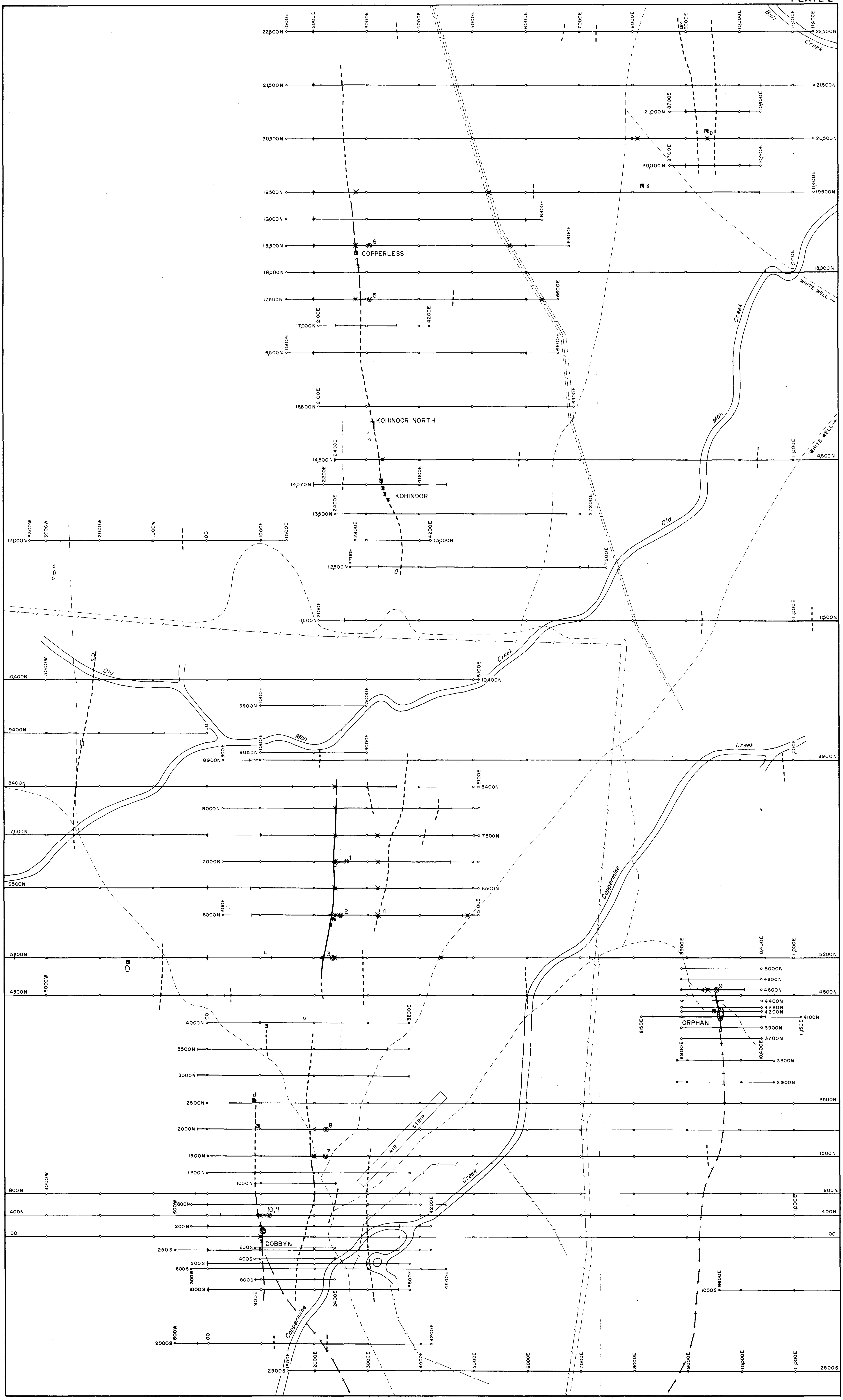
LOCALITY MAP AND GEOPHYSICAL GRID

TO ACCOMPANY RECORD No 1965/221

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

E54/B7-28

DOBBYN AREA, QLD, 1964



LEGEND

Geophysical traverse		Fence	
Traverse surveyed with IP		Railway (dismantled)	
Road or track		Permanent mark (steel peg in concrete)	
Shaft		Recommended drill hole	
Open cut		strong	IP metal factor anomaly
Workings		medium	
		weak	

5°50'

