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RENISON BELL
DETAILED MAGNETIC SURVEYS,
TASMANIA 1964

by

J.S. MILSOM

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SUMMARY

Detailed airborne and ground magnetic surveys were made in May 1964 in the Renison Bell area of Tasmania.

An area of approximately ten square miles east of Renison Bell was covered by the airborne survey and several new magnetically anomalous areas were noted. Ground magnetic surveys were made in three parts of this area to complement the aerial work. In addition to the orebodies, which contain a high proportion of pyrrhotite, magnetic anomalies derive from basic igneous rocks that are rich in magnetite, and possibly from sources in the 'red rock' marker bed at the base of the Crimson Creek Formation.

One survey flight was also made in the Cuni area, where small, high-grade copper-nickel deposits have been mined. No anomalies were noted that could be related to mineralisation.

1. INTRODUCTION

In May 1964 a detailed aeromagnetic survey of the Renison Bell tinfield was made using the Cessna aircraft of the Bureau of Mineral Resources. The survey was planned to be made at a nominal height of 280 ft above ground level (the magnetometer, in towed-bird assembly, at 250 ft above ground level) and at a nominal flight-line separation of one tenth of a mile. In practice, however, owing to the difficulties associated with flying at low altitude in rugged terrain, both the height of the aircraft and the line separation varied considerably.

The Renison Bell tinfield has been the subject of several previous geophysical surveys. As cassiterite is found in massive sulphide orebodies containing a high percentage of pyrrhotite, the lodes are well suited to investigation by magnetic methods. Previous ground surveys by the Bureau of Mineral Resources have concentrated on the magnetic and the self-potential methods (Davidson, Williams, Loh, Horvath, & Keunecke, 1957). In 1963, Renison Associated Tin Mines N.L. requested additional ground surveys employing the induced-polarisation and magnetic methods in an attempt to locate extensions of the Federal orebody and to solve problems connected with the ore-bearing structures in the Dalcoath region; but ground parties were not available for this work and a detailed aeromagnetic survey was programmed as a substitute. The survey area was extended to include other mineralised areas near Renison Bell, notably the Exe River and Cuni districts, but, owing to delays in the development of the MNS1 magnetometer, the field work was not commenced until May 1964, when surveying had to be confined to three fine days. Consequently only the area near Renison Bell and a part of the Cuni district were flown.

A limited amount of ground magnetic surveying in the Dalcoath area and in the area to the east of the Federal Lode was carried out concurrently with the airborne survey. After the completion of the airborne survey on 17th May, a brief ground magnetic follow-up was made on Dreadnought Hill, where a large magnetic anomaly had been detected from the air. This part of the survey was completed on 28th May.

Operational details of the surveys are given in Appendix A.

2. GEOLOGY

General

The geology of the Renison Bell area has been discussed by Blisset (1962), who summarises most of the previously published information. A great deal of information has also been obtained in discussions with R. Shakesby, geologist to Renison Associated Tin Mines N.L., whose ready co-operation is acknowledged.

The country rocks at Renison Bell consist of sedimentary and metamorphic rocks of the Cambrian Crimson Creek Formation and the Upper Proterozoic Oonah Quartzite and Slate. The Oonah Quartzite and Slate is exposed as an anticline plunging to the south-east, where it is overlain by the Crimson Creek Formation conformably (Blisset, 1962) or with a low-angled unconformity. Flat-lying ore deposits are generally located close to this contact.

The Oonah Quartzite and Slate is represented near Renison Bell by an unknown thickness of muddy indurated sandstone overlain by about 150-200 ft of finely laminated sandy shale known locally as the 'Renison Bell shale'. Lavas are known in the upper parts of the formation in some districts, but have not been seen near Renison Bell.

At the base of the Crimson Creek Formation at Renison Bell is the 'red rock' series of chert, mudstone, medium-grained sandstone, and conglomerate. The rocks are often, but not always, red in colour and are lithologically quite distinct from the remainder of the Crimson Creek Formation, in which they are the only available marker bed. The thickness of the 'red rock' is extremely variable up to a maximum of about 150 ft, and suggests a lens type of deposit. The remainder of the formation consists of about 8000 ft of massive red, purple, or blue argillite with mudstone, siltstone, and greywacke. Pebbles of granite have been reported in the occasional conglomerate bands. The formation is generally non-magnetic, but magnetite is dispersed irregularly in the 'red rock'.

Both acidic and basic igneous rocks crop out in the vicinity of the Renison Bell mines. To the south and east there is a broad irregular sill of gabbro and pyroxenite, which was intruded in late Cambrian times at the base of the Dundas Group sediments, and which overlies the Crimson Creek Formation. The dominant rock type is pyroxenite, with minor serpentinite as an alteration product. Asbestos was worked south-west of Renison Bell at Serpentine Hill and, here, chromite and magnetite are dispersed through the intrusion. Smaller gabbro intrusions, possibly also of Upper Cambrian age, are common near Renison Bell, notably north of the road about one mile east of Renison Bell township, on Commonwealth Hill, and near the Dalcoath open cut.

Quartz feldspar porphyry crops out on Pine Hill. It is considered by most authors to be of Devonian age and to be comagmatic with the Heemskirk batholith, but there is no direct evidence of this. The structure of the porphyry is largely concealed by scree, but it is probably a complex sill. Quartz porphyry and feldspar porphyry dykes with a cryptocrystalline groundmass have been extruded from the sill, trending north-west, and one of these crosses Renison Bell Hill and crops out in the Argent River and in a quarry at the roadside west of Rension Bell Creek. Irregular quartz veins, carrying cassiterite and green tourmaline, occur within the sill, which is thought to have been the source of mineralisation at Renison Bell.

Post-mineralisation basalt dykes intersect the lodes in parts of the workings, and one of these crops out near the summit of Dreadnought Hill.

Economic

Ore is found at Renison Bell in near-vertical fissure or fault lodes and in flatter-lying sill-like bodies. These 'sills' are generally assumed to extend from the fissure lodes, and the cassiterite concentration generally decreases away from the fissures, but no contact between fissure and 'sill' has yet been exposed in the mine workings. The 'sills' appear to have been formed by metasomatic replacement of favourable beds in the surrounding formations.

Three 'sill' horizons are identified, the first of which, known as the No.1 sill, lies immediately above the 'red rock' marker bed. This 'sill' is about 30 ft thick and of largely dolomitic composition, with some pyrrhotite and very poor cassiterite. No.2 sill, which lies immediately below the 'red rock' and is well mineralised, also contains dolomite and pyrrhotite. It is generally narrower than the No.1 sill and is underlain by about 120 ft of 'Renison Bell shales', towards the bottom of which are lenses of bedded pyrite and pyrrhotite. Although different in nature from the other flat-lying lodes, these lenses are collectively termed the No.3 sill; they frequently contain high-grade cassiterite ore. Geological interpretation and mapping are complicated by the abundance of small normal faults with throws of from 10-30 ft.

The two main fissure lodes run parallel and strike roughly north-west. The western, or Renison Bell, lode extends for more than 3000 ft along strike and is known at various points as the Main Lode, the Lead Lode (because of a locally high galena content), the Blow Lode, and the Upper Blow Lode. The eastern lode has been worked as the Dreadnought Lode and the Federal Lode. Recent drilling at the Federal workings has disclosed a second lode, now known as the Basset Lode, a few feet west of the Federal Lode and parallel to it. Mineralisation is extremely variable along strike of both the Renison Bell Lode and the Federal Lode and, in the case of the Renison Bell Lode at least, is not continuous.

In the primary zone, the orebodies consist of massive sulphides, chiefly pyrrhotite with lesser amounts of pyrite and arsenopyrite. The other gangue minerals are 'dolomite' (frequently altered to pistomesite) in the 'sills', and quartz in the fissure lodes. Minor amounts of chalcopyrite, sphalerite, and galena are frequently encountered in both types of lode. Marcasite is common in the upper levels of most of the orebodies as an alteration product of pyrrhotite. Where the original ore was largely massive pyrrhotite, it has often been protected by a thin marcasite coating and is, in the main, unoxidised. Magnetic effects are therefore to be expected from ore within a few feet of the surface, and even from loose boulders.

Cassiterite and wolfram were the first ore minerals to be emplaced, the wolfram having preceded the cassiterite and occasionally forming the centre of cassiterite crystals. These were followed by the main sulphide suite carrying small amounts of chalcopyrite and stannite. A late stage of mineralisation is marked by the development of sphalerite and galena. Cassiterite is found finely dispersed throughout the sulphides, the No.2 sill at the Battery Mine averaging about 1.2 percent tin and the Federal Lode about 0.72 percent tin.

Mining at Renison Bell is just entering its third phase. Originally, a number of small companies worked the soft friable gossan from which cassiterite was easily extracted. These companies concentrated on the fissure lodes which are generally oxidised to far greater depths than the 'sills'. After amalgamation of the various companies to form Renison Associated Tin Mines N.L., treatment of the complex sulphide ores was undertaken and interest switched to the 'sill' lodes - as at the Battery Mine, the only orebody currently being worked. The recent exploration programme has revealed very large reserves of sulphide ore in the Federal and Basset fissure lodes and it is to be expected that future operation will be concentrated on these bodies.

A number of small mines have been worked in the Cuni area, on the Melba Flat about three miles south-east of Renison Bell, exploiting small deposits of high-grade nickel ore associated with a north-striking dolerite sill. The sill has been intruded into rocks of the Crimson Creek Formation, dipping steeply to the east. A large pyroxenite sill, rich in magnetite, crops out about half a mile east of the dolerite and is continuous with the body referred to in the Renison Bell area. East of Cuni the pyroxenite has been largely serpentinised and contains segregations of magnetite. A ground magnetic survey (Horvath, 1957) detected a well-defined anomaly over one of these segregations, which was later drilled and proved to assay up to 0.36 percent nickel. It was suggested that further surveys should be carried out to detect other magnetite segregations, which might contain economic concentrations of nickel. A detailed aeromagnetic survey should detect such magnetite bodies.

3. INTERPRETATION

Renison Bell area (aeromagnetic)

Four major anomalous regions and several smaller features are shown on the aeromagnetic contour map (Plate 3). The largest anomalies are associated with the pyroxenite sill that crops out in the south-eastern part of the Renison Bell area. North of the sill and separated from it by a magnetic trough is a large unexplained double anomaly. This is shown on the geological map (Plate 2) to be in an area of outcrop of the Crimson Creek Formation, which is known to contain a minor magnetic bed (the 'red rock' basal unit) but nowhere gives rise to similar anomalies. It seems most likely that the large double anomaly is due to a second ultra-basic sill. If this is so, then the sill must be an earlier intrusion than the one further south. The most likely stratigraphic position for such an intrusion would seem to be at or near the base of the Crimson Creek Formation since its upper section consists of an unbroken succession of massive argillites. A depth estimate made on the western anomaly indicates an outcropping or near-surface body but such an estimate must necessarily be treated with extreme caution, since the method of interpretation used assumes a prismatic source of infinite vertical extent. The magnetic profile along line A-B, which crosses both peaks of the double anomaly and cuts the western contour lines at right angles, was used in the estimation, and is shown in Plate 4. Its position in relation to the Renison Bell ore deposits and the pyroxenite sill to the south, together with its large areal extent, suggest that the double anomaly is most likely due to an igneous intrusive, but the possibility of it being due to an orebody cannot be entirely excluded. South of Renison Bell township, even larger anomalies are known at the Blow and Federal Lodes and are considered to be due to pyrrhotite mineralisation. More intensive geological mapping or other geophysical work may solve this problem, although the drilling of a single cored hole is probably as effective and economical a means as any of determining the source.

