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SOUTHERN CAPE YORK PENINSULA AIRBORNE MAGNETIC AND RADIOMETRIC SURVEY, QUEENSLAND 1969

by

E.P. Shelley, D.N. Downie and J.E. Rees

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SUMMARY

During the period August to November 1969, an airborne magnetic and radiometric survey was made over a portion of the southern Cape York Peninsula, Queensland. This record presents and discusses the results.

Contours of depth to magnetic basement were constructed in the Carpentaria Basin. The basin deepens to the northwest reaching 700 m below sea level at the northwest boundary of the survey area. A shallow basement depression has been interpreted in the southeast part of the basin with a ridge extending from it to the northwest.

Areas of moderate magnetic disturbance over the Tasman Geosyncline were correlated with Permian volcanics, with the Barron River Metamorphics, and with shearing associated with granite intrusions. The rest of the region was generally undisturbed. Several areas have been recommended for detailed prospecting.

Anomalies offshore are possibly related to the pre-Cainozoic surface, and appear to be associated with passages between the reefs.

Radiometric data were analysed statistically, and the results interpreted in terms of surface geological units. Strong radiometric anomalies were correlated with acid volcanics, Precambrian metamorphic rocks, and some granitic rocks and drainage systems.

1. INTRODUCTION

A regional airborne magnetic and radiometric survey was made by the Bureau of Mineral Resources (BMR) over a portion of southern Cape York Peninsula, Queensland, during the period August to November 1969. The 1:250,000 map areas of WALSH*, MOSSMAN, and CAIRNS (land area) were covered and the survey was extended seawards to the edge of the Great Barrier Reef (Plate 1).

East-west survey lines were flown at 1.6 km spacing at an average altitude of 250 m above ground level. Every fourth line was flown offshore.

The objectives of the survey were to determine rock structures and thicknesses in the Carpentaria Basin as an aid to oil prospecting, and to provide magnetic and radiometric data to assist mineral exploration in the Mossman and Cairns regions. The offshore part of the survey area was flown as an aid to the study of crustal structure in this area.

Regional gravity surveys of the Great Barrier Reef and its adjacent coastal areas between Townsville and Cape Melville were made by BMR from 1954 to 1960 and are described by Dooley (1965). The surveys extend almost half way across the MOSSMAN area. The main gravity feature of the area is the marked regional trend which parallels the coast and is almost certainly due to crustal thinning at the edge of the continent. Superimposed on this trend are broad negative anomalies, which correlate in places with exposed granites and elsewhere may indicate areas where granite is present beneath the Palaeozoic and Mesozoic sediments.

In 1958 a seismic survey was made by BMR in the Carpentaria Basin (Robertson & Moss, 1959). Two traverses were shot in the WALSH area. One, midway between 'Highbury' and 'Gamboola', yielded a basement depth of 330 m below sea level and the other, about 21 km SSW of 'Drumduff', a depth of 650 m. It was inferred from the basement depth values that in the southeast of WALSH either the basin deepens rapidly from the margin or the margin is faulted.

An airborne magnetic and radiometric survey of the HERBERTON 1-mile map area was made by BMR in 1967 (Waller, 1968) to evaluate the application of these methods in delineating different granites. He found no close correlation between the magnetic and geological data and concluded that the use of airborne magnetic and radiometric methods in this area was limited. Waller (1968) also determined the susceptibilities of some rocks from the HERBERTON area. He records the susceptibility of granites and the Hodgkinson Formation as 'very small' and the Featherbed Volcanics as having a susceptibility of the order of 2×10^{-5} c.g.s.

* Throughout this Record the names of standard 1:250,000 Sheet areas are written in capitals to distinguish them from ordinary place names.

2. GEOLOGY

Systematic geological mapping by joint parties from BMR and the Geological Survey of Queensland was carried out over the area from 1960 to 1966. Geological maps at 1:250,000 for CAIRNS and MOSSMAN areas have been published and a preliminary edition of the WALSH area is available.

These maps, together with the works of Fardon & de Keyser (1964) and Amos & de Keyser (1964), constitute the main source material for the following geological description of the area. Other important references used are Fairbridge (1950), White (1961), de Keyser (1961), de Keyser & Wolff (1964), and the relevant parts of 'The Geology of Queensland' (Hill & Denmead, 1960)

Most of the west and south of the survey area is of low relief. A broken strip of granite and metamorphic mountains extends along the coast with some peaks rising to 1400 m. The south of MOSSMAN Sheet area is also generally mountainous. The Great Dividing Range is poorly defined in this area, having a general trend of NNW from the southeast corner of MOSSMAN to Mount Amy in the north part of MOSSMAN Sheet.

The geology of the survey area has been described in five sections:

(1) The Precambrian shield in the central north part of the area.

(2) The Palaeozoic Tasman Geosynclinal zone in the east.

(3) The Mesozoic deposits of the Carpentaria Basin in the west.

(4) The Cainozoic rocks and coral reefs.

(5) The economic geology of the survey area.

The Precambrian shield

The oldest rocks exposed in the survey area belong to the Precambrian. Presumably these also form the basement rocks of the latter geosynclines and basins.

In the central north part of the survey area, Precambrian rocks crop out over an area of about 2200 square kilometres. They comprise part of the northern end of the Georgetown Inlier (White, 1961), and consist largely of almandine-amphibolite schists and gneisses belonging to the Dargalong Metamorphics.

The Precambrian rocks were intruded by a large, generally concordant, Devonian batholith - the Kintore Adamellite - composed mainly of biotite-muscovite adamellite (Whitaker & Willmott, 1968).

Little is known of the structure of the Precambrian rocks in the survey area. However, outside the area, in the southern and central parts of the Georgetown Inlier, the main trends are NW to WNW with regional dips to the SW (Hill & Denmead, 1960).

The Tasman Line, which separates the Palaeozoic Tasman Geosyncline in the east from the Precambrian in the west, is formed in the survey area by the Palmerville Fault. This fault, downthrown to the east, is regarded by de Keyser (1963) as a major structure extending from Princess Charlotte Bay in the north to Townsville in the south. It has been active since the Silurian with latest movements in the Cainozoic.

To the west, the Precambrian rocks underlie the sediments of the Carpentaria Basin.

The Tasman Geosyncline

The Palaeozoic rocks of the Tasman Geosyncline occupy a strip about 130 km wide between the coast and their faulted western boundary with the Precambrian shield.

The oldest rocks exposed in the geosynclinal region are the Upper Silurian to Lower Devonian Chillagoe and Mount Garnet Formations. These were deposited in a broad continental shelf environment, the Chillagoe Shelf (Hill, 1951), and form the western margin of the Palaeozoic rocks.

The Chillagoe Formation occurs in a strip 3 to 14 km wide in the west of the MOSSMAN Sheet area. It is faulted against Precambrian metamorphics and must also be separated from them by a major unconformity. The formation consists of an estimated 1500 to 3000 m of sediments and volcanics including fossiliferous reef limestone, bedded chert, quartz-greywacke, siltstone, conglomerate lenses, and interbedded basalts (Amos & de Keyser, 1964).

The Mount Garnet Formation, which crops out in the southwest of MOSSMAN Sheet area, is a thick sequence of quartz-greywacke, felspathic sandstone, arkose, siltstone, and bedded chert, with subordinate conglomerate, rare lenses of limestone, and interbedded basalt. Amos & de Keyser (1964) state that the Mount Garnet Formation differs from the Chillagoe Formation

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in containing a predominance of clastic sediments and little limestone. Also, as the boundary between the two formations is transitional, they consider the Mount Garnet Formation to be a more clastic facies of the Chillagoe Formation.

The major portion of the geosynclinal zone is occupied by the Middle Devonian to possibly the Lower Carboniferous Hodgkinson Formation, which was deposited in the Hodgkinson Basin. This formation, which is 6000 to 12,000 m thick, consists of a monotonous rhythmically bedded sequence of greywacke and siltstone with intercalations of chert, basic volcanics, conglomerate, and rare limestone lenses. These sediments are steeply folded, strongly faulted, and have a NNW regional strike.

In the southeast portion of MOSSMAN Sheet area and in the CAIRNS area the Hodgkinson Formation has undergone some regional metamorphism to steeply folded and strongly cleaved low-grade micaceous schists, phyllite, slate, greywacke, and siltstone with rare limestone lenses. These rocks are known as the Barron River Metamorphics. Fardon & de Keyser (1964) suggest that they could well contain pre-Hodgkinson sediments that are deeper water time-equivalents of the Chillagoe and Mount Garnet Formations. The degree of metamorphism increases slightly eastwards, and in the CAIRNS area rocks of greenschist facies grade occur.

After the deposition of the Hodgkinson Formation, the Tasman Geosyncline region underwent an orogeny. Permo-Carboniferous granites were emplaced mainly in the central part of the Hodgkinson Basin. The granitic rocks are mostly biotite granite, adamellite, granodiorite, and diorite.