MN TN

FEET

1000 500 0 1000 2000 3000

GEOPHYSICAL RESULTS DOBBYN, KOHINOOR, AND ORPHAN MINE AREAS

TO ACCOMPANY RECORD No. 1965/221

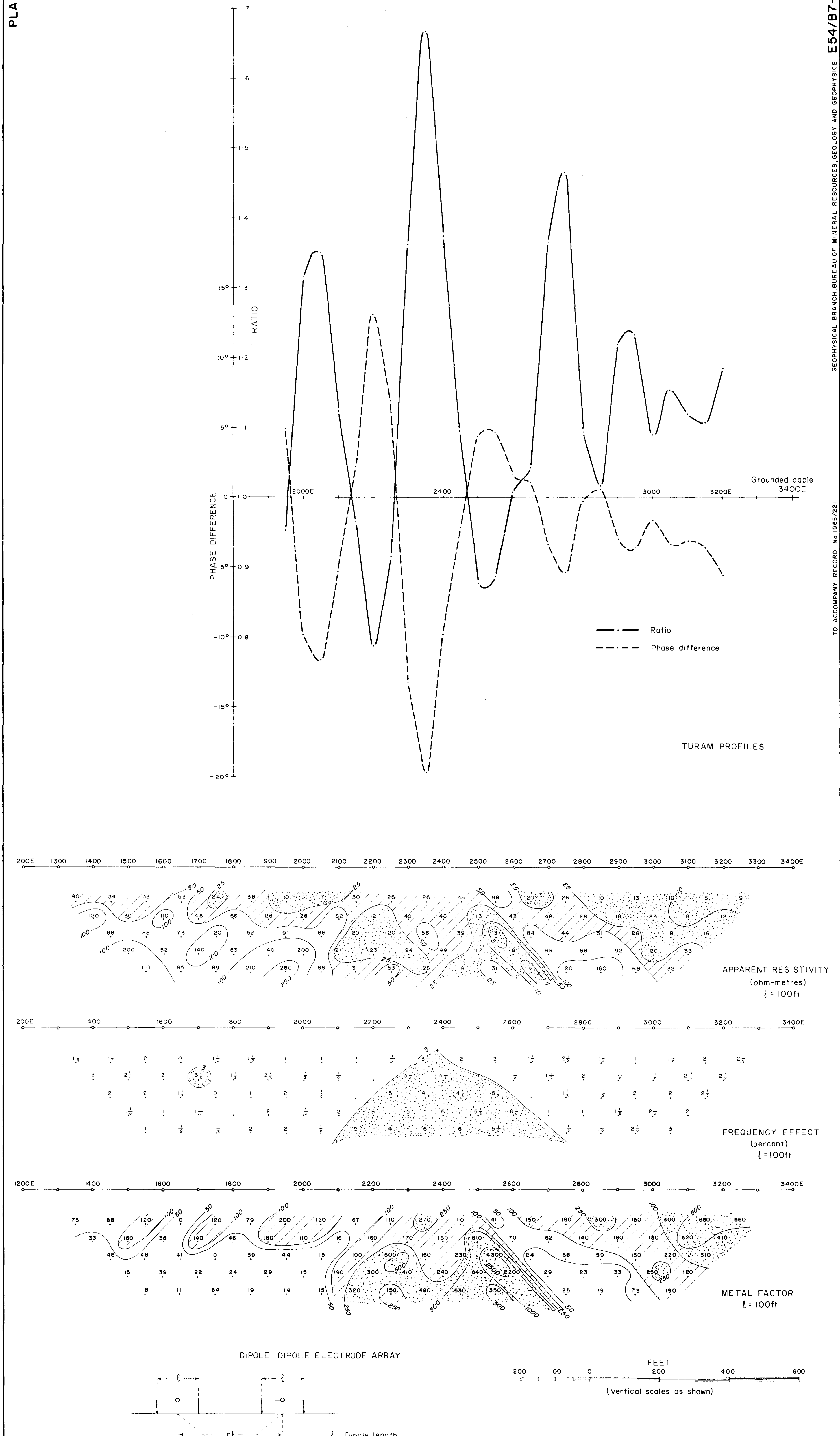
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS E54/B7-29