Much of the area between the Battery (Boulder) Mine and Renison Bell township has already been covered by ground magnetic surveys (Davidson et al, 1957). Comparison of the results of these surveys with the aeromagnetic contours show that the main magnetic features have been detected from the air but that much of the minor detail is lost. However, 30-40-gamma anomalies, which it has not been possible to contour, can be seen on some of the aeromagnetic profiles (Plate 4). Most of these anomalies derive from the relatively flat-lying 'sill' bodies and 'red rock', which give rise to dipole type fields, decreasing with the third power of distance.

A large anomaly appears on the aeromagnetic contour map near Dreadnought Hill. This anomaly (Plate 4, Profile C - D) was the subject of a certain amount of ground follow-up work and is discussed separately in the section on the Dreadnought area.

Comparison of the ground and airborne magnetic results is complicated by the fact that no attempt was made to maintain a constant aircraft-to-ground separation over the extremely steep-sided valley of Renison Bell Creek between Renison Bell Hill and Dreadnought Hill. This is not possible in a westerly direction and the area, already exhaustively surveyed on the ground, was not considered important enough to justify special flights parallel to the creek. Altitude effects are probably operative in the region of the Federal Lode, since the aircraft could not be held to 280 ft above ground level down the slopes of the Stebbins and Dreadnought Hills; at times it was as much as 400 ft above ground level. This seems the most likely explanation for the anomaly at the Federal Lode being about 300 gammas greater on the traverse flown roughly along the hill contours than on the westerly directed flight-line traverses. Altitude effects have not lead to any major anomaly being over-looked; they are, in any case, greatest in the area already covered by ground surveys, where the terrain is most rugged.

North of the Battery Mine a magnetic 'high' extends south-east from the main Dreadnought-Federal complex anomaly. This 'high', which appears on profile E-F (Plate 4) with a peak at fiducial number 708, could be due to the known Battery orebody, but is rather larger than would be expected from a sill-type lode. It may indicate an additional fissure lode parallel to the Federal Lode, or that the Federal Lode has been thrown to the west by cross faulting. The numerous ground magnetic anomalies found in 1950 (Davidson et al, 1957) in the region of the Blow Lode are not resolved by the airborne survey and appear as a single large anomaly, the magnitude of which suggests that there are very large amounts of pyrrhotite in the region. Small anomalies, however, presumably due to sill-type bodies, are noticeable on the aeromagnetic profiles in this area and can be seen on profile E-F.

The most interesting anomaly detected beyond the area covered by ground surveys and detailed geological mapping is a magnetic ridge due east of the Dalcoath workings. This ridge strikes a few degrees north of east and forms the southern boundary of the large flat magnetic 'low' that separates the anomalous area at Renison Bell from the magnetic 'high' over the pyroxenite sill. It is not immediately obvious on the contour map because of the general rise in magnetic field values in this region, but it is a prominent feature on the westerly-directed profiles, where it appears as a double anomaly, and on profile G-H (Plate 4), on which it is 300 gammas in amplitude. The ridge runs roughly at right angles to the axis of the Dreadnought-Federal anomaly system, and may be due to a mineralised cross fault in the same system.

The known mineralisation at the Dalcoath workings, treated in detail below, may in some way be related to such an orebody. After the subtraction of an assumed background field the ridge anomaly was analysed and the top of the source was estimated to be 70 ft below surface. The source appears to be 300 ft wide and to dip steeply to the north. Because of the difficulties in extracting the anomaly from the rapidly changing background these estimates should be treated with caution. It is possible that the anomaly is not due to mineralisation but is associated with the gabbro that crops out to the south and east of the Dalcoath workings. However, there seems to be no magnetic indication of the gabbro from the air over its outcrop, and ground magnetic traverses over the western part indicate that it is only slightly magnetic (see below, Dalcoath area).

At the northern end of the large 'low' noted above there is a small anomaly striking almost due north across the road about a mile east of Renison Bell. The source of this anomaly, which appears on profile A-B (Plate 4) at fiducial number 611, is probably the gabbro dyke shown on the geological map.

The magnetic profiles north of the road and east of Renison Bell are mostly undisturbed, except near the Pieman River, where the effects of ultra-basic sills are again seen. In view of the marked north-west trends of the contours near Renison Bell, magnetic surveys north and west of the town would probably be of considerable interest. The area south-west of the known workings presents many practical difficulties, but further aerial work here would be an important aid to geological mapping.

East Federal area

Five traverses east of the Federal open cut were magnetically surveyed on the ground (Plate 5). No anomalies were detected that cannot be adequately accounted for by surface effects from scrap iron, particularly near old diamond-drill sites.

Dalcoath area

The Dalcoath area is geologically complex and the appearance of mineralisation there has not yet been fully explained. The orebody is well exposed in the wall of the large open cut, where it is seen to be bounded by well-defined upper and lower surfaces. If the occurrence is similar in pattern to those further north, the lode is to be classed as a sill-type body, but it is considered more likely to be a mineralised shear zone. Ground magnetic work in the area (Plate 6) was undertaken in the hope that the results, taken together with the aeromagnetic information, would assist in determining the pattern of lode formation.

Because of dense forest, and because of cloud obscuring Pine Hill on the most recent photographs, plotting of flight lines to the west and south-west of the Dalcoath workings proved impossible, and the airborne survey, therefore, only just includes the workings. Apart from a possible connection with the ridge anomaly to the east, little useful information was obtained in this area. A broad anomaly is centred between the gabbro outcrop and the workings, which lie close to the 3000 gammas contour. This anomaly has not been well-defined, but appears to strike approximately north and to merge into a more extensive 'high' to the south-west. A broad 'low' north of Dalcoath Creek separates the anomalies at Dalcoath from those at Federal.

The ground magnetic profiles (Plate 6) are exceedingly disturbed and no clear magnetic pattern emerges from them. It has not been found possible to contour the data without making a large number of unjustifiable assumptions and, for this reason, only the profiles are presented. A large proportion of the disturbances arise from sources at or near the surface, notably boulders of massive pyrrhotite that were originally quarried in the large open cut and are now scattered about the area.

The survey was performed in two parts. Initially, traverses spaced at 200 ft intervals from 8000N to 7400N were read and, on the basis of the profiles obtained, traverses were inserted at 7900N, 7650N, and 7550N; additional traverses to the south were made at 7300N and 7200N. These later traverses varied in length, being designed to cover areas of special interest.

A very large negative anomaly on traverse 8000N is tentatively correlated with an axinite dyke intersected in a trench north of the open cuts. On traverse 7800N there is a large positive anomaly, roughly coincident with the small open cut and probably due to mineralisation. Two smaller positive anomalies appear on the intermediate traverse 7900N and are probably also associated with pyrrhotite bodies. A traverse at 7700N is essential if an attempt is to be made to relate the magnetic patterns at the large and small open cuts.

Traverse 7600N across the large open cut was highly disturbed only in the cut itself, where large pyrrhotite boulders are scattered on the surface, and ore is exposed in the cut walls above the level of the stations. Short traverses 7650N and 7550N were added in the hope of tracing ore beyond the limits of the cut. The negative anomaly on 7650N is very difficult to explain, but as it appears on one or possibly two readings, it is probably a surface effect.

Ore has been removed immediately beneath traverse 7650N and this may account for the absence of positive indications. The large positive anomaly on 7550N is correlated with the ore that is exposed in the south face of the cut a few feet north of the traverse. The 'high' on traverse 7400N may also be associated with this but the amplitude is very much less. The large 'low' at the eastern end of the traverse seems to be associated with the boundary of the gabbro, and appears to a lesser extent on traverse 7200N. The magnetic profile along traverse 7300N, which does not reach the area of gabbro outcrop, is almost featureless, as is the western part of 7200N.

Traverse 7200N was pegged only to station 200E, but in view of the possible basic igneous source of the ridge anomaly detected to the east from the air readings were taken for a further 200 ft along the approximate line of the traverse at intervals of approximately 25 ft. These readings indicated that the gabbro, at least near its western edge, is not highly magnetic. Samples of gabbro were taken from traverse 7400N at 360E and from the track to Pine Hill that was under construction further east. The susceptibilities were quite low, 0.12×10^{-3} and 0.17×10^{-3}, compared with a susceptibility of 1.2×10^{-3} for a sample of pyrrhotite from the Dalcoath open cut (see Appendix B).

Further geophysical work in the Dalcoath area would be desirable. The potentialities of the magnetic method have certainly not been exhausted and there would seem to be good reason for reading full-length intermediate traverses at 7700N and 7500N. In addition, the self-potential method could be usefully applied to the entire grid, with the exception of traverses 7200N and 7300N. There would seem to be little justification for extending the survey area to the south, but traverses further north might yield useful information.

Dreadnought area

The main purpose of the ground survey on the western slope of Dreadnought Hill was to determine the extent to which the large aeromagnetic anomaly, which roughly coincides with the hill, could be accounted for by the known basalt dyke just west of the summit. This dyke strikes roughly north and crops out for a distance of about 500 ft along strike. The traverses surveyed in 1950 on Renison Bell Hill had later been extended by Renison Associated Tin Mines N.L. to the summit of Dreadnought Hill for geological mapping and these only required pegging for the magnetic survey. In the limited time available only traverses 400S and 500S could be extended over the summit of the hill, and these only for a few hundred feet. Only these two traverses extend far enough to the east to pick up any possible anomalous field due to the northerly extension of the Federal-Basset Lode system, here termed the Dreadnought Lode. Most traverses cross areas in which 'sills' and 'red rock' have been mapped.

Large magnetic anomalies were detected in the region of basalt outcrop, which appears, both on the ground and from the magnetic results, to be a much less regular body than that depicted in Plate 7. Here the dyke is shown to be only about 20 ft wide, but baked argillite crops out strongly to the east of this position for a maximum distance (on traverse 800S) of nearly 200 ft, and the largest anomalies occur in this area.

The dominant magnetic feature is the very large negative anomaly on traverse 800S; this can only be explained by the assumption that the basalt has a large remanent magnetisation opposed to the present direction of the Earth's field. Remanent fields of this nature are difficult to interpret, since the direction of the remanence vector, which may alter markedly within a body, has a greater effect on the anomaly form than the shape or situation of the body itself. From the magnetic contour pattern it would seem that the simplest explanation would be to postulate two magnetic bodies striking approximately magnetic north and arranged en echelon. The southern body, on this interpretation, would be the source of the larger negative anomaly, most prominent on traverse 800S, and of the magnetic 'high' immediately west of this. The more northerly and westerly body would be the source of the smaller negative anomaly, seen on traverses 700S and 600S, and the associated 'high' to the west. The remanence vector in the two bodies is required to oppose the Earth's field and, in addition, to dip to the west to account for the magnetic 'highs'. Smaller anomalies at 400-550E on 600S require additional sources to be postulated.