In the MOSSMAN area there are a few small outcrops of Permian shallow water sediments and coal measures which unconformably overlie the older Palaeozoic rocks. These sediments are penecontemporaneous with the Upper Permian Nychum Volcanics, which are unconformable on Precambrian and Palaeozoic formations and consist of acid lavas, pyroclastics, and ignimbrites with minor basalt and andesite.

Overlying the Hodgkinson Formation and Nychum Volcanics in the south part of MOSSMAN Sheet are the Upper Permian - partly Triassic Featherbed Volcanics. These were associated with cauldron subsidence, and consist of massive ignimbrites and subordinate acid lavas.

The Carpentaria Basin

In the survey area, the eastern edge of the Carpentaria Basin trends approximately northwest, from the southwest corner of MOSSMAN Sheet area to the central north part of WALSH.

The oldest sediments exposed are the Lower Cretaceous Wrotham Park Sandstone and Blackdown Formation; the former are unconformable on the Precambrian and folded Palaeozoic rocks. The thickness of sediments in the basin increases towards the west (Laing & Power, 1960) The Mesozoic rocks are generally obscured by Quaternary alluvium, soil and gravel, in most of the WALSH area.

In the south of MOSSMAN, isolated from the Carpentaria Basin, an outcrop of partly Triassic Pepper Pot Sandstone is faulted against the Featherbed Volcanics.

The Cainozoic rocks

Tertiary olivine basalts form thin veneers on the Hodgkinson Formation in the Mareeba district as well as in the central north portion of MOSSMAN Sheet area. Quaternary deposits occur extensively in the west of the survey area, where they overlie most of the Carpentaria Basin rocks, and also in the southeast sector of the area.

Coral reefs fringe many parts of the coastline and extend to the limits of the continental shelf. A description of reef features, their possible origins, and local morphological variations has been given by Fairbridge (1950).

Economic geology

The numerous mines and prospects in the CAIRNS and MOSSMAN areas indicate widespread mineralization in the Palaeozoic geosynclinal rocks. The Precambrian rocks in the survey area have been of no economic interest.

De Keyser & Wolff (1964) and de Keyser, Bayly & Wolff (1960) have made a study of the mineralization in the Chillagoe district, which is immediately south of the survey area. The geology at Chillagoe is a continuation of the geosynclinal zone in the MOSSMAN area, and these writers' general conclusions can probably be applied to deposits within the survey area.

The mineralization is related to the late Palaeozoic hornblende-biotite granites. De Keyser & Wolff (1964) considered that the main conditions of ore deposition were high temperature-pneumatolytic to hypothermal, and noted that the tin and tungsten mines are located towards the axial parts of the Tasman Geosyncline close to the exposed granite areas, whereas the copper, lead, zinc, and silver lodes are concentrated along its western margin. Examination of the MOSSMAN geological map confirms this general distribution pattern.

Within the survey area gold, tin, copper, tungsten, antimony, lead, and silver minerals have been mined and uneconomic deposits of manganese, mercury, cobalt, and bismuth minerals have been recorded.

De Keyser, Bayly & Wolff (1960) classifys the mineral deposits in the Chillagoe region into four groups. These arre: (1) contact metasomatic deposits; (2) lodes developed in shears and fissures; (3) disseminations in granite; and (4) quartz pipes in granite. The descriptions of the mineral deposits within the survey area by Amos & de Keyser (1964) suggest that a similar classification is valid for the area, although group 1 is thought to be of only minor importance.

The most important lodes in the survey area are those developed in shears and fissures in the Hodgkinson Formation. All major gold lodes are of this type and the tin deposits at Cannibal Creek and the Mount Molloy copper bodies in MOSSMAN are fissure-vein deposits in cleaved siltstones and greywackes. Some of the wolfram lodes in granite are also of this type. An example of the group 3 type of deposit is the China Camp tin lode in the northeast part of MOSSMAN Sheet area.

Significant quantities of cassiterite and gold also occur in placer deposits; a large proportion of the gold production of MOSSMAN area comes from alluvial sources.

The only areas of possible petroleum discovery are the Carpentaria Basin and the offshore Barrier Reef platform.

3. MAGNETIC RESULTS AND INTERPRETATION

The magnetic data are displayed in Plate 2, which shows all profiles of total magnetic intensity reduced to an east-west scale of 1:500,000 and related to a series of east-west lines which approximate the flight paths. A north-south scale of 1:1250,000 has been used to improve data presentation. The profiles are accurately positioned, with respect to longitude, near

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longitudes 142°30'E, 142°48'E, 143°06'E, 143°24'E, 143°42'E, 144°00'E, 144°18'E, 144°36'E, 144°54'E, and 145°20'E. Idealized flight-lines were drawn as the mean straight line joining control points. The aircraft's ground speed was considered constant between any two adjacent control points on any one traverse.

Every fourth magnetic profile displayed in Plates 3, 4, and 5 at a scale of 1:250,000 and superimposed on the geology to facilitate correlation. Plates 6, 7, and 8 illustrate the magnetic interpretation.

The magnetic data recorded over the Carpentaria Basin have been quantitatively analysed, and contours of depth to magnetic basement have been drawn. A discussion of the interpretation methods used appears in Appendix A. An attempt has also been made to delineate geological structure within the basement rocks. The interpretation of the magnetic data in the rest of the area is mainly qualitative; broad zones of similar magnetic character are delineated. These zones have been numbered for reference in the following discussion. A few anomalies were analysed quantitatively.

The Precambrian area

Anomalies in the range 10 to 100 gammas and with short wavelength correspond to the Dargalong Metamorphics. These fall into zones 3 and 5 (Plates 6 and 7). Differentiation of the metamorphic units was not possible. Few trends are evident, but those that are present strike mainly north, and are located in areas mapped as Arkara Gneiss.

Magnetically smooth areas (zones 1 and 2, Plate 6) correspond to outcrops of Aralba Adamellite. Another magnetically undisturbed region has been delineated as zone 4 and corresponds to the Kintore Adamellite. This zone strikes SSE into the Carpentaria Basin, and suggests that the adamellite extends some 15 km under the Wrotham Park Sandstone.

There is no magnetic effect from the Precambrian dolerites.

The Tasman Geosyncline

Over the Chillagoe Formation anomalies average 30 gammas in amplitude. Some anomalies range up to 180 gammas and these have been correlated with interbedded basic volcanics and delineated as zones 7, 8, and 9 (Plate 7). Analysis of several anomalies shows that the volcanic horizons have a steep easterly dip, which is in accordance with the geology.

The Mount Garnet Formation occurs within the generally undisturbed zone 10, except for a strong negative trend with a maximum amplitude of 120 gammas (zone 17). This trend parallels the regional geological strike, and has two mines located on it. Anomalies of 5 to 50 gammas, 20 km. north of Nychum homestead, are thought to reflect the faulted boundary with the Hodgkinson Formation.

The Hodgkinson Formation out crops over the larger part of the MOSSMAN area and occupies most of zone 10. Anomalies are mostly less than 30 gammas.

In the northwest part of MOSSMAN Sheet area a zone (16) of 10 to 60 gamma anomalies corresponds to interbedded volcanics, as do isolated anomalies in zones 11, 12, 14, and 15. Zone 13 contains anomalies up to 60 gammas, but interbedded volcanics have not been recorded in that area. However, a dolerite dyke has been mapped in the southern end of the zone. Other zones, which have been correlated with interbedded volcanics, are 23 and 28.

Several zones have been correlated, with shearing, in the Hodgkinson Formation. Zone 25 in the northeast of MOSSMAN contains anomalies in the range 30 to 400 gammas, while zones 26, 29, 30, 32, and 36 to the south have anomalies ranging only up to 150 gammas. Zones 30 and 32 also correlate with dolerite dykes. Analysis of the anomalies in zone 30 indicated that the dykes dip to the southwest at 45° and are approximately 250 m thick with their tops at or near ground level. The mean calculated susceptibility was 3.95×10^{-3} e.m.u., which is similar to published values for basalt and dolerite (Grant & West, 1965).

Zone 27 southwest of Daintree contains an elongated anomaly of 140 gammas amplitude. Analysis suggests that it is due to a tabular body approximately 150 m below ground level and dipping 50°W. It is 450 m thick and the calculated susceptibility of 2.64×10^{-3} e.m.u. corresponds to a basaltic type of rock.

Zone 33 has been correlated with serpentinite in its southeast portion. Continuity of the anomaly northwards and a second anomaly to the west suggest that the serpentinite may be more extensive at depth. Zone 34 parallels zone 33 and may represent a repetition of the ultra-basic rock.

Anomalies in the range 20 to 120 gammas are contained in zones 35 and 37. Interpretation showed that the causative bodies have a vertical dip, which is in agreement with geological mapping. They are thought to be dolerite dykes.

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Zone 38 contains an anomaly whose amplitude ranges from 30 to 180 gammas and which branches north of line 223. It may be caused by basic material at depth in the Hodgkinson Formation, or alternatively by Atherton Basalt flows beneath alluvium in the Barron River drainage system.

Zones 43 and 44 (Plate 8) correspond to serpentinite west of Cairns. Zone 42 contains anomalies up to 120 gammas, and is thought to represent an area of high grade Barron River Metamorphics.