PLATE 3

E54/B7-30

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

TO ACCOMPANY RECORD No 1965/221



PROFILES
TRAVERSE 7000N

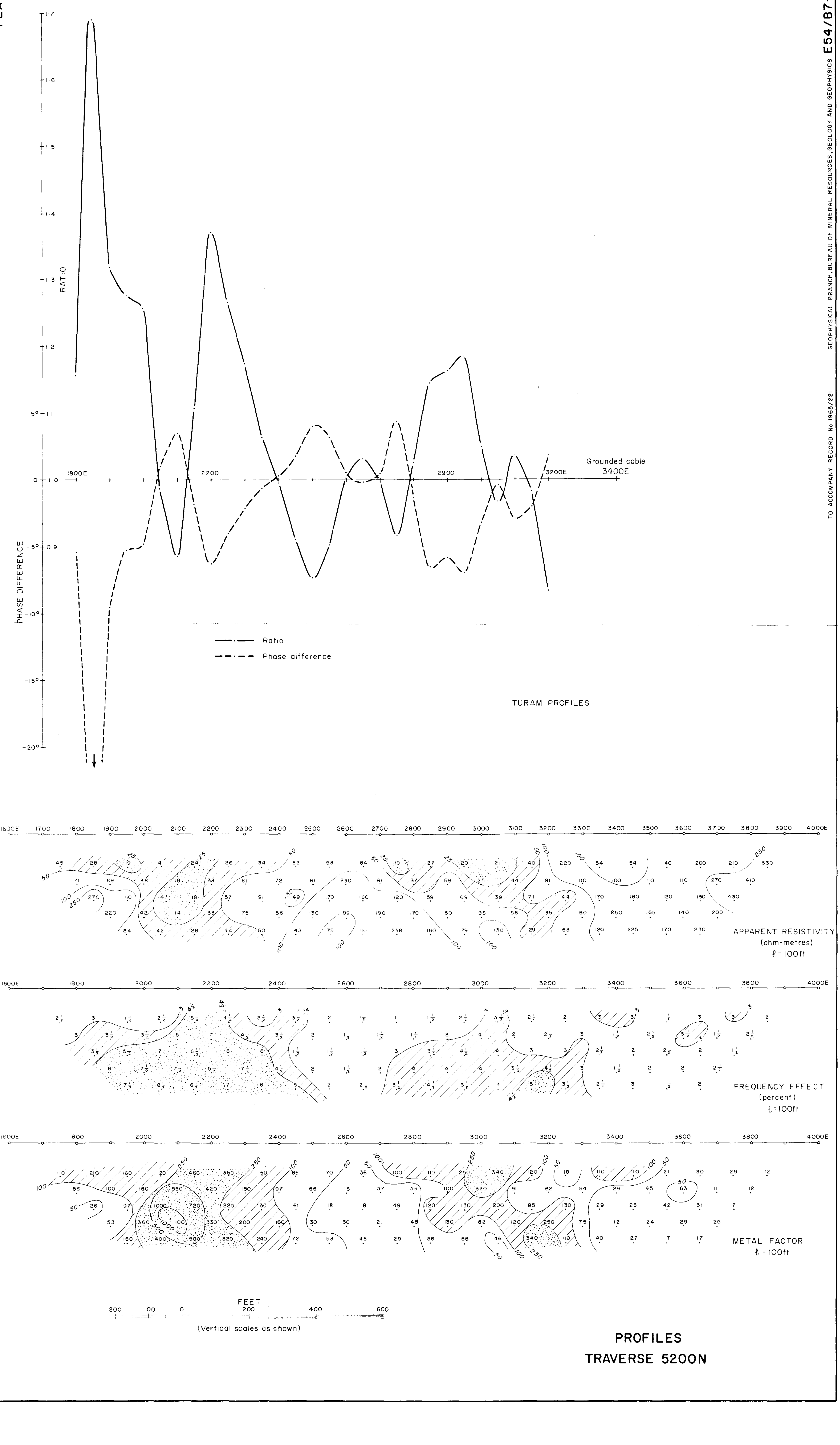
DOBBYN AREA, QLD. 1964

PLATE 4

E54/B7-31

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