Examination of the magnetic profiles makes the above explanation seem less plausible. For instance it requires that the anomaly on traverse 500S, which at first sight appears typical of that due to a dipping dipole, be separated into two parts, the positive peak to be due to one source and the negative peak to another. It should also be noted that the information on which the contours have been drawn is barely adequate and that an approximate northerly strike of the magnetic anomalies has been assumed. Remanence variations within a single body, which may not have, over its entire length, the great vertical extent implied by the term 'dyke', may be sufficient to account for the observed field.

On the ground, the anomalies, considered to be due to basaltic rocks, extend at the most for 600 ft from north to south and possibly rather more than 300 ft from east to west. The largest anomalies are negative, and changes from positive to negative occur very rapidly. The northern profiles suggest a source in that region of limited vertical extent only. In view of these limitations it seems unlikely that the basalt is the source of more than a small part of the aeromagnetic anomaly at Dreadnought Hill; the anomaly therefore seems likely to be largely due to pyrrhotite mineralisation. On traverses 400S and 500S, which were extended beyond the geological traverses and a short way down the east side of Dreadnought Hill, the disturbances due to the dyke are superimposed on a much wider anomaly, with an amplitude of just over 3000 gammas. An anomaly of this type is probably due to a more deep-seated source (the anomaly on traverse 400S suggests a source depth of approximately 100 ft below the surface) and the anomalous field can be expected to decrease less rapidly with increased vertical separation between source and detector. This is probably the anomaly that appears on the aeromagnetic map. Profile C-D (Plate 4) crosses the basalt dyke and, although there is no apparent negative anomaly, it is noticeable that the positive anomaly is much steeper in the west than in the east. It is possible that this is due to an unresolved negative anomaly west of the positive peak. Pyrrhotite in fissures such as the Federal Lode has been oxidised to depths of more than 100 ft, and this could account for the lack of near-surface anomalies when crossing the presumed northerly extension of the Basset Lode. Both the aeromagnetic work and the two northernmost ground traverses suggest the possibility of a repetition of the Federal orebody at Dreadnought Hill.

Other interesting features of the groundresults concern the 'sill' orebodies and the 'red rock' series, and particularly the agreement between the magnetic results and the geological mapping. On traverse 1100S there is a large anomaly over the 'red rock', which is believed to be faulted out just to the north of the traverse. This is confirmed by the absence of major anomalies on 1000S. Samples of 'red rock' collected in and near this area show a wide range of susceptibilities but are generally quite strongly magnetic (Appendix B). A broad anomaly on traverses 700S, 800S, and 900S is the only feature not satisfactorily accounted for by the surface mapping. The source may possibly be in the No.1 sill, whose non-appearance on the ground poses several geological problems. No.1 sill normally shows only weak pyrrhotite mineralisation, but a small magnetic anomaly appears over its outcrop further north on traverse 400S. The 'red rock' in this section gives rise to relatively small anomalies. A sharp anomaly just west of the base line on 500S suggests faulting in the 'red rock' or possibly a small magnetic lens within it.

Cuni area (aeromagnetic)

A single flight was made at Cuni when conditions were too turbulent at Renison Bell. There was also too much turbulence to fly Cuni in the preferred direction, along westerly directed flight-lines, so the lines were flown on a southerly heading, parallel to the dolerite sill. In view of this and the fact that ground surveys have shown the sill to be only slightly magnetic, it is not surprising that it is not indicated on the aeromagnetic contour map. A weak linear anomaly suggests that a second sill runs parallel to the dolerite and about ¼ mile west of it, but this anomaly could be due merely to a magnetic bed within the Crimson Creek Formation. The broad circular anomaly on the western edge of the surveyed area is not a surface feature and no explanation can be postulated at present. An aeromagnetic survey along westerly directed flight lines, covering not merely the small area shown but the whole of the Melba Flat, would probably yield useful information.

The flight was made with the recorder set at a sensitivity of 100 gammas full-scale deflection. At this sensitivity the magnetometer, giving readings at ½-second intervals, was unable to resolve the highly disturbed field over the serpentinite. Consequently the three eastern lines could not be contoured or interpreted and are therefore not indicated in Plate 3. It is not possible to say whether further flights would detect magnetite segregations, but it would seem probable.

Conclusions

Anomalies on Dreadnought Hill and east of the Dalcoath workings appear on the aeromagnetic contour map (Plate 3) and are thought to be due to mineralisation of the pyrrhotite - pyrite type. Anomalies known to be due to such mineralisation were detected at the Federal Lode and at Renison Bell Hill. The magnitude of the anomaly at Renison Bell Hill suggests that the mineralisation there is more extensive than is estimated at present.

Extension of the ground magnetic survey to the eastern side of Dreadnought Hill would allow a drilling target to be selected, but it is probable that this area will be drilled systematically in any case as part of the normal development of the Federal Lode. No extension of the Federal Lode has been detected to the south, except possibly near the Battery Mine. Ground geological work, or possibly other geophysical surveys, should precede further magnetic surveying east of Dalcoath since it is by no means certain that the anomaly is due to mineralisation.

The large double anomaly about one mile due east of Renison Bell township is not thought to be due to mineralisation, but the possibility should be tested, perhpas by other geophysical methods.

The survey did not cover those areas to the north of the road where further extensions of the Dreadnought or Renison Bell Lodes might have been detected, nor the area immediately north of Pine Hill. It is considered that reconnaissance geophysical (preferably magnetic) surveys would be warranted in these areas.

The results of the ground survey east of the Federal Lode are purely negative and further ground surveys in this area are not recommended. Further ground traverses near the Dalcoath workings, however, might provide useful information.

No recommendations for ground work are made with regard to the Cuni area, but further airborne surveys would probably be justified.

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APPENDIX A

Operational details

Survey specifications

Height: Nominally 280 ft above ground level for the aircraft and 250 ft above ground level for the detector (in towed-bird assembly). Aircraft height and bird position relative to aircraft fluctuated considerably over rugged terrain.

Line spacing: Nominally 1/10 mile but actually averaging 1/13 mile at Renison Bell.

Flight direction: East in Renison Bell area, south in Cuni area.

Sensitivity (airborne magnetometer): 100 gammas or 1000 gammas full-scale deflection.

Ground traverse spacings: Usually 100 ft but modified at Dalcoath and East Federal.

Ground station spacing: 25 ft.

Grid: Renison Associated Tin Mines N.L. (Dalcoath and East Federal), B.M.R. (Dreadnought).

Traverse direction: Grid east. Traverses cleared and pegged by Renison Associated Tin Mines N.L.

Equipment

Magnetometer: MNS1 nuclear magnetometer, reading total absolute magnetic field at half-second intervals, fiducial pulses occurring at four-second intervals.

Recorder: Moseley, with six-inch rectilinear chart running normally at four inches per minute, but on occasions eight inches per minute.

Radio altimeter: AN/APN-1 with outputs to cockpit dial and limit light system, and to recorder.

Recorder for radio altimeter: TIC six-inch curvilinear chart.

Camera: Modified Vinten camera with wide-angle (186°) lens. One exposure on 35-mm film at four-second intervals.

Ground magnetometer: ABEM vertical force variometer No.4, reading to ± 1 gamma.

Personnel

B.M.R.: J. Milsom, R. Buckley, I. Parkinson, S. Scherl, J. Williams, P. Zerial.

T.A.A.: First Officer G.B. Litchfield.

Operations

The road party arrived in Zeehan on 28th April and left on 20th May. The aircraft arrived in Zeehan on 3rd May and left on 15th May. J. Milsom remained in Zeehan until 29th May to complete the ground survey.

APPENDIX B

Susceptibilities of rock samples

'Red rock'

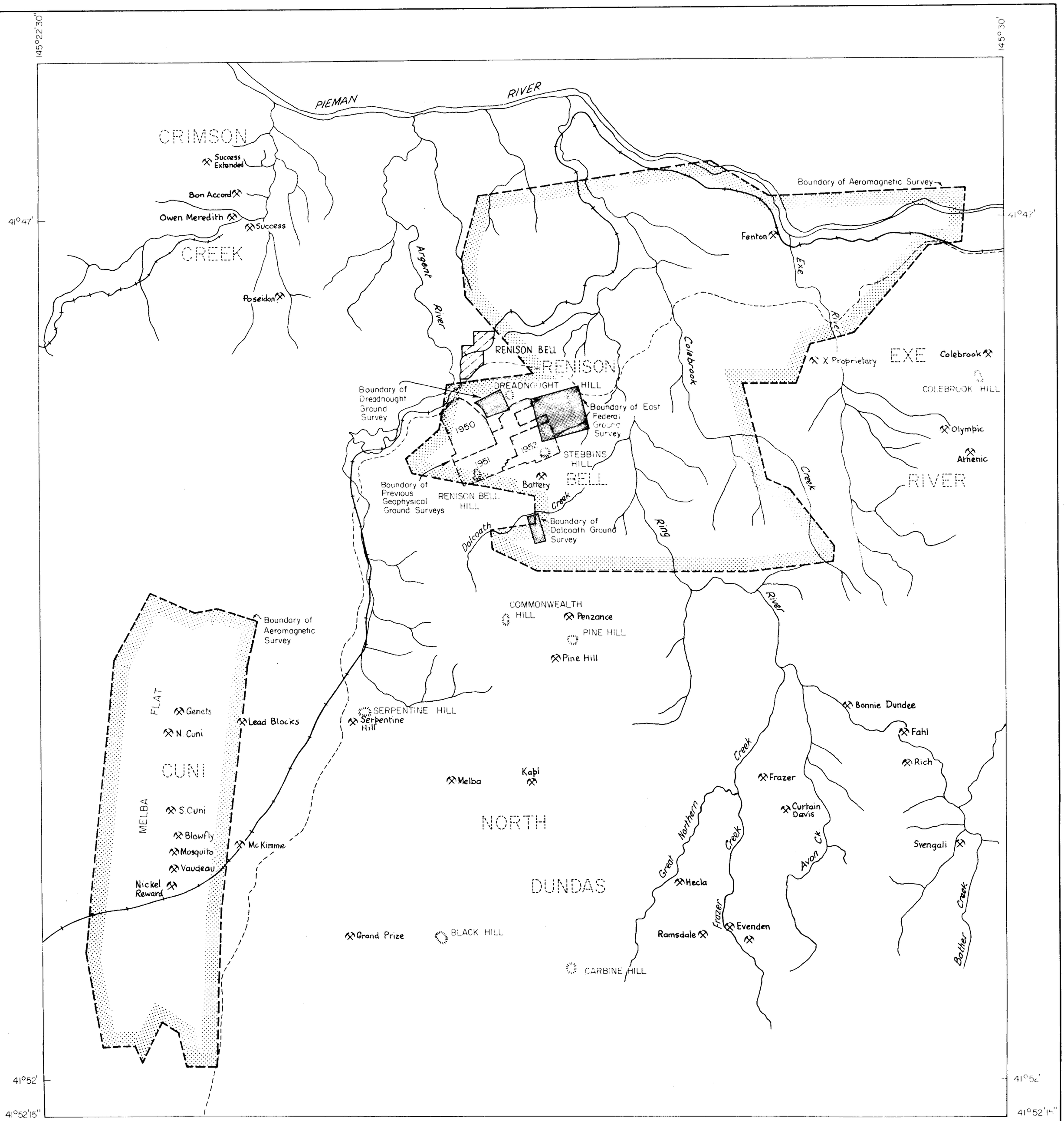
All samples were collected between Renison Bell Hill and Dreadnought Hill. All are slightly weathered samples taken from the surface.