No definite anomalies have been correlated with the Palaeozoic granites in the survey area, although some of the large granite bodies in the MOSSMAN area (Plate 7) appear to be associated with broad magnetic lows of 10 to 40 gammas amplitude.

Outcropping Nychum Volcanics correlate with zones 18, 19, 20, and the southeast and northeast parts of zone 6 (Plates 6 and 7). The larger portion of zone 6 is interpreted as representing the extent of the Nychum Volcanics underlying the Carpentaria Basin. Anomalies are generally in the range 20 to 150 gammas, but there are some strong negative anomalies up to 750 gammas. These are thought to represent subordinate basic rocks within the predominantly acid lava sequence.

The attenuation of anomaly amplitude from line 208 to line 218 along the eastern edge of zone 6 (Plate 7) is interpreted as a deepening of the basement surface in this region. The absence of suitable anomalies for detailed analysis precluded verification of this interpretation.

The Featherbed Volcanics are confined to one region in the south of MOSSMAN Sheet area and correlate well with zone 21. The zone boundaries agree well with the faulted contacts between these volcanics and the Hodgkinson Formation.

Zones 22 and 24 in north central part of MOSSMAN, zones 39 and 40 in the southeast of MOSSMAN and zone 41 in CAIRNS (Plate 8) have been correlated with Cainozoic olivine basalts.

The Carpentaria Basin

The aeromagnetic profiles shown in Plates 2 and 3 reveal a series of negative magnetic anomaly trends in the western half of the WALSH area. These magnetic trends strike south in the north of the area and swing around to the SE in the south. These features have been attributed to remanently magnetized dyke-like bodies at the basement surface. Methods used in the determination of the depth to these bodies are described in Appendix A.

In the southeast of the WALSH area, anomalies are more numerous and still predominantly negative, but trends are not so strongly developed. The disturbed nature of the magnetic profiles in the southeastern part of the basin indicates the extent of the Nychum Volcanics beneath the sediments. The larger-amplitude anomalies, therefore, have been attributed to magnetic features in the Precambrian basement, and the high-frequency/low-amplitude anomalies to overlying Nychum Volcanics.

The general form of the magnetic basement is shown in Plate 6 as contours of depth to magnetic basement. The individual depth estimates, on which the contours are based, have a probable error of $\pm$ 15 percent. In some cases application of a standard depth factor of 1.6 used in the method of Peters (1949) gave depth estimates considerably less than those obtained using standard curves. This indicates that the factor was too large; a factor of 1.3 was taken as being more suitable to the 'thin-dyke' anomalies that occur in the western part of the area. The poor resolution of individual anomalies in the southeast region made depth estimates less reliable in this area.

The basement contours generally parallel the margin of the basin, becoming more widely spaced in the south. The level of the magnetic basement falls towards the northwest reaching a maximum depth in excess of 700 m below sea level at the northwest boundary of the survey area. A shallow basement depression has been interpreted in the southeast of the basin, with a ridge extending from it towards the northwest. Troughs have been delineated both north and south of the ridge. No other significant basement features were delineated.

The interpreted magnetic basement depths are in agreement with the limited seismic data available. Two seismic reflection/refraction traverses were shot in the WALSH area (Robertson & Moss, 1959). The interpreted basement depths are indicated in Plate 6.

<u>The Offshore area</u>

According to the magnetically undisturbed nature of the Hodgkinson Formation, the seaward extent of the Tasman Geosyncline sediments is indeterminate. Gravity data (Dooley, 1965), however, do not indicate a large accumulation of sediments on the continental shelf.

In the south, anomalies up to 200 gammas occur offshore between lines 219 and 235 (Plates 2 and 5) and may represent an extension of the Barron River Metamorphics. From line 175 to 219 the profiles are generally featureless with the exception of a few isolated anomalies, which range up to about 80 gammas in amplitude. As the flight-lines were 6.4 km apart offshore, the strike extent of these anomalies is not known. Hence, analysis is difficult. They are possibly caused by volcanic rocks, and if so, suggest that the geosynclinal rocks extend at least 30 to 40 km offshore.

An interesting feature in the southern region is the group of anomalies which strike NE to ENE (Plate 5). Analysis of several of these anomalies suggests that they occur over the northern edges of flay-lying slabs at a depth of 450 to 600 m below sea level. As these anomalies approximately coincide with passages between the reefs it is thought that the slabs may represent topographic highs on the pre-Cainozoic surface, which were favoured for coral reef growth.

A gravity anomaly of approximately -20 mgal is also associated with one of the passages, the Trinity Opening. Dooley (1965) suggested that the anomaly may be associated with the difference in reef and shelf topography which exists north and south of the opening. Insufficient gravity data were available to determine the type of feature associated with the anomaly.

4. RADIOMETRIC RESULTS AND INTERPRETATION

The purpose in processing the radiometric data has been to make them most useful as an aid to surface geological mapping. Therefore the aim has been to filter out from the total-radioactivity measurements any effects that might have arisen from the characteristics of the detector itself, from non-geological variations in the source area being scanned, or from variations in the air mass between them. The surveyed area has been divided into zones in which the data are statistically different from those in adjacent zones; these zones are believed to relate directly to the surface geology.

The radiometric results are presented in Plates 9, 10, and 11 superimposed on topographic maps. Correlation with geology can be made by referring to Plates 3, 4, and 5 respectively. A description and discussion of the interpretative technique used appears in Appendix B. Zone types 3, 4, and 5 have been combined in MOSSMAN and CAIRNS Sheets (Plates 10 and 11) for clarity of presentation.

The Precambrian rocks (Plates 9 and 10)

The Precambrian belt is represented by a region of high surface radioactivity while containing some units of lower radioactivity. Zone type 3 generally corresponds to Kintore Adamaellite in the central zone and to Aralba Adamellite and Pombete-type schist in the northwest. The Arkara gneiss is generally represented by zones of type 5 and 6 and the Saraga schist by types 5, 6, and 7. Small occurrences of type 7 are attributed to outcrops of Saraga schist within the Arkara gneiss or areas of Arkara gneiss with high effective surface radioactivity.

As a general observation the results outline zones of low radioactivity, which correspond to adamellite outcrops, within regions of higher radioactivity corresponding to outcropping Dargalong Metamorphics; within the metamorphic series there is some evidence of resolution.

The Tasman Geosyncline (Plates 10 and 11)

Middle Devonian to Lower Carboniferous sediments are generally defined by zones of types 3 to 5, although there occur zones of type 2 corresponding to alluvial deposits, e.g. between the Hann Tableland and the eastern edge of the Featherbed Volcanics. Along the coastal plain, extreme altitude variations have generated large areas of type 1 which correspond to the Hodgkinson Formation. Regions of type 1 near Brooklyn homestead and Maitland Downs homestead, to the north, correspond to areas of mapped Quaternary alluvium.

There is no surface expression of the interbedded volcanics within the Hodgkinson, Mount Garnet, and Chillagoe Formations; this probably reflects their basic composition and limited extent.

The Featherbed Volcanics in the south part of MOSSMAN Sheet area are well defined by zone types 6 and 7, while the Nychum Volcanics corresponding to types 3 to 5 and 6. The outcrops of Almaden and Elizabeth Creek Granites adjacent to the volcanics have not been resolved.

The high (zones types 6 and 7) in the central part of MOSSMAN does not seem to be related to mapped Hodgkinson Formation. Dominance of types 6 and 7 suggests a source equivalent to the Featherbed or Nychum Volcanics. Although none is mapped in the area, it is possible that alluvium associated with the Mitchell River system reflects a genetic relationship to past outcrops of volcanics, and thus suggests that the volcanics, or their derivatories, extended farther to the north than their present location.

Granites are not generally distinct as weathering has resulted in strong dispersion of their radioactive constituents and in surface contamination of surrounding sediments. Drainage patterns to the north of Hann Tableland have extended the contamination associated with the central high of the Hodgkinson Formation. Mareeba Granite, in the north of the Windsor Tableland and in the far northeast of MOSSMAN Sheet, are well defined by zone types 6 and 7, and the high between the Daintree and Normanby Rivers is interpreted as a further occurrence of Mareeba Granite.

Mesozoic Carpentaria Basin (Plates 9 and 10)

The radioactivity results in the Carpentaria Basin show no differentiation of Mesozoic sediments. The eastern edge of the basin has been delineated by zone boundaries, and the areas of high surface radioactivity are associated with major drainage patterns.

In the southeastern quarter, zone types 7 and 8 can be correlated with the Mitchell, Lynd, and Walsh River systems. The broad plateau associated with the Walsh River suggests that local Nychum Volcanics outcrops may be the cause of the high surface radioactivity, especially near the eastern edge of the basin. Source material for the alluvial deposits was probably derived from extensive volcanics and minor granites to the east and south of Walsh River; the high radioactivity is partly due to concentration of accessory minerals such as zircon and apatite. The record of gamma radiation above 1.6 MeV in this region suggests that uranium and thorium are the dominant components of the surface radioactivity.