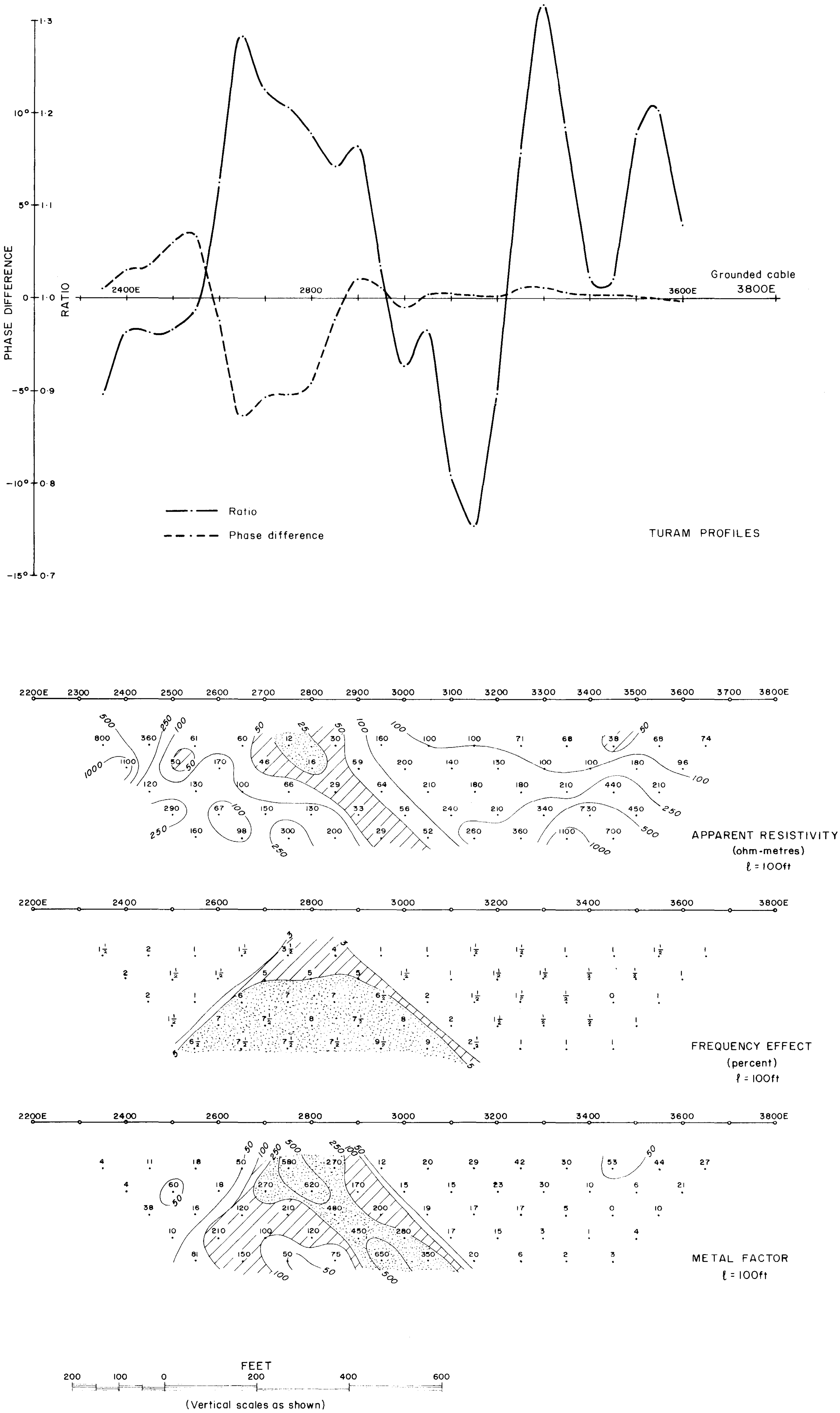
TO ACCOMPANY RECORD No. 1965/221



PROFILES
TRAVERSE 5200N

DOBBYN AREA, QLD, 1964

PLATE 5

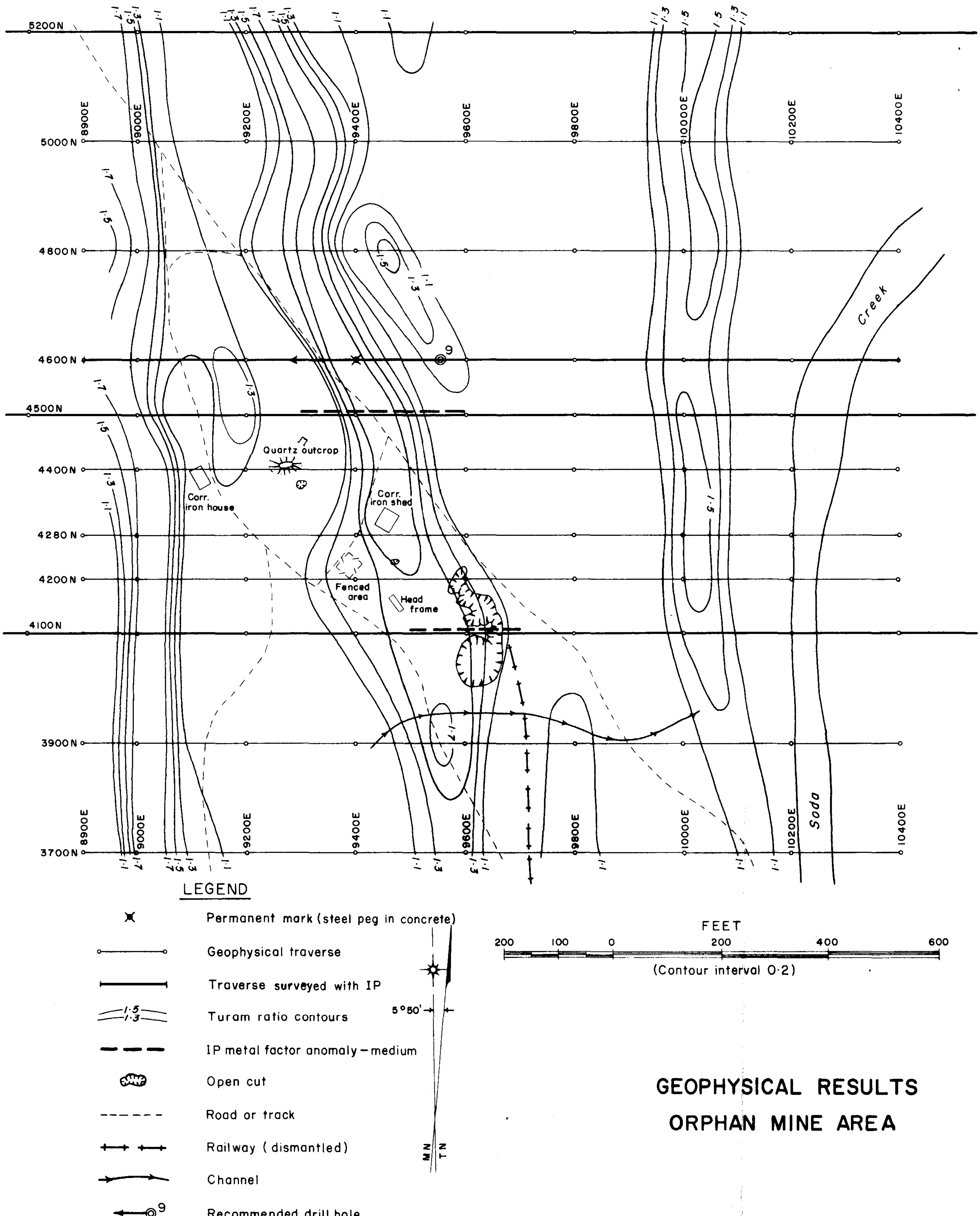


PROFILES
TRAVERSE 18,500N

TO ACCOMPANY RECORD No. 1965/221 GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS E54/B7-32