Sample No.	Description	Susceptibility (10^{-3} cgs)
R1	Fine-grained pink sandstone	0.053
R2	Fine-grained pink sandstone with quartz veinlets	1.0
R3	Silicified pink sandstone with quartz veinlets	0.32
R4	Pink to dark brown sandstone with quartz veinlets	5.2
R5	Medium-grained pink sandstone with small iron-rich fragments	8.4
R6	Slightly silicified fine-grained pink sandstone	6.4
R7	Fine-grained pink sandstone with a little quartz	2.8

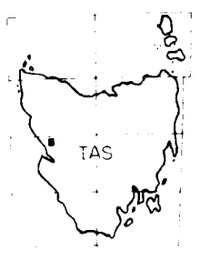
Dalcoath area

Positions refer to the geophysical traverses (Plate 6) with depths below surface.

Position	Description	Susceptibility (10^{-3} cgs)
8000N/200W; surface	Argillite with slight pyrite	0.095
7600N/90E; 30 ft	Pyrrhotite with some other sulphides	1.2
7550N/50E; 15 ft	Argillite from orebody hanging wall, slightly mineralised	0.026
7400N/360E; surface	Gabbro	0.12
7550N/00; 2 ft	Oxidised sulphide ore, spongy, black	0.026
8010N/00; surface	Argillite	0.053
Pine Hill track; surface	Gabbro	0.17



LOCATION DIAGRAM



DETAILED MAGNETIC SURVEYS, 1964
TASMANIA

RENISON BELL AREA

LOCALITY MAP

SCALE

0 1 2 MILES

LEGEND

- River or creek
- Railway
- Road or track
- Mine or prospect
- Hill feature

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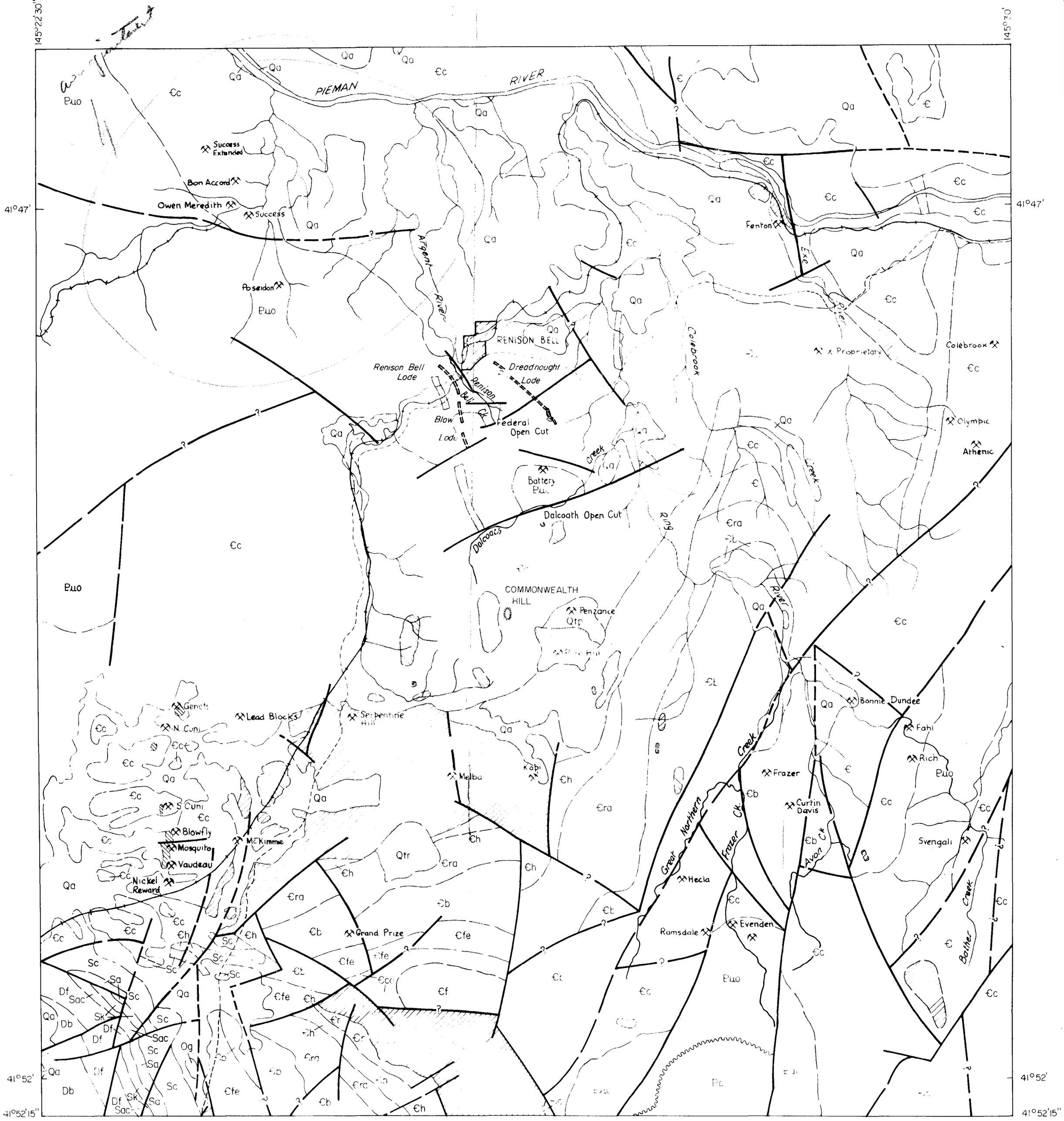
TO ACCOMPANY RECORD No. 1964/158



GEOLOGICAL LEGEND

QUATERNARY	Qa	Sand, soil and alluvium
	Qtμ	Quartz porphyry talus
	Qtr	Conglomerate talus
DEVONIAN	Db	Bell Shale
	Df	Florence Quartzite
SILURIAN	Sac	Austral Creek Siltstone
	Sk	Keel Quartzite
	Sa	Amber Slate
	Sc	Crotty Quartzite
ORDOVICIAN	Og	Gordon Limestone
CAMBRIAN — DUNDAS GROUP	€f	Fernflow Formation
	€cc	Comet Formation
	€fe	Fernfields Formation
	€b	Brewery Junction Formation
	€ra	Razorback Conglomerate
	€h	Hodge Slate
	€r	Red Lead Conglomerate
	€	Unassigned
	€c	Crimson Creek Formation
PROTEROZOIC	Puo	Ocnah Quartzite and Slate
	Pc	Concert Schist

DETAILED MAGNETIC SURVEYS, 1964
TASMANIA

RENISON BELL AREA

GEOLOGY

SCALE

1 0 2 MILES

GEOLOGICAL LEGEND

DEVONIAN	Quartz porphyry
CAMBRIAN	Serpentinite and pyroxenite
	Gabbro, norite, and dolerite
	Lode
	Fault
	Fault inferred or concealed
	Geological boundary
	Unconformity

TOPOGRAPHICAL LEGEND

- River or creek
- Railway
- Road or track
- Mine or prospect
- Open cut
- Hill feature

Geology based on 1:63,360 geological map "Zeehan" published by the Department of Mines, Tasmania

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K55/BI-17

TO ACCOMPANY RECORD No. 1964/158

145°22'30"

145°30'

41°46'

41°49'30"

41°52'

145°26'