Areas of zone type 4, associated with Staaten River, Pandanus Creek, and Cockburn Creek in the southwest part of WALSH Sheet and in other areas, probably represent concentrations of radioactive components derived from the surrounding sediments.

5. CONCLUSIONS AND RECOMMENDATIONS

The negative magnetic anomalies in the Carpentaria Basin exhibit such strong linear patterns that it is unlikely they could be caused by interbedded volcanics in the Mesozoic rocks. Moreover, negative anomalies are not common over the outcropping Permian Nychum and Featherbed Volcanics, and where they do occur, they are isolated and not linear.

Therefore these linear anomalies were assumed to have their cause in the basement rocks, and were used to determine the depth to the basement surface. However, their negative nature precludes any interpretation of the nature of the basement rocks. These negative anomalies appear to be generally confined to the WALSH area, being most numerous between lines 208 and 238, and decreasing in importance slowly southwards and rapidly northwards. Magnetic results over Precambrian rocks in the GEORGETOWN area, 150 km south of WALSH and in the HANN RIVER area north of WALSH, do not display any negative anomalies.

The only basement features of interest are the shallow depression in the southeast of the basin and the ridge which extends from it to the northwest.

In the Tasman Geosyncline the main areas of importance are the sheared regions in the Hodgkinson Formation associated with granite, especially the one in the northeast of MOSSMAN Sheet area (zone 26). Detailed prospecting is recommended in these regions.

Another area of interest is zone 17 in the Mount Garnet Formation. Two mines are located at the northern end of a -120 gamma anomaly, which extends for about 16 km.

The limited magnetic data offshore suggest that the geosynclinal rocks extend at least 40 km from the coast. Gravity results, however, suggest that any sedimentary material would not be very thick. Further magnetic traverses over Trinity Opening will be necessary to determine the detailed nature of the feature causing the magnetic and gravity anomalies.

Fair correlation exists between the statistically interpreted radiometric units and the mapped geology. River systems generally influenced the results, but it is thought that altitude variations, except over the coastal range, were mostly eliminated by the statistical method. This statistical approach should now be evaluated in an area which has not been geologically mapped.

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APPENDIX A

METHOD OF DEPTH DETERMINATION

Depth determinations were made mainly using the half-maximum slope method of Peters (1949). A curve fitting method (Gay, 1963) was also used, where suitable anomalies allowed a reasonable fit between anomaly and standard curve.

The horizontal distance between points of half-maximum slope varies from 1.2 x depth for a thin sheet to 2.0 x depth for the edge of a semi-infinite block. In most cases a factor of 1.6 was used. This is applicable to a body whose width is equal to about twice its depth of burial.

A comparison between adjacent profiles generally enables an adjustment to be made for depth determinations influenced by oblique intersections of magnetic contours with flight-lines. Strongly developed north-south magnetic trends over the basin area made strike correction possible for the majority of depth determinations. All the depths shown in Plate 3 have been corrected for strike.

Systematic errors are introduced by the application of standard factors for depth determinations in areas where they are inappropriate. Anomaly interpretation by curve fitting methods produces more reliable estimates provided the anomalies have simple forms. Depth estimates obtained by the two methods usually differed by less than 15 percent. This method of depth determination was used, wherever possible, to establish control depths and to provide anomaly analysis for local adjustment of half-slope factors.

APPENDIX B

METHOD OF RADIOMETRIC INTERPRETATION

The method developed for this survey is a statistical approach based on the correlation, between lines, of statistically significant radiometric zone types.

The following assumptions were made:

1. Geological differences are reflected in radio-nuclide concentrations.

2. For the duration of any flight-line, meteorological conditions and detector parameters are constant.

3. Lines flown on any one day have minimal differences caused by meteorological and detector parameters, while lines flown on different days may be affected by considerably different degrees of parameter variation.

Frequency distributions of total radioactivity (Channel 1) were plotted for each line, sampling at each fiducial (approx. 600 m) and using a class width of 4 counts per second. These distributions which have been termed 'line distributions', exhibit relatively strong peaks (Figs. 1a and 2) indicating that there may be statistically significant surface radioactivity units. Adjacent lines within the same flight (Fig. 1a) exhibited similar distributions with similar dispositions of peaks and troughs. Adjacent lines from different flights (Fig. 2), and different flights as a whole, display similar overall distributions, but the intensity levels associated with each peak were generally different.

To establish whether line distribution peaks do correlate with surface rock types, an analysis was made of radiometric records over geological exposures in the southern half of MOSSMAN and CAIRNS Sheet areas. The geology was divided into eight major rock types, and frequency distributions were plotted for each exposure greater than 10 fiducials wide (approx. 6 km). Table 1 summarizes the properties of the distribution obtained, and examples are given in Fig. 1b.

The average skewness factor of each exposure suggests that rock types generate right-skew populations. Analysis of exposure distributions showed that 85 percent were right-skew with wider exposures tending to have smaller skewness factors. In this case the skewness is probably related to surface contamination and the effect of variable ground clearance, since mathematical expressions of radiometric intensity contain both exponential and at least second degree functions of the distance from source to detector. Boyle (1956) has used the chi-square test to establish that most rock types generate a normally distributed population. Bowie et al (1958) and el Shazley et al (1968) confirmed this, and similarly use the arithmetic mean as being the intensity characteristic of a rock type.

TABLE 2: EXPOSURES SIGNIFICANT RANGE ANALYSIS

Percentage of distribution of population either side of mode within multiples of standard deviation about mode.

Distribution (x S.D.)	-3	-2	-1	+1	+2	+3
Exposure	98	90	70	50	73	85
Normal	99.73	95.46	68.26	68.26	95.46	99.73

The analysis suggests that modal intensities are characteristic of the rock types. A random sample of 20 percent of the exposures further indicated that choice of normal distribution parameters was not valid (Table 2). Since surface contamination was expected to be severe because of strong drainage patterns, the range -1 standard deviation to +2 standard deviations about the mode was chosen as being characteristic of each exposure. Fig. 3 is an example of the degree of correlation of line distribution peaks and troughs with an exposure of significant ranges. As might be expected there is compounding of some exposures into one peak and the appearance of peaks which have no direct geological correlation. However, there is generally fair correlation of rock types with line distribution peaks.

The frequency distributions on each line were analysed in order to establish statistically significant intensity levels, and these levels were correlated from line to line. It was assumed that statistical significance is related to geological significance, and that correlation between lines reflects geological continuity.

TABLE 1: STATISTICAL PROPERTIES OF EXPOSURES

Regional averages in southern half of MOSSMAN and CAIRNS Sheet areas - lines 206 to 241 inclusive.

Rock type	Code	Number of exposures	Width (fids)[1]	Median count[2]	Mean count	Modal count	Standard deviation	Skewness factor	Coefficient of variation %
Dargalong Metamorphics	A	6	12	74	68	70	7	2.0	10
Mount Garnet & Chillagoe Formations	B	31	27	66	66	66	10	0	15
Hodgkinson Formation	C1[3]	11	39	22	20	12	5	0.7	25
	C2	30	100	55	48	46	12	0.2	25
	C3	11	76	112	106	105	12	0.2	11
	C4	3	45	162	158	150	10	0.8	6
Granites	D	25	23	52	46	46	12	0.8	26
Nychum Volcanics	E	19	26	86	88	78	11	0.8	12
Featherbed Volcanics	F	15	54	104	96	88	14	0.6	15
Mesozoic sediments	G	34	30	48	42	38	7	1.0	17
Quaternary alluvium	I	28	31	32	30	26	7	1.0	23

(1) Average fiducial distance is approximately 600 m.

(2) Intensities are in counts per second.

(3) Where C is polymodal, C2 is taken as representing the Hodgkinson Formation.

Trough intensities separating adjacent peaks on a line distribution were chosen as being significant intensity levels for that line. These levels were marked on the recorded profiles, and their locations transferred onto the generalized flight-line plot. Line to line correlation of these significant intensities resulted in a contoured form of presentation. The contours were then generalized and assumed to represent the boundaries of radioactivity units.

Since the intensities recorded may have been modified by many variables, it is considered that regional averages of modal intensities are more indicative of a unit's radioactivity characteristics than intensities obtained from any one flight. Modal intensity distributions for the radioactivity units in WALSH, MOSSMAN, and CAIRNS Sheet areas are shown in Figure 4.

Because of the large number of zones of type 3, 4, and 5 in MOSSMAN and CAIRNS, these three units have been combined for clarity in Plates 10 and 11.

The radioactivity units generated in the southern half of MOSSMAN and CAIRNS can be compared on a regional basis with the data for geological exposures in that area. Histograms of exposure modal intensities (Fig. 5a) show similar forms, reflecting the similarity of influences affecting each exposure, and suggest that compounding of exposure distributions does occur. Two forms of compounding seem plausible as shown in Figures 5b and 5c. Figure 5b assumes that the two volcanic sequences (E and F) can be resolved and Figure 5c that the Nychum Volcanics (E) cannot be differentiated from the Mount Garnet and Chillagoe Formations (B). The former case appears more likely. Mode distributions of zone types for the southern half of MOSSMAN and CAIRNS are shown in Figure 5d.