DOBBYN AREA, QLD, 1964

PLATE 6

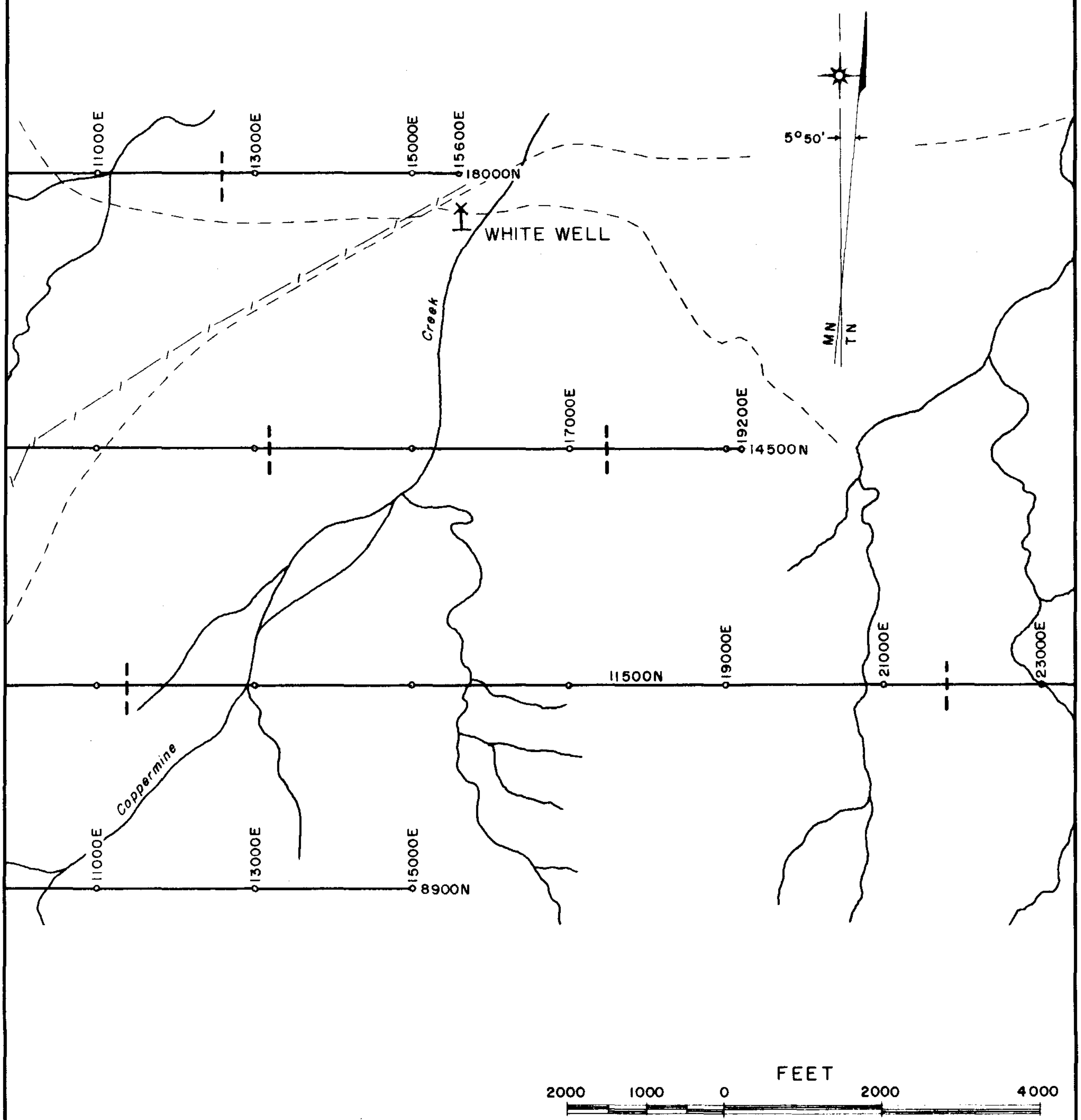


GEOPHYSICAL RESULTS ORPHAN MINE AREA

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS E54/B7-33

TO ACCOMPANY RECORD No. 1965/221

DOBBYN AREA, QLD 1964



LEGEND

Geophysical traverse surveyed with IP