PIEMAN

HUSKISSON RIVER

Success Creek

Crimea Tramway

Creek

RIVER

Almura Creek

RING RIVER

Renison Bell

Isaacson Creek

Dreadnought Hill

ARGENT

Stebbins Hill

Renison Bell Hill

Dolcoath

DALCOATH OPEN CUT

Creek

Colebrook Hill

Colebrook Creek

Exe Creek

RIVER

Commonwealth Hill

Pine Hill

HENTY RIVER

Creek

LITTLE Cuni

Sligo Creek

Serpentine Hill

Melba Creek

Nevada Tramway

Black Hill

Creek

DETAILED MAGNETIC SURVEYS, 1964
TASMANIA

RENISON BELL AREA

TOTAL MAGNETIC INTENSITY CONTOURS

SCALE

1 0 1 MILES

GEOPHYSICAL LEGEND

2,000 / 1,000 — Aeromagnetic contours with flight-line intersections

GEOLOGICAL LEGEND

Basalt dyke

DEVONIAN — Quartz porphyry

CAMBRIAN — Serpentinite and pyroxenite

CAMBRIAN — Gabbro, norite and dolerite

CONTOUR INTERVAL

RENISON BELL:- 100 GAMMAS

CUNI:- 20 GAMMAS

12°10' TRUE NORTH MAGNETIC NORTH

TOPOGRAPHICAL LEGEND

River or creek

Main road

Road or track

Railway

Hill feature

Open cut

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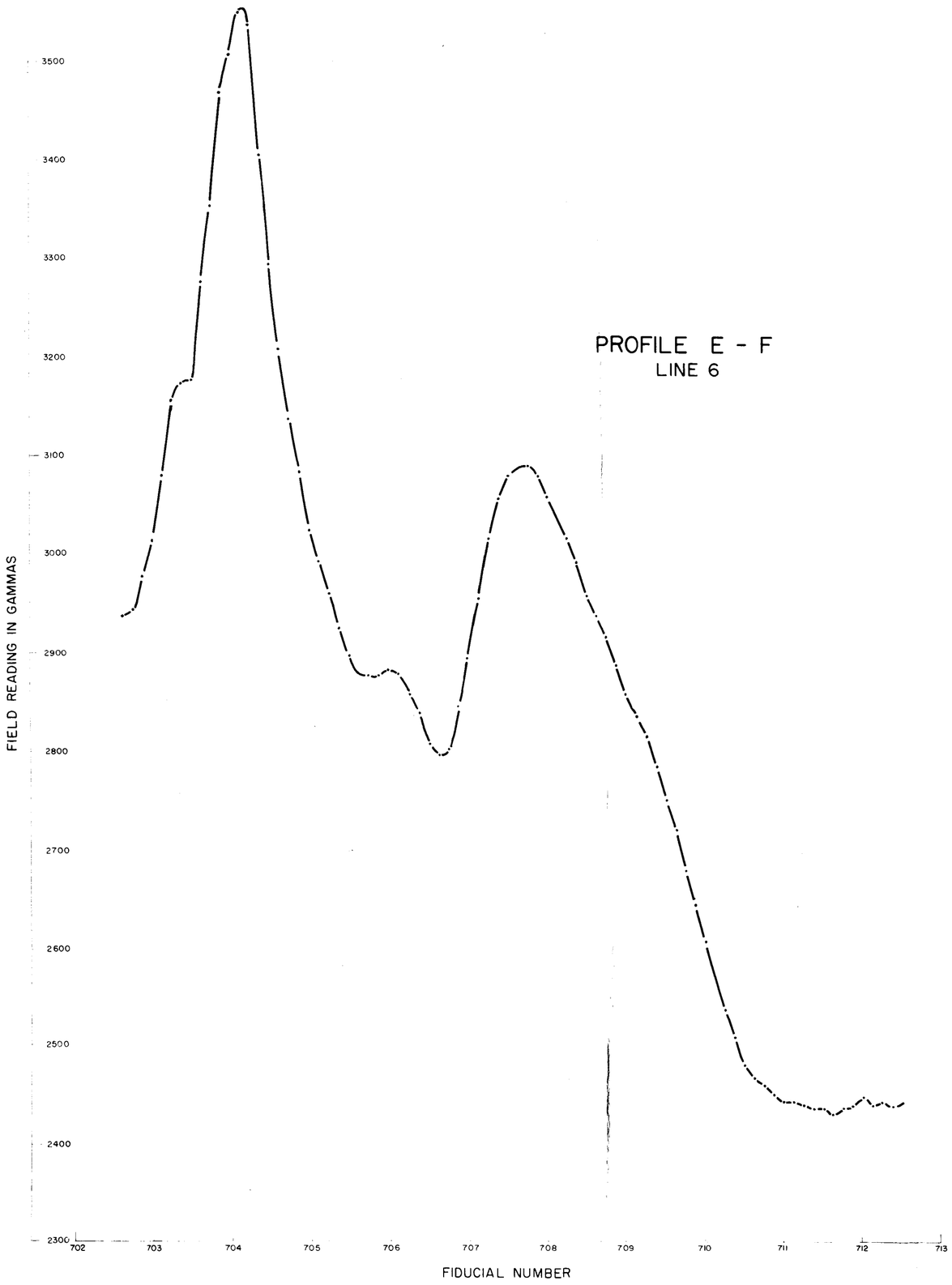
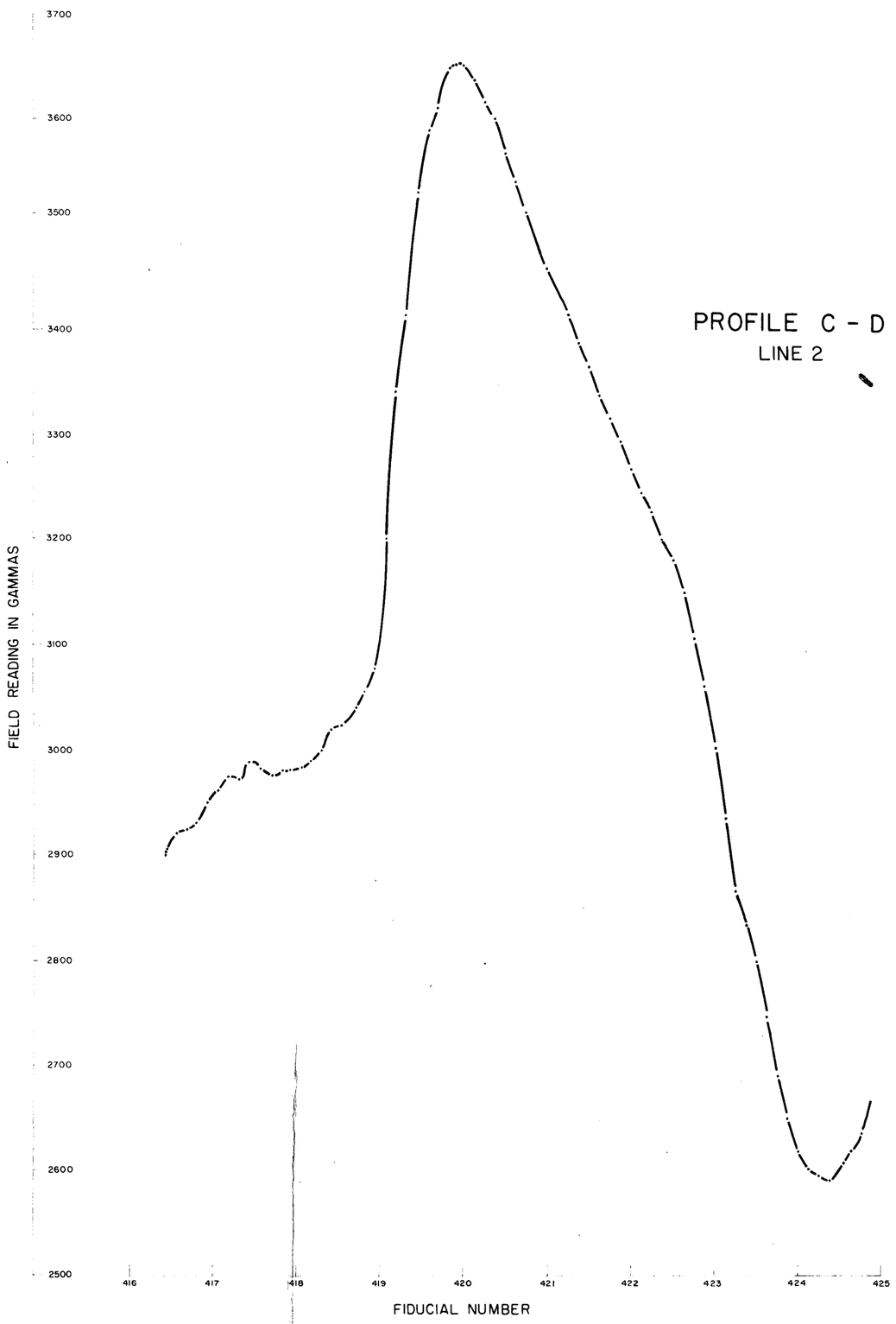
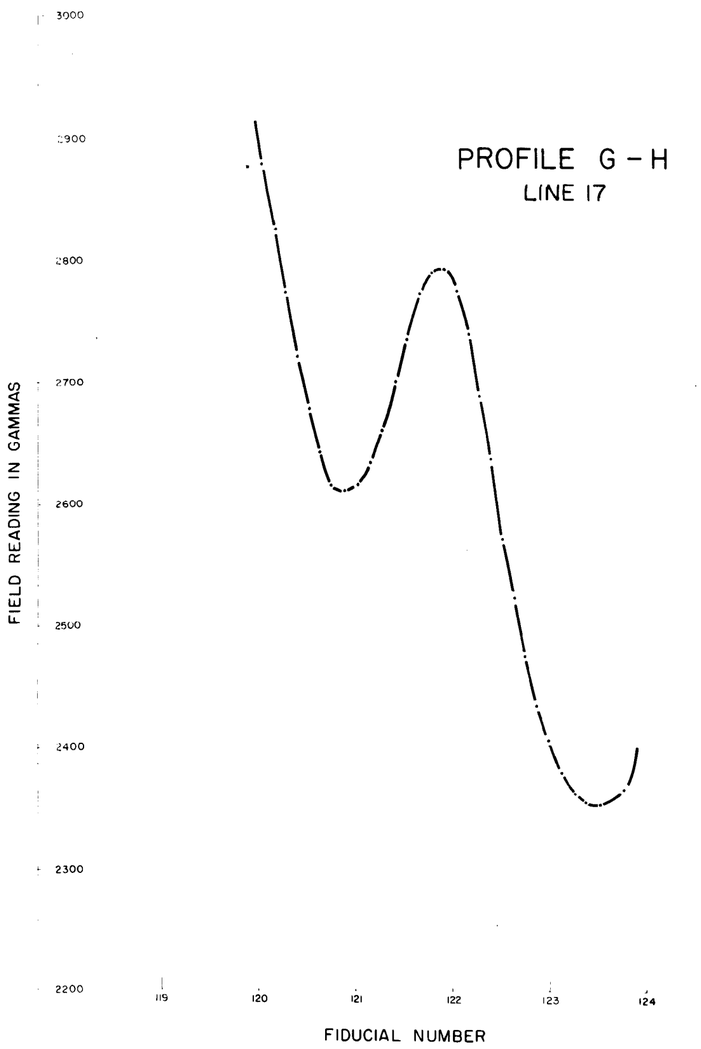
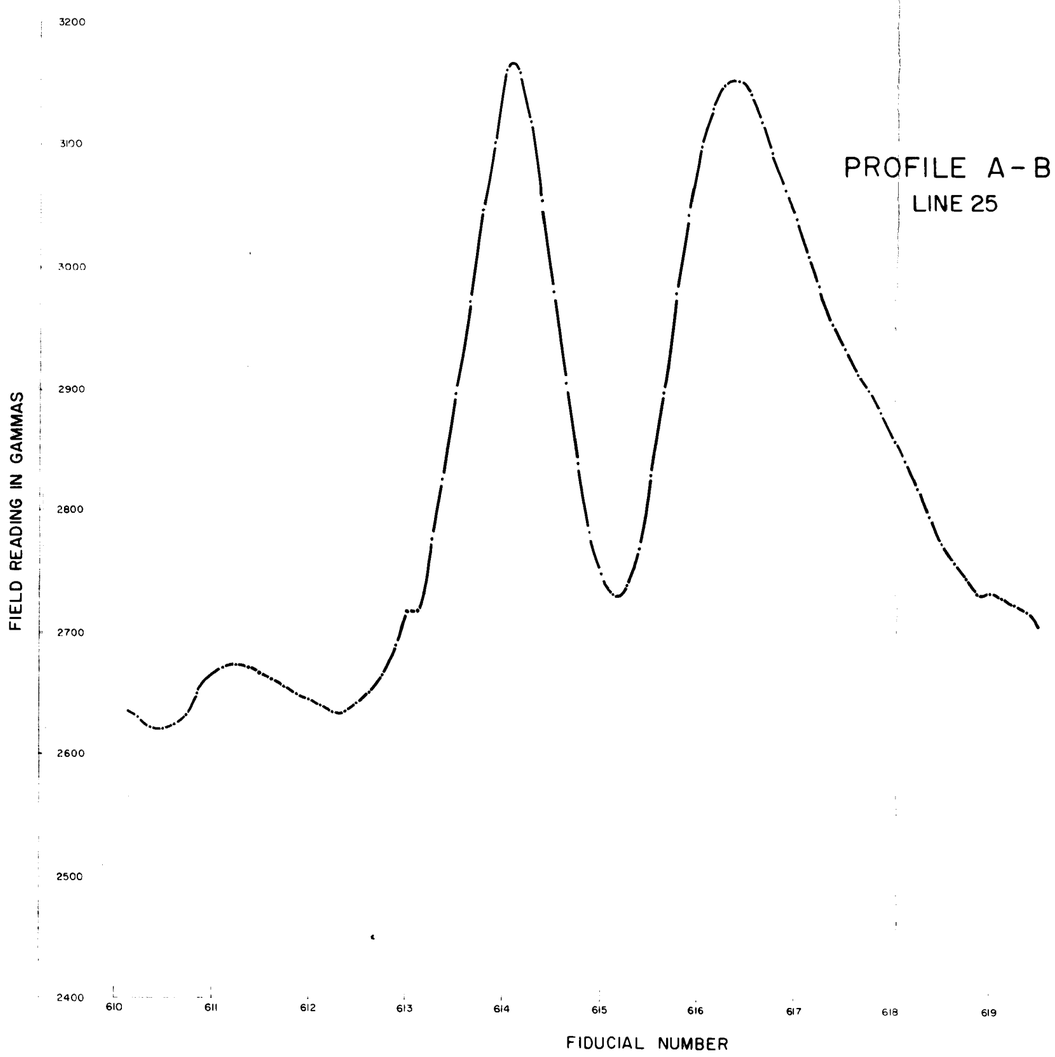
K55/BI-19