The above correlation analysis suggests that the method does have potential application in surface geological mapping, and especially, if given adequate geological control, for extrapolation into unmapped areas. A reliable estimate of the specific source activity associated with each zone type could also be made, if there was absolute calibration of instruments.

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APPENDIX C

OPERATIONAL DETAILS

Staff

Geophysicists	E.P. Shelley (party leader) R.D. Beattie D.N. Downie J.E. Rees
Technical Officer	R. Curtis-Nuthall
Draftsman	P. Kersulis
Technical Assistants	K.A. Mort D. Park G.J. Swords
Pilots	Captain F. O'Grady Captain S. Spenceley Captain J. Bartlett Captain R. Fisher First Officer R. Smith T.A.A. First Officer J. Lindsay
Aircraft Maintenance Engineers	K. Smith N. Oliver A. Smith B. Hopkins

Equipment

Aircraft	DC.3 - VH-MIN
Magnetometers	MFS-5 fluxgate types, tailboom installation, with output to Speedomax and digital recorders. MFD-4 fluxgate type, ground installation for magnetic storm warning and diurnal monitor, output to Esterline Angus recorder.
Scintillometer	Two-channel Hamner with twin crystal detector, output to DeVar recorder.
Radio-altimeter	Bonzer - output to DeVar recorder.
Air position indicator	Output to DeVar recorder.
Camera	BMR 35-mm strip.

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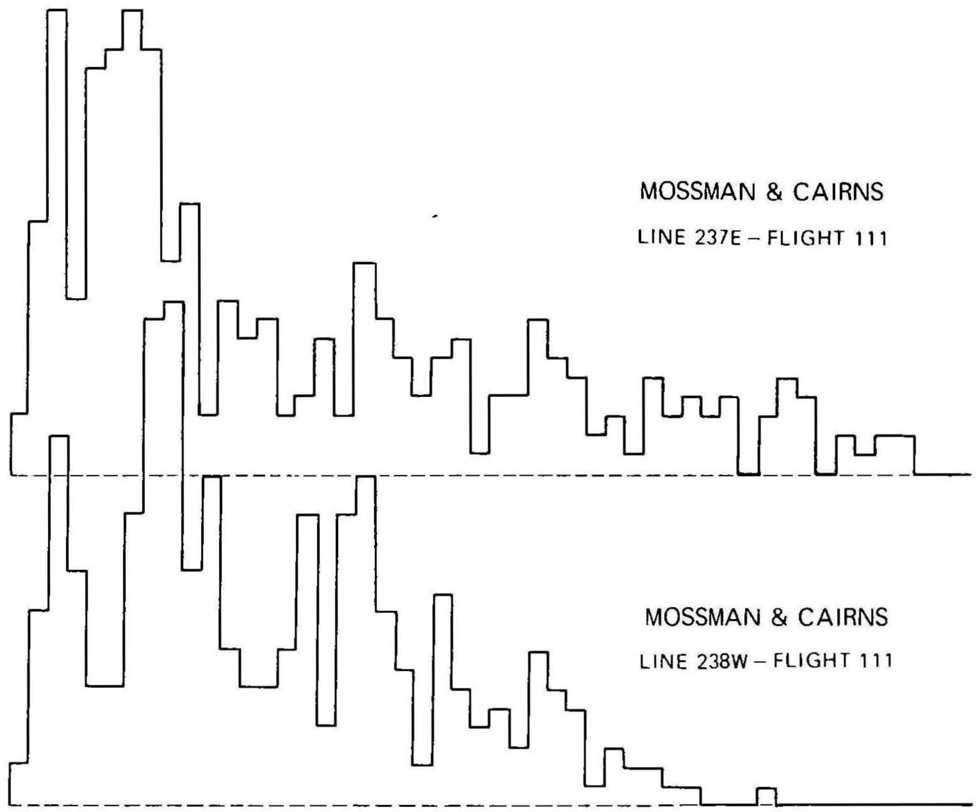
Survey specifications

Altitude	Nominally 250 m above ground level
Line orientation	East-west
Line spacing	1.6 km onshore, 6.4 km offshore
Tie system	Single and double ties flown north-south and at 32 km intervals west from longitude 144°54', plus a double tie offshore along the line of the reef.
Navigation	Aerial photographs
Magnetometer sensitivities	MFS-5 - 50 gammas per inch MFD-4 - 100 gammas FSD
Scintillometer sensitivities	Channel 1. 0.20-3.00 MeV 200 cps FSD Channel 2. 1.60-3.00 MeV 20 cps FSD
R/altimeter sensitivity	600 m FSD (logarithmic)

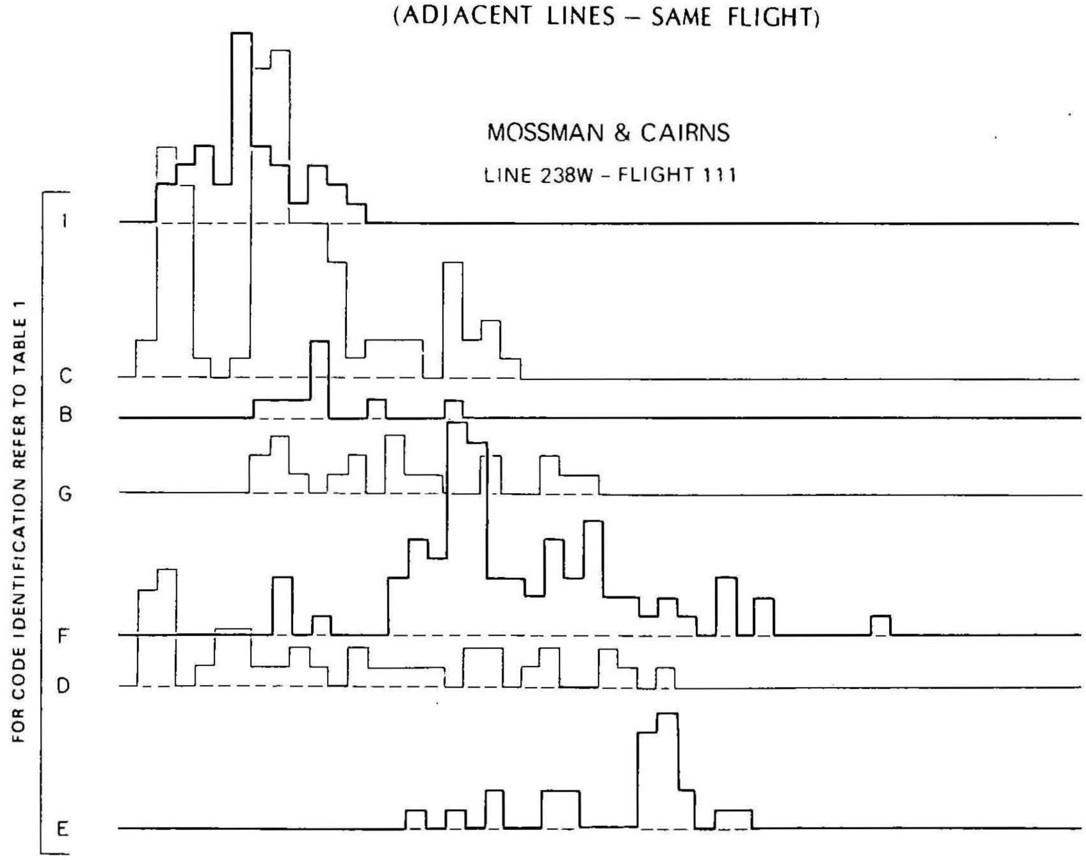
Survey logistics

Line distance flown	25,700 km
Survey area	43,800 square kilometres (includes approximately 7200 square kilometres offshore)
Road party arrived Cairns	13 and 21 August
Aircraft arrived Cairns	19 August
Flying commenced	21 August
Flying concluded	18 November
Party departed Cairns	24 November

FIGURE 1



(a) LINE FREGUENCY DISTRIBUTIONS
(ADJACENT LINES – SAME FLIGHT)