Road or track

Creek

Fence

Windmill

IP metal factor anomaly — weak

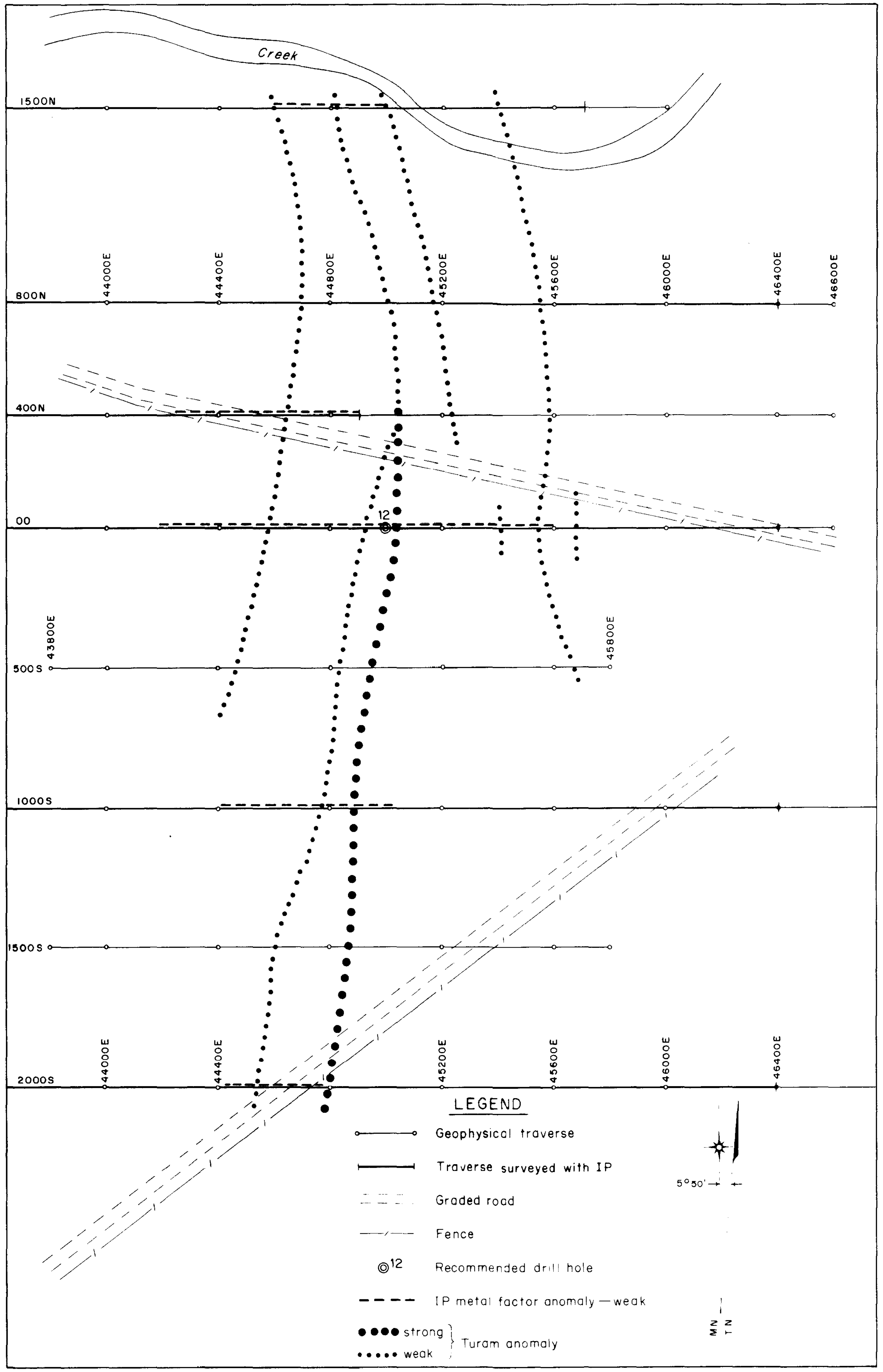
GEOPHYSICAL RESULTS AREA SOUTH OF WHITE WELL

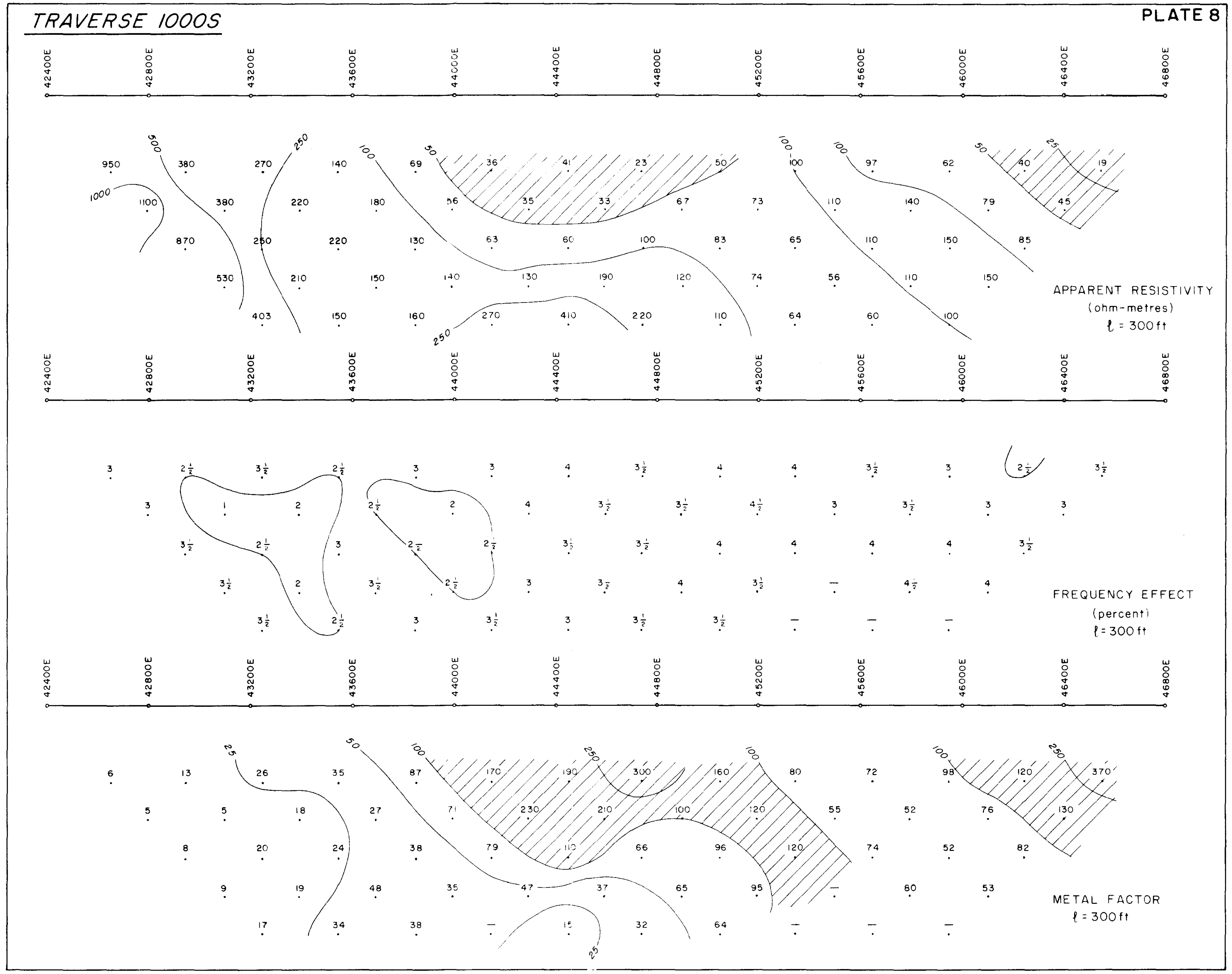
GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS E54/B7-34