TO ACCOMPANY RECORD No. 1964/158









DETAILED MAGNETIC SURVEYS, 1964

TASMANIA

RENISON BELL AREA

SELECTED

AEROMAGNETIC PROFILES

FOR LOCATION OF PROFILES SEE PLATE 3

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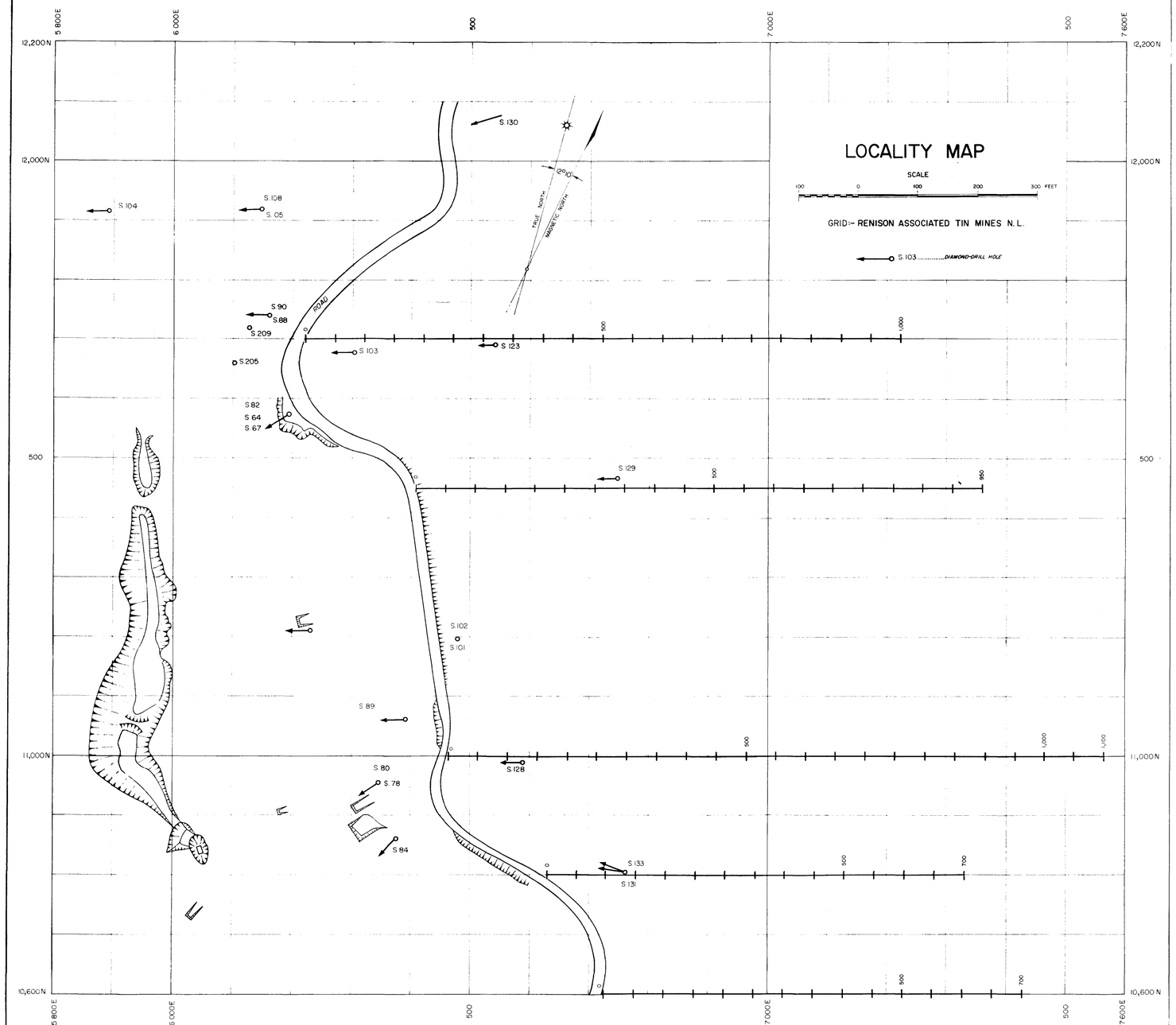
TO ACCOMPANY RECORD No. 1964/158



LOCALITY MAP

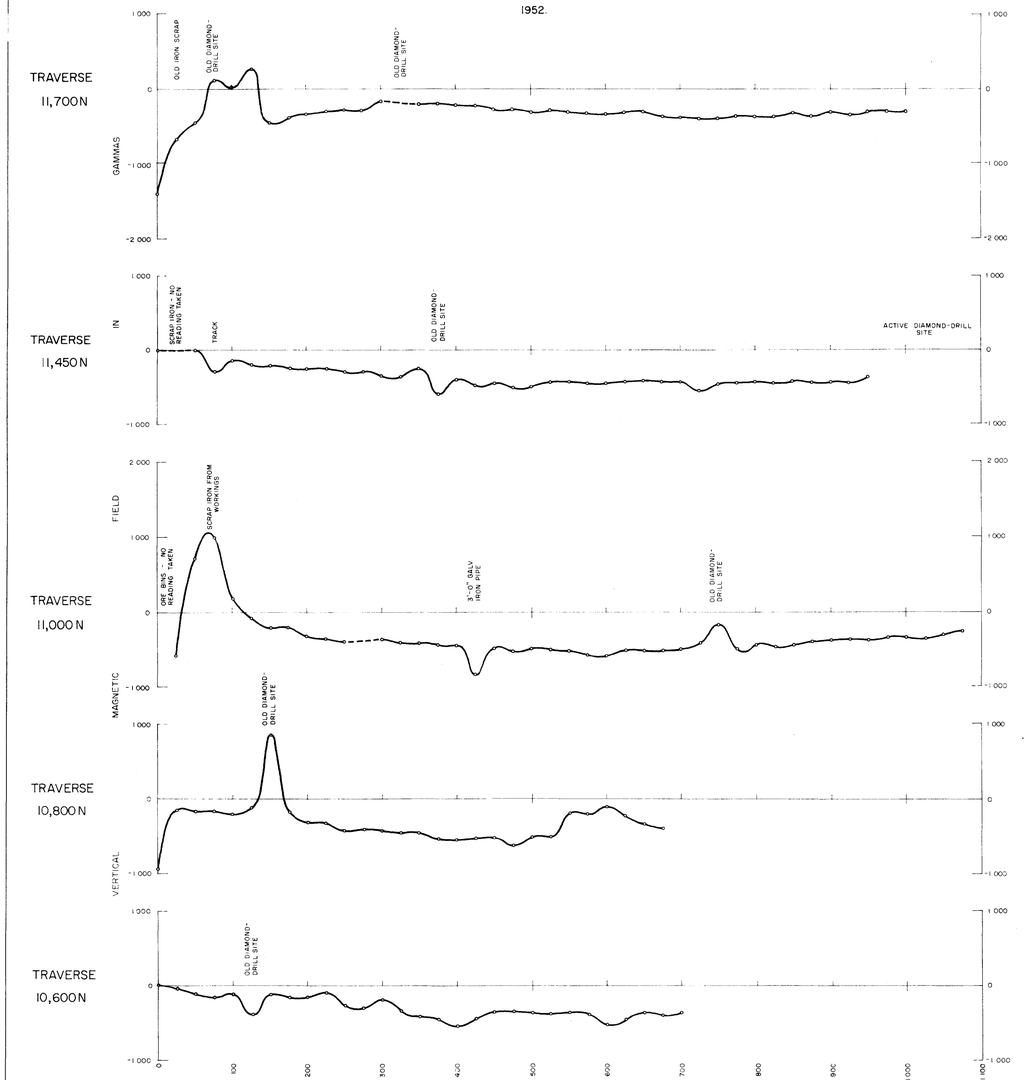
SCALE

100 0 100 200 300 FEET

GRID:- RENISON ASSOCIATED TIN MINES N.L.

S.103 ..... DIAMOND-DRILL HOLE

LOCAL BASE:- BASE VALUE APPROX.
450 GAMMAS ABOVE BASE USED 1950-1952.