(b) EXAMPLE OF GEOLOGY EXPOSURE DISTRIBUTIONS

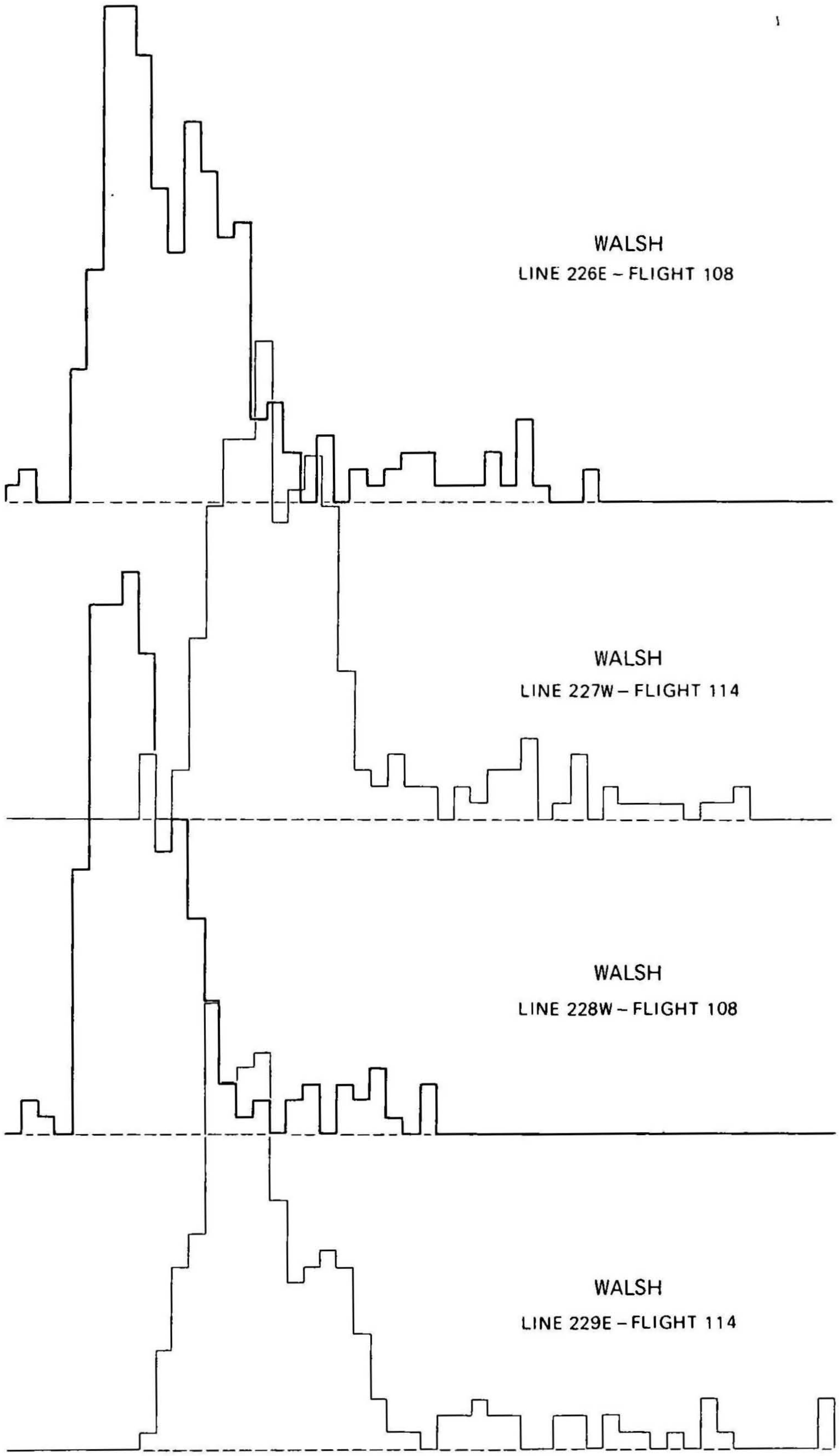
SCALE

VERTICAL	*Frequency*	*10 per inch*
HORIZONTAL	*Intensity*	*40 counts per second per inch*

28

To Accompany Record No. 1971/124

E55/B1–23A



LINE FREQUENCY DISTRIBUTIONS

(ADJACENT LINES – DIFFERENT FLIGHTS)

SCALE

VERTICAL *Frequency: 10 per inch*

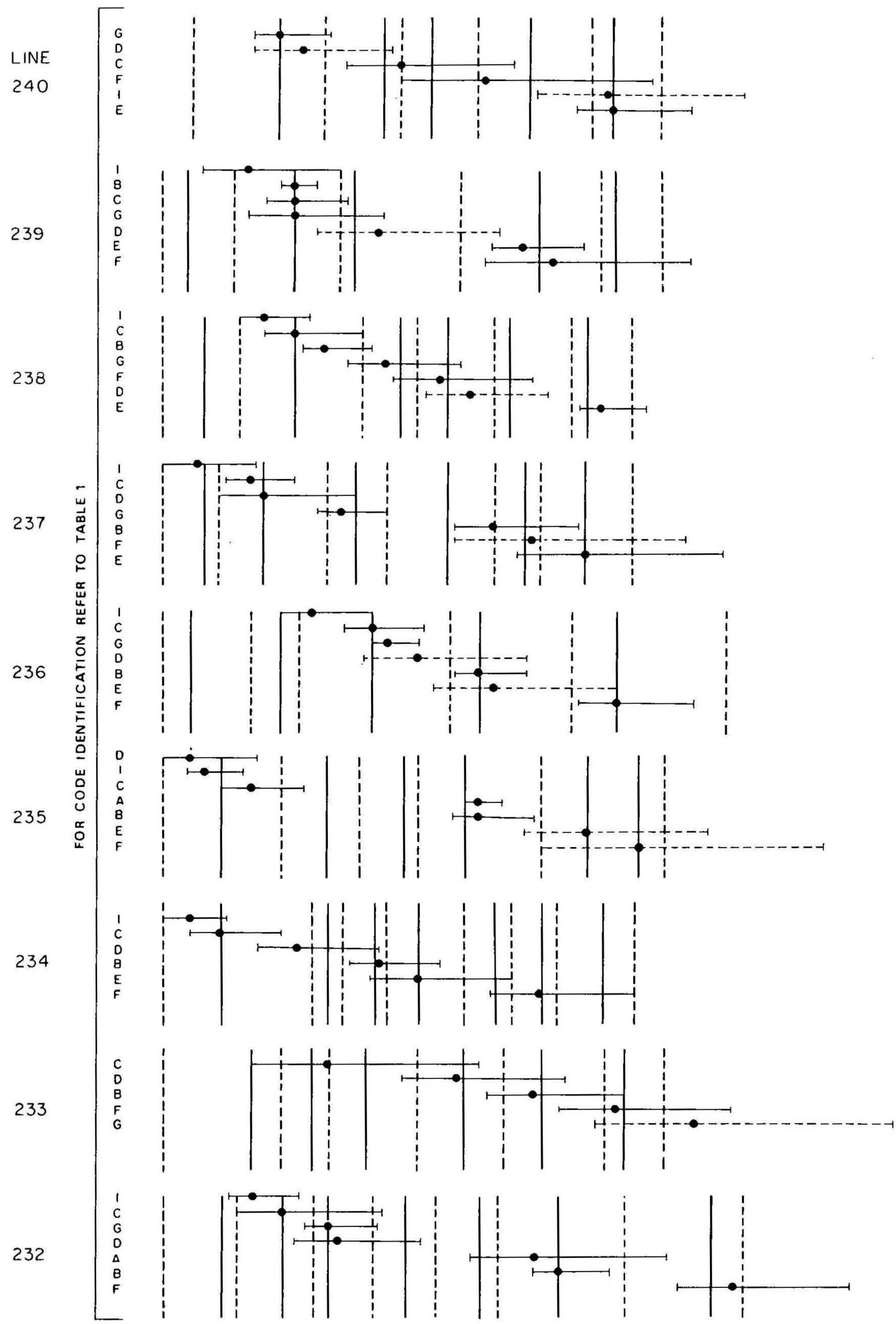
HORIZONTAL *Intensity: 40 counts per second per inch*

29

To Accompany Record No 1971/124

E54/B1–52A

FIGURE 3



COMPARISON OF LINE DISTRIBUTIONS WITH EXPOSURE SIGNIFICANT RANGES

MOSSMAN AND CAIRNS

LEGEND

Exposure range $-1\sigma_s$ to $2\sigma_s$ about mode

Mode determined assuming distribution slightly skewed and using mode mean - 3(mean - medium)

SCALE

HORIZONTAL *Intensity 40 counts per second per inch*

LEGEND

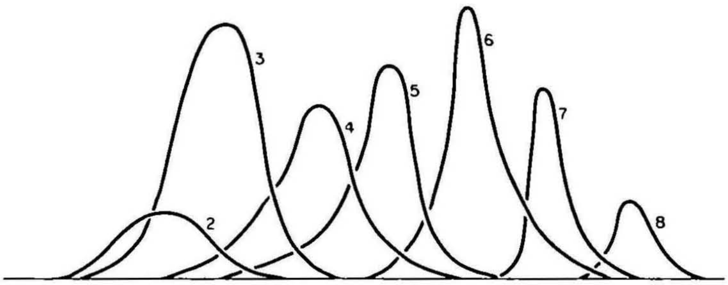
Peak on line distribution

Trough on line distribution

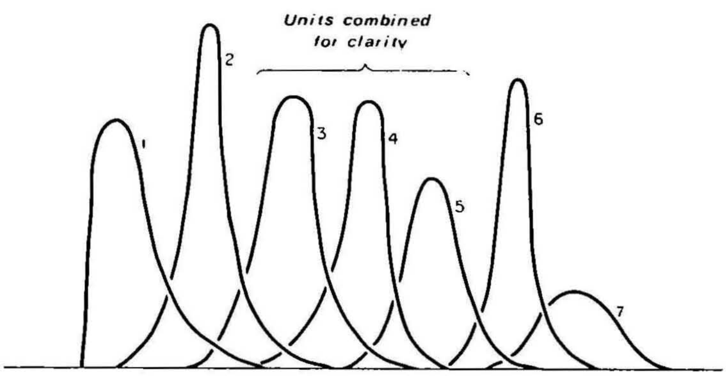
30

To Accompany Record No 1971/124

E55/B1-24A



a. WALSH SHEET



b. MOSSMAN & CAIRNS SHEETS

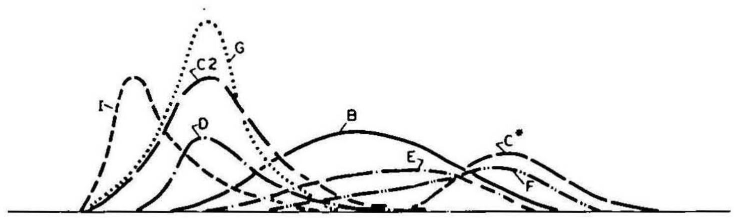
RADIOMETRIC UNIT MODAL INTENSITY DISTRIBUTION

(Units delineated on Plates 6, 7 and 8)