TO ACCOMPANY RECORD No. 1965/221

DOBBYN AREA, QLD, 1964

PLATE 8





FEET
400 200 0 400 800 1200

GEOPHYSICAL RESULTS
AREA AROUND 45,000E

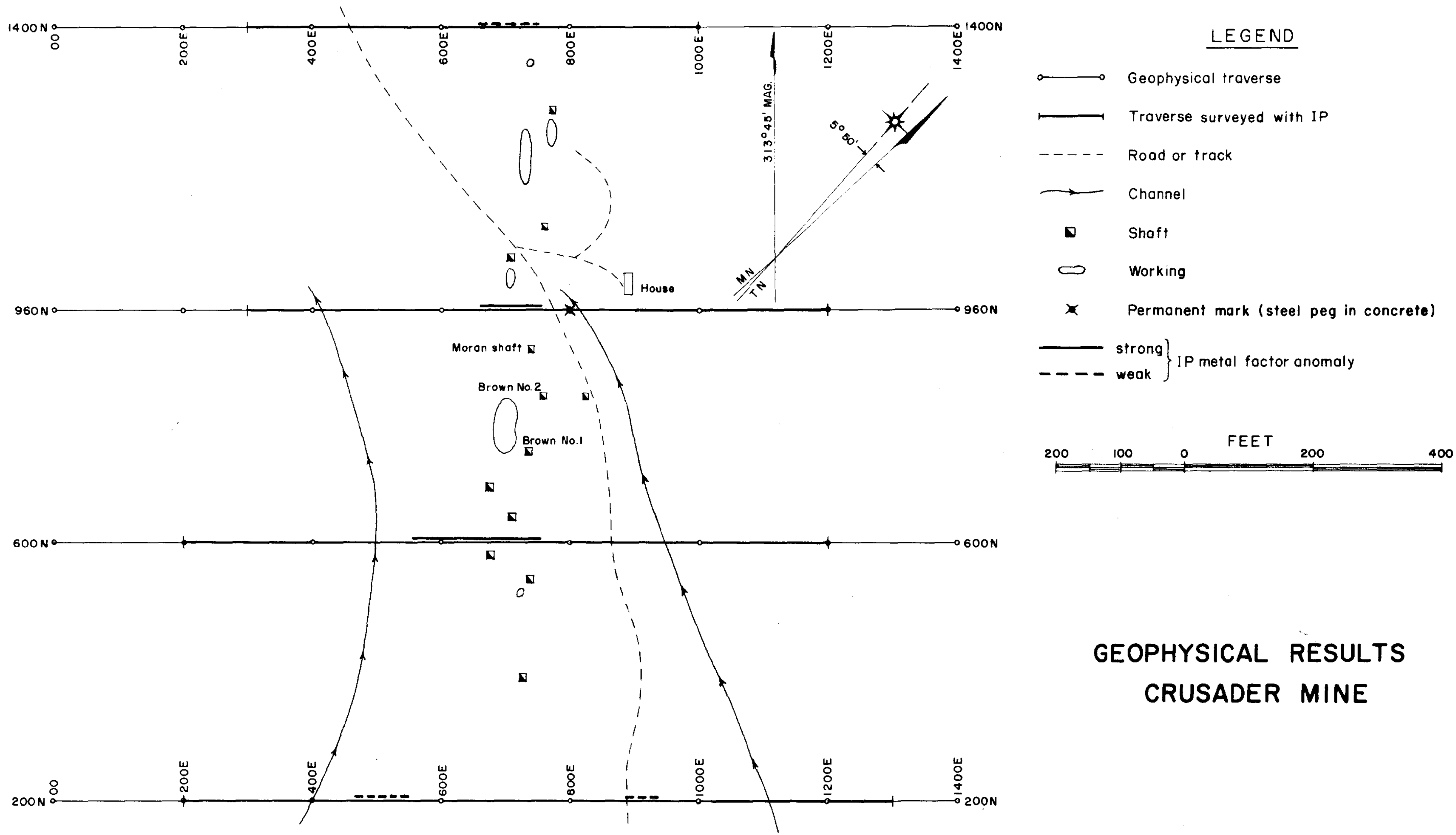
DOBBYN AREA, QLD, 1964

TO ACCOMPANY RECORD No 1965/221

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

E54/B7-35

DOBBYN AREA, QLD, 1964