DETAILED MAGNETIC SURVEYS, 1964

TASMANIA

RENISON BELL AREA

MAGNETIC VERTICAL FORCE PROFILES - EAST FEDERAL AREA

SCALE

100 0 100 200 300 400 500 FEET

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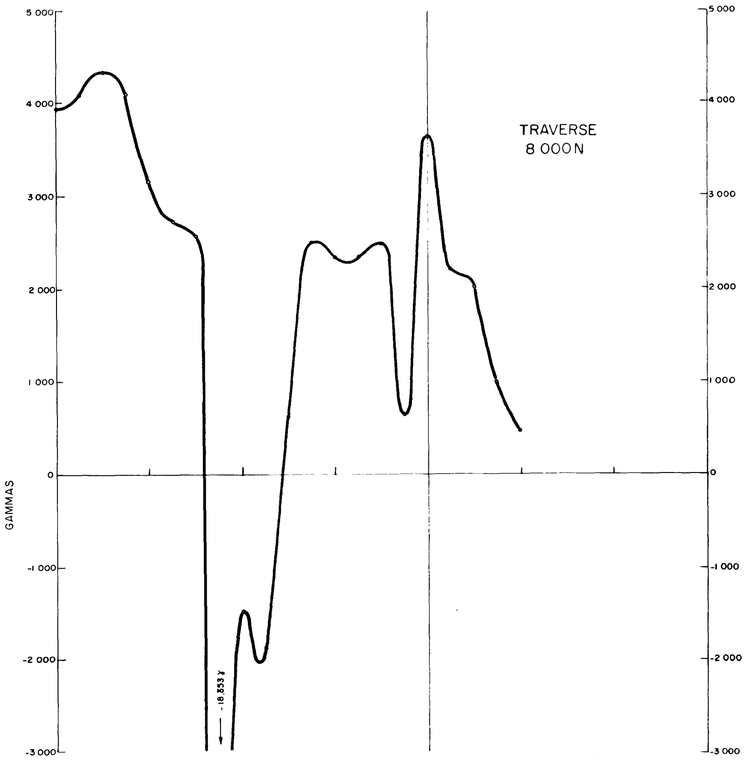
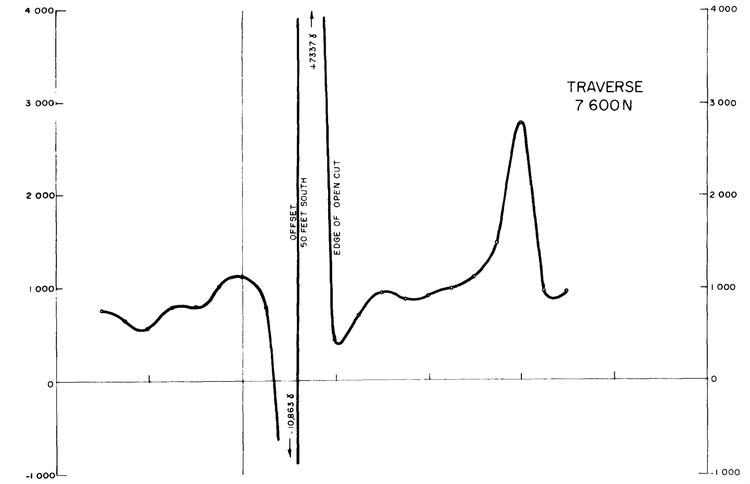
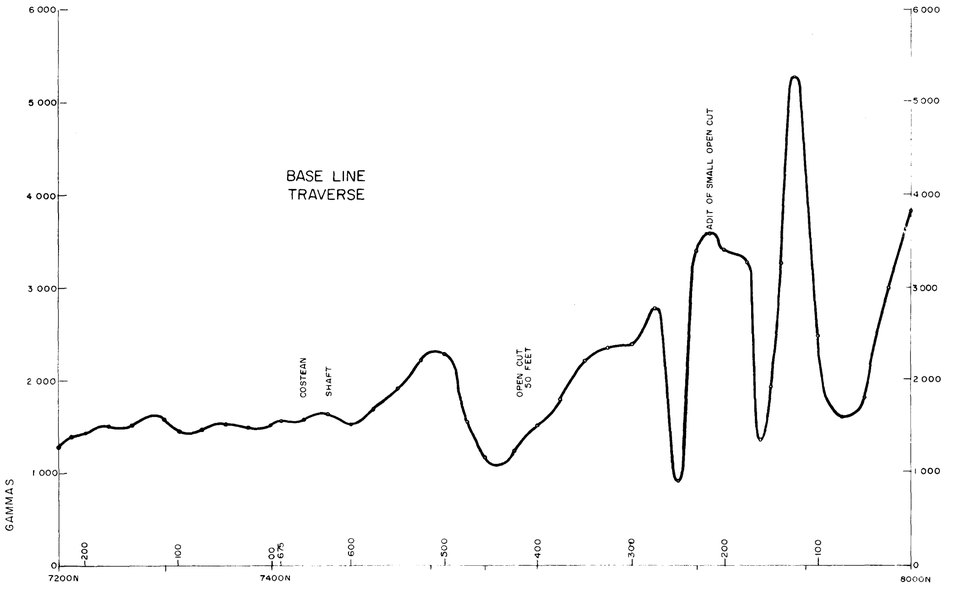
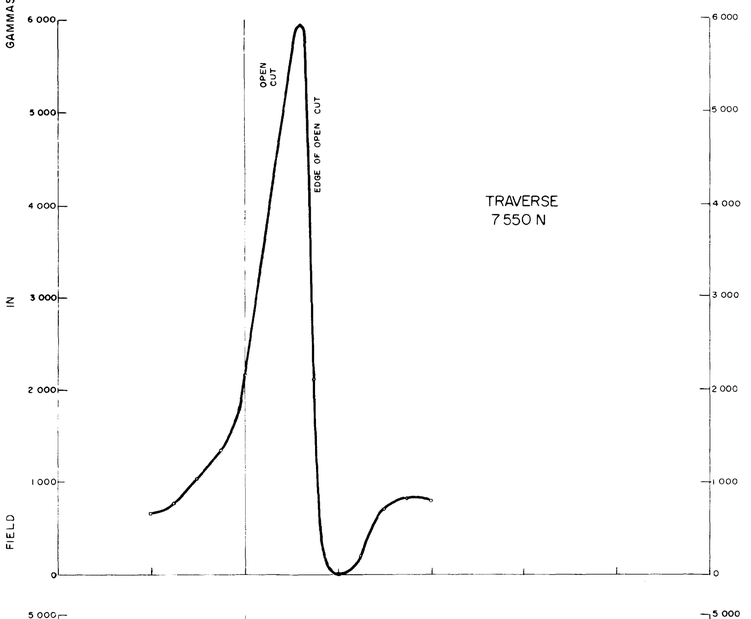
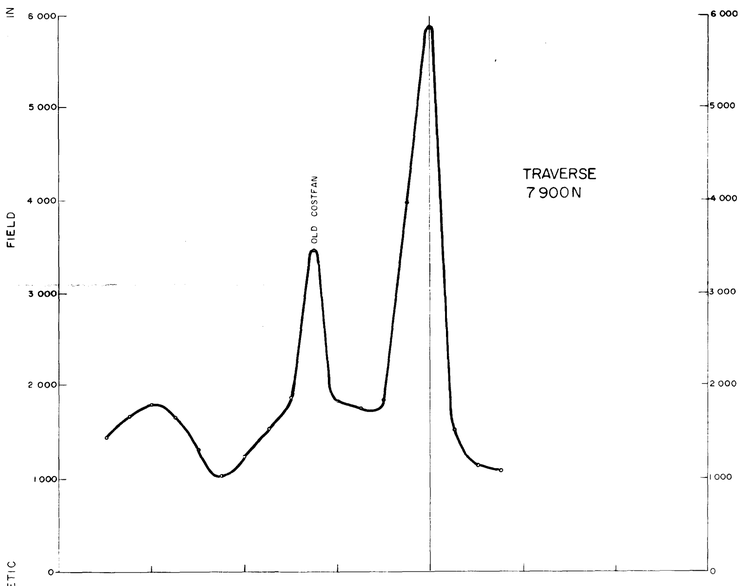
TO ACCOMPANY RECORD No 1964/158