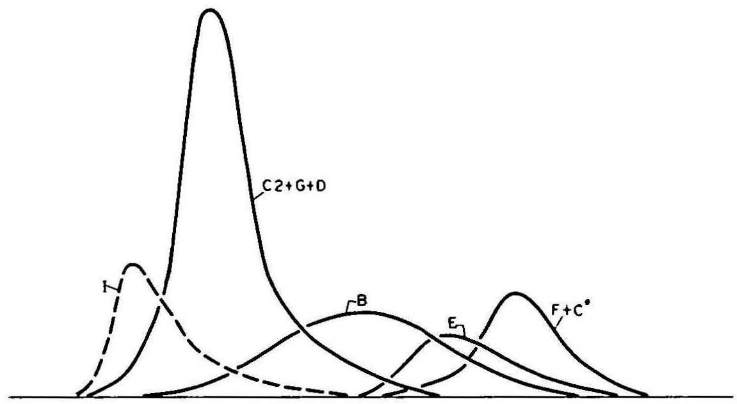
SCALE

VERTICAL *Frequency: 10 per inch*
HORIZONTAL *Intensity: 40 counts per second per inch*

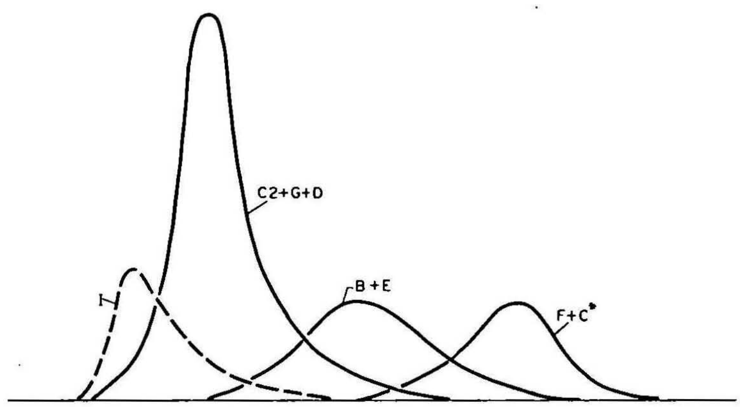
31



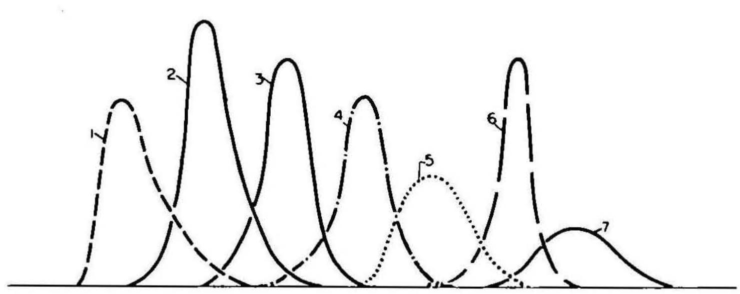
a. EXPOSURE MODE DISTRIBUTIONS



b. COMPOUNDED EXPOSURE MODE DISTRIBUTIONS



c. COMPOUNDED EXPOSURE MODE DISTRIBUTIONS



d. UNIT MODE DISTRIBUTIONS

EXPOSURE DISTRIBUTION ANALYSIS AND CORRELATION

(MOSSMAN & CAIRNS – SOUTHERN HALF)

CODE IDENTIFICATION	
B	F
C2	G
D	I
E	

C* = C1 + C3 + C4

FOR CODE IDENTIFICATION REFER TO TABLE 1

SCALE

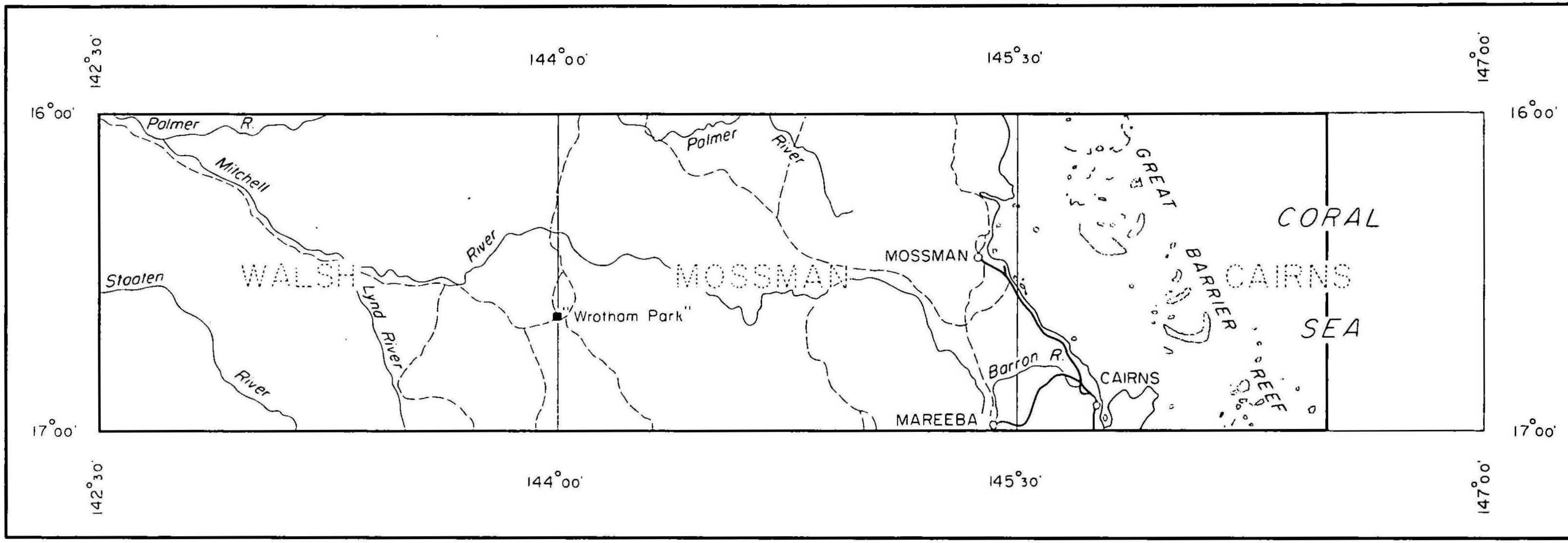
VERTICAL *Frequency 10 per inch*

HORIZONTAL *Intensity 40 counts per second per inch*

To Accompany Record No 1971/124

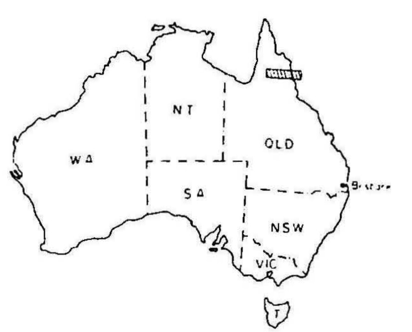
E55/B1-25A

PLATE 1

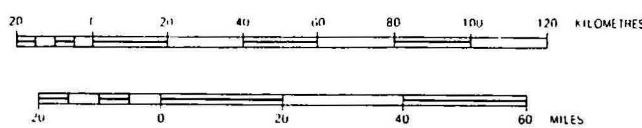


AIRBORNE SURVEY, SOUTHERN CAPE YORK
PENINSULA, QLD 1969

LOCATION DIAGRAM



LOCALITY MAP



REFERENCE TO 1:250,000 MAP SERIES

RUTLAND PLAINS	HANN RIVER	COOKTOWN	SD55-14	SD55-15
GALBRAITH	WALSH	MOSSMAN	CAIRNS	SE55-3
NORMANTON	RED RIVER	ATHERTON	INNISFAIL	SE55-7