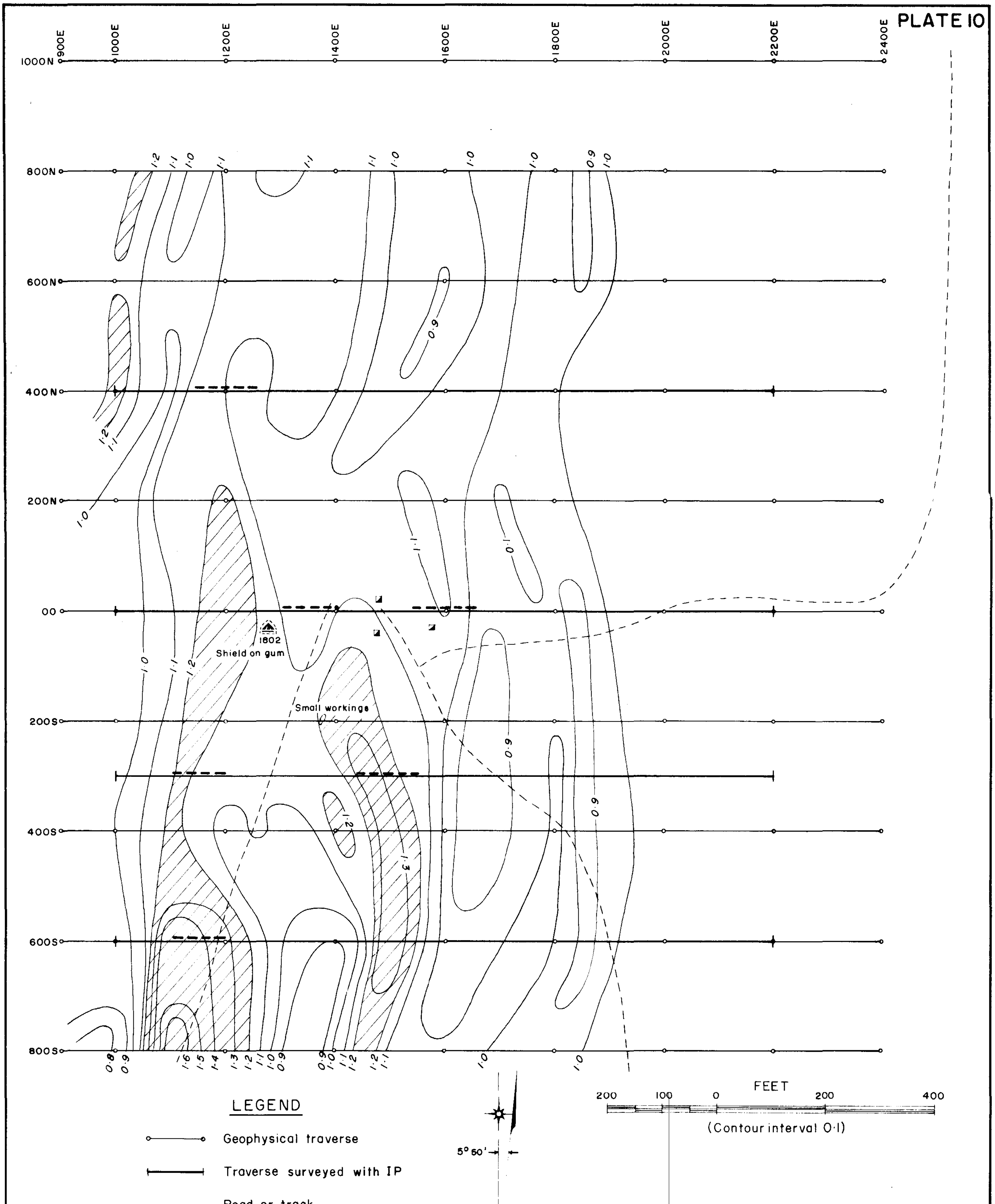
GEOPHYSICAL RESULTS
CRUSADER MINE

PLATE 9

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

TO ACCOMPANY RECORD No. 1965/221

E54/B7-36



GEOPHYSICAL RESULTS DINKUM DIGGER MINE

GEOPHYSICAL BRANCH, BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS E54/B7-37

TO ACCOMPANY RECORD No. 1965/221

DOBBYN AREA, QLD, 1964