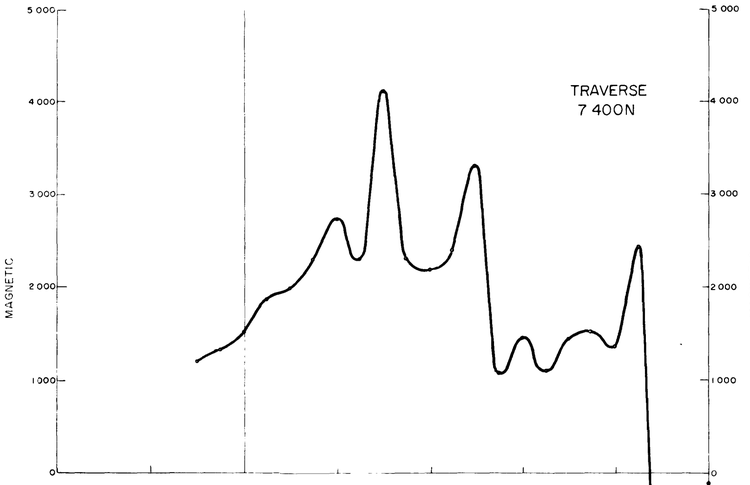


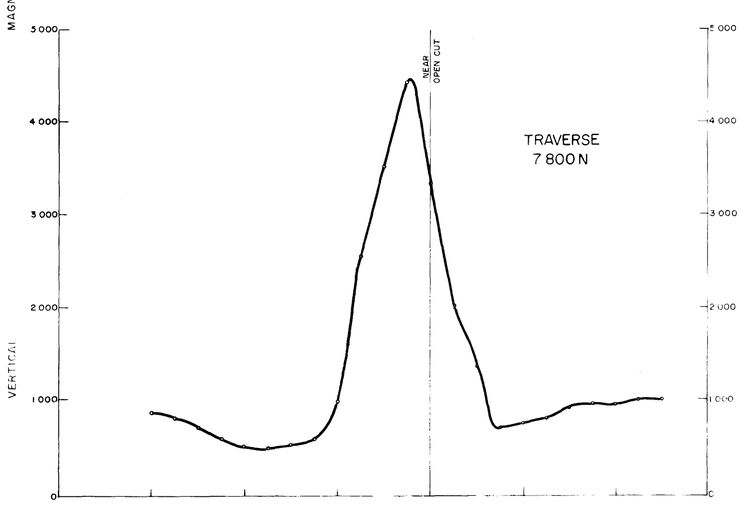


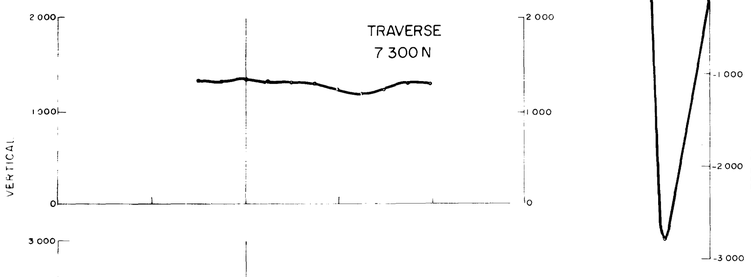


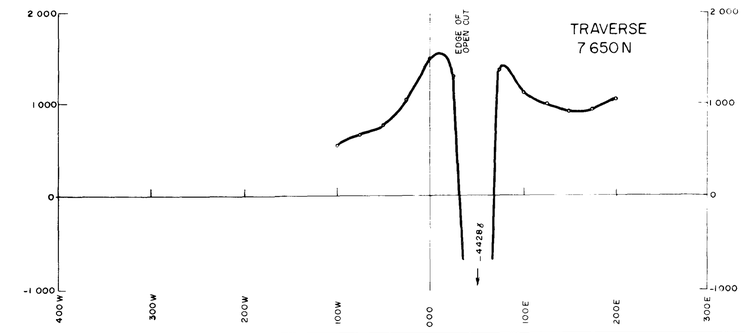


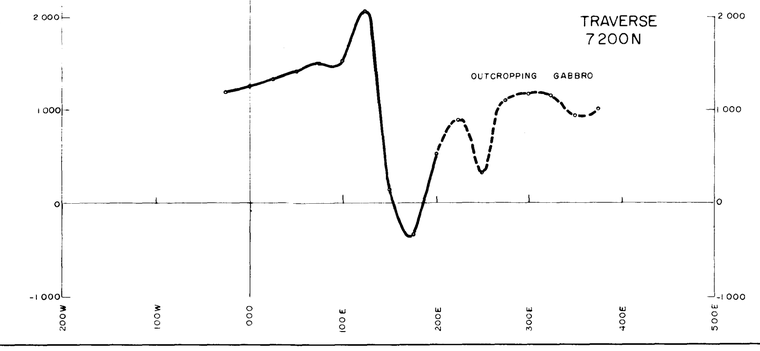


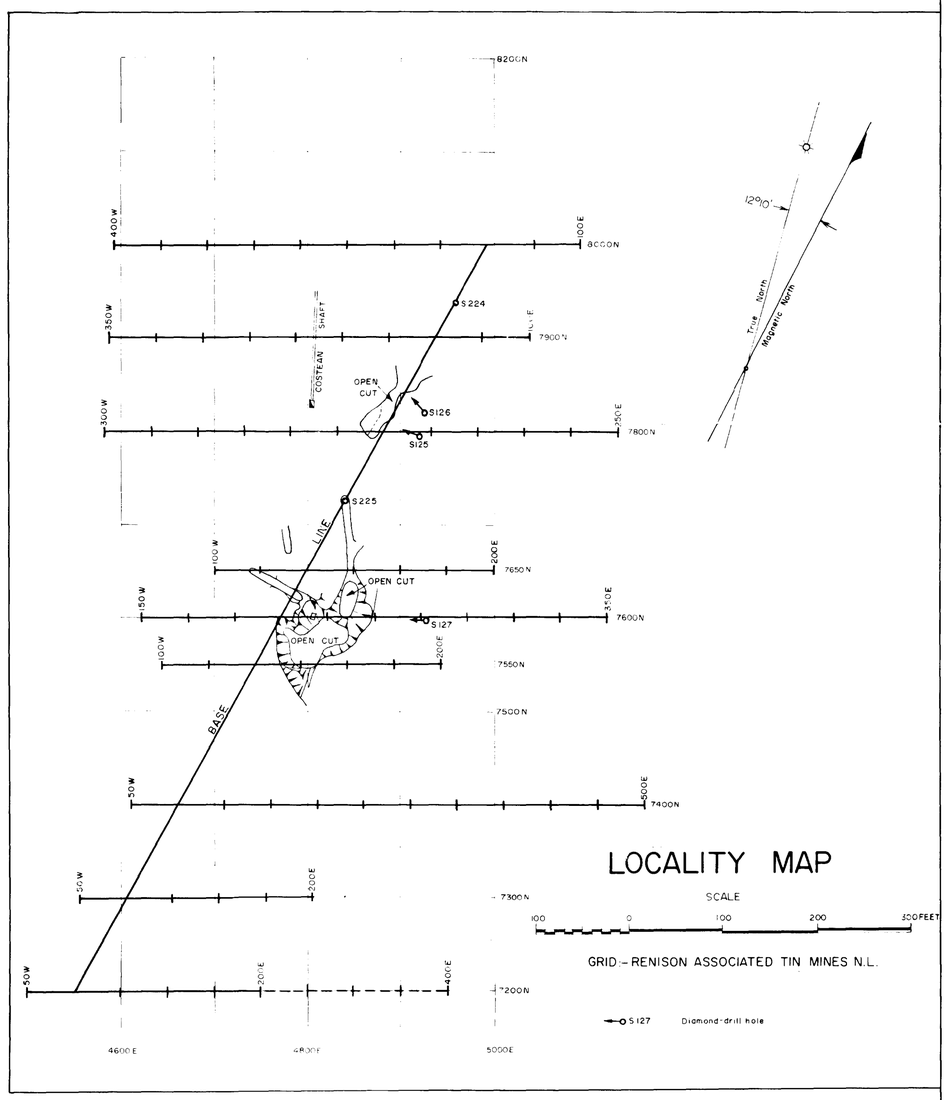












DETAILED MAGNETIC SURVEYS, 1964
TASMANIA

RENISON BELL AREA

MAGNETIC VERTICAL FORCE PROFILES – DALCOATH AREA

SCALE
100 0 100 200 300 400 500 FEET

LOCAL BASE:- BASE VALUE APPROX. 100 GAMMAS
BELOW BASE USED 1950-1952.

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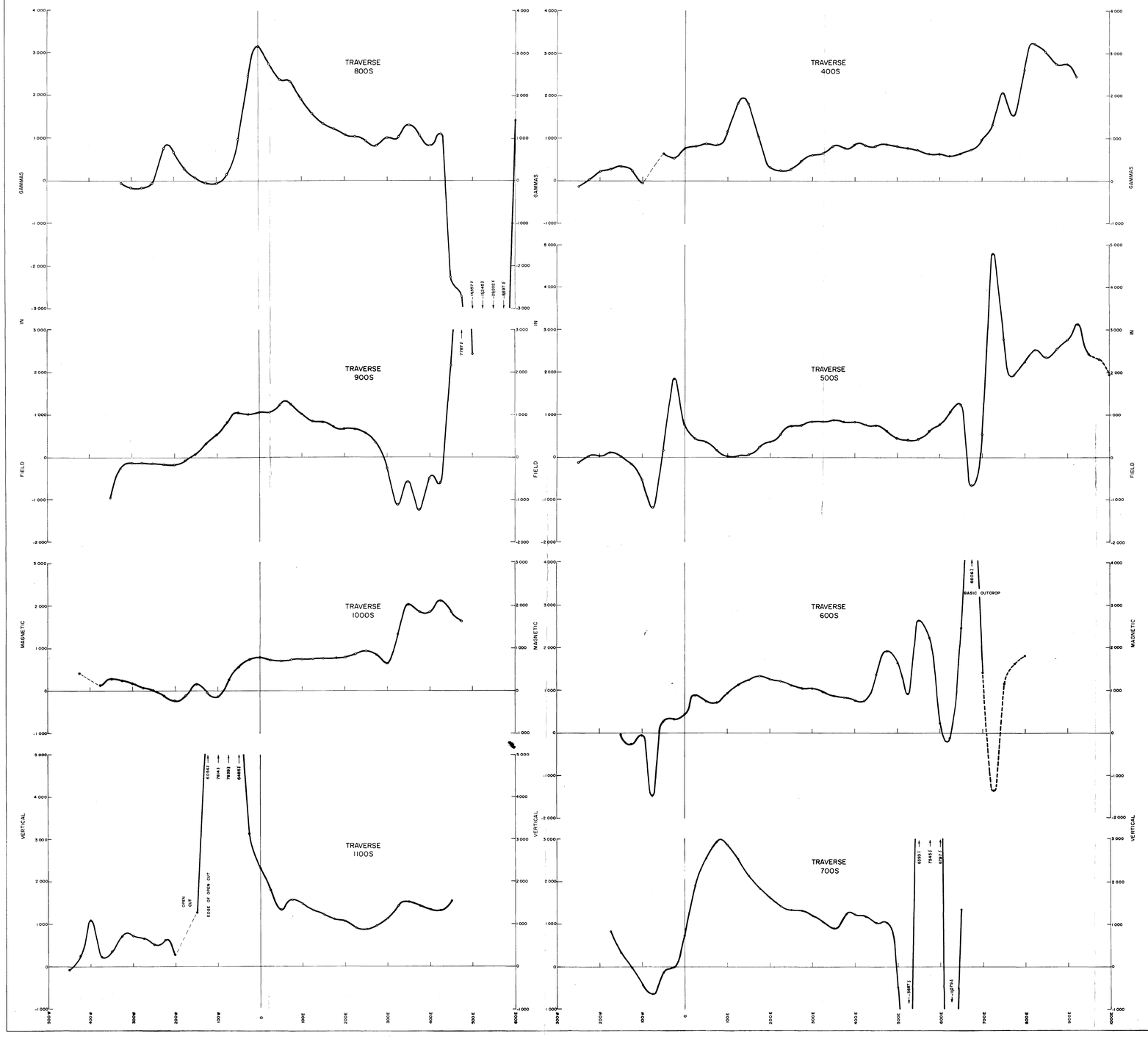
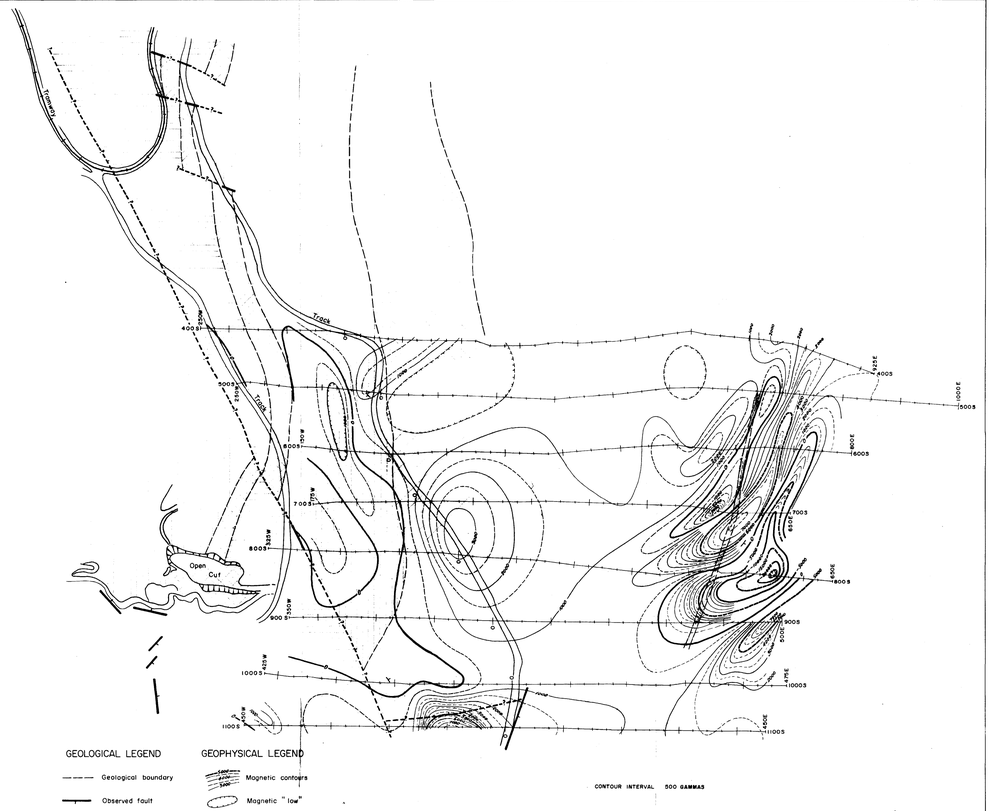




GEOLOGICAL LEGEND

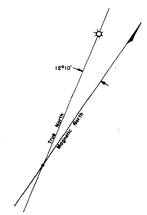
- Geological boundary
- Observed fault
- Inferred fault
- Argillite
- No.1 sill
- Red rock
- No.2 sill
- Renison Bell shales
- Basalt dyke

GEOPHYSICAL LEGEND

- Magnetic contours
- Magnetic "low"

GEOPHYSICAL GRID, GEOLOGY AND MAGNETIC VERTICAL FORCE CONTOURS

GEOLOGY SUPPLIED BY RENISON ASSOCIATED TIN MINES N.L.



DETAILED MAGNETIC SURVEYS, 1964
TASMANIA

RENISON BELL AREA

MAGNETIC VERTICAL FORCE PROFILES AND CONTOURS DREADNOUGHT AREA

SCALE

100 0 100 200 300 400 500 FEET

Geophysical Branch, Bureau of Mineral Resources, Geology and Geophysics K55/81-22

TO ACCOMPANY RECORD No. 1964/158