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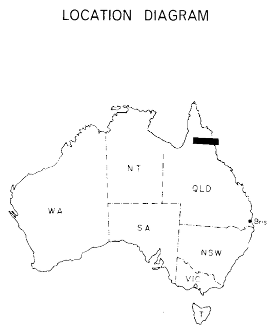
To Accompany Record No. 1971/124

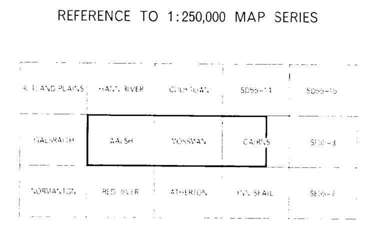
E55/B1-17A

PLATE 2

LOCATION DIAGRAM

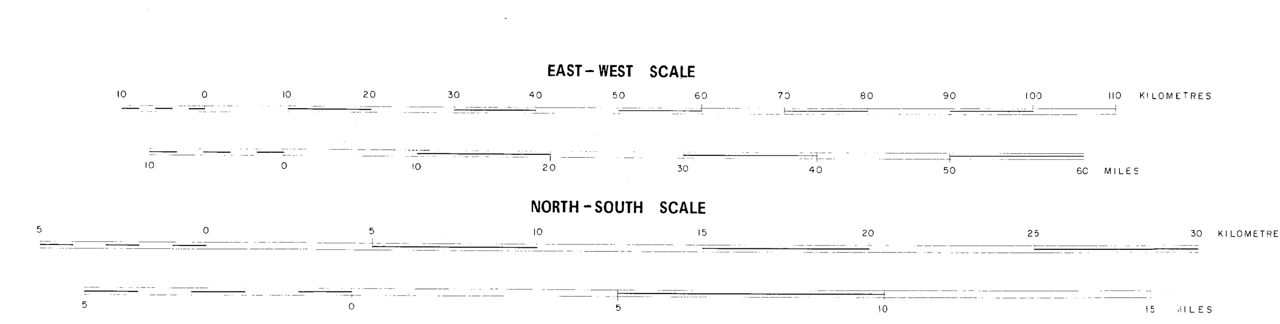


REFERENCE TO 1:250,000 MAP SERIES

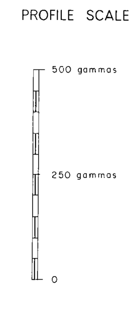


AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

TOTAL MAGNETIC INTENSITY PROFILES



PROFILE SCALE



EXPLANATORY NOTES

THE SURVEY WAS MADE WITH A DC 3 AIRCRAFT AT AN ALTITUDE OF 250 METRES ABOVE GROUND LEVEL ALONG LINES SPACED 1·6 KILOMETRES APART. THE FLIGHT-LINES ARE IDEALIZED AND SERVE AS BASELINES TO THE PROFILES. THEY APPROXIMATE THE ACTUAL FLIGHT–PATH WITH A PROBABLE ERROR OF ±0·5 KILOMETRE.

THE PROFILES HAVE BEEN CORRECTED FOR THE SOUTH COMPONENT OF A REGIONAL GRADIENT IN TOTAL MAGNETIC INTENSITY. THIS COMPONENT AMOUNTS TO 6·3 GAMMAS PER KILOMETRE.

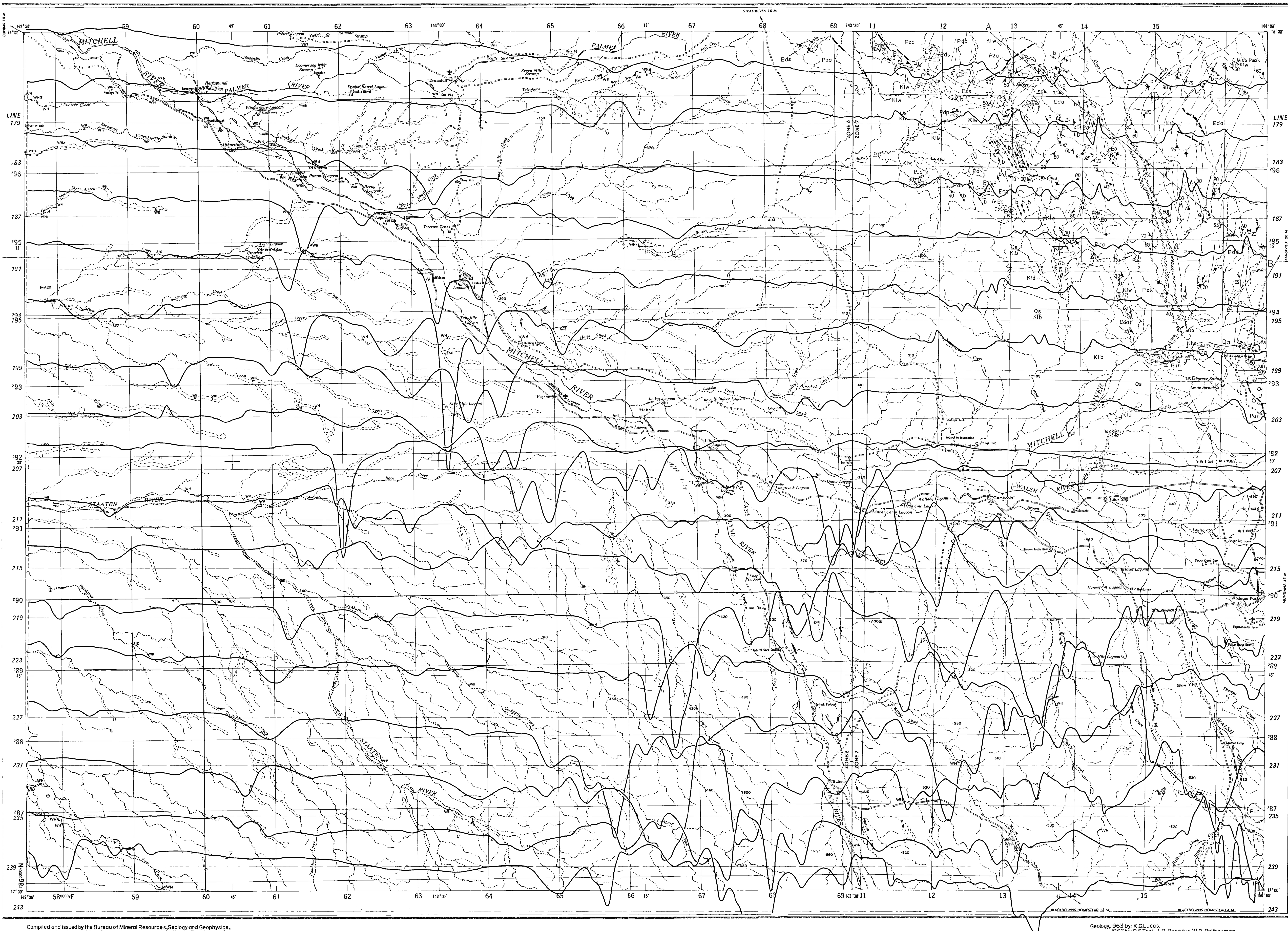
AUSTRALIA 1:250,000 GEOLOGICAL SERIES

WALSH

QUEENSLAND

SHEET SE 54-4

PLATE 3

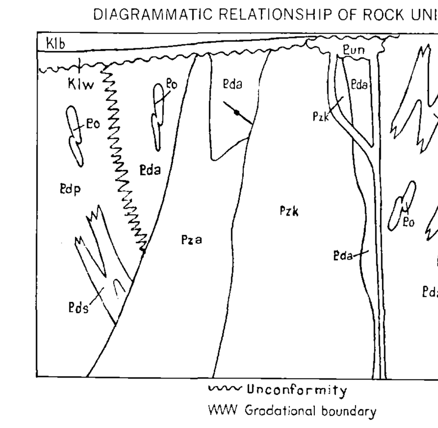


Reference

Era	Period	Formation	Symbol	Description
CAINOZOIC	QUATERNARY		Qa	Alluvium, mainly silty
			Qs	Sand, mainly residual
			Czx	Gravel, mainly residual
MESOZOIC	LOWER CRETACEOUS	Blackdown Formation	Klb	Grey siltstone, mudstone, shale, calcareous lenses. Large sandstone lenses
		Wrotham Park Sandstone	Klw	Pebble conglomerate, feldspathic pebbly sandstone
PALAEOZOIC	UPPER PERMIAN	Nychum Volcanics	Pun	Acid flows and pyroclastics. Subordinate basic flows
PRECAMBRIAN TO PALAEOZOIC		Kintore Adamellite	Pzk	Even-grained biotite-muscovite adamellite
		Aralba Adamellite	Pza	Porphyritic biotite-muscovite adamellite
PRECAMBRIAN			Po	Dolerite
	Dargalong Metamorphics	Pombete-type schist	Pdp	Muscovite-quartz schist, muscovite-biotite-quartz-feldspar schist
		Saraga-type schist	Pds	Medium-grained muscovite-quartz schist, sillimanite in places
		Arkara-type gneiss	Pda	Biotite-quartz feldspar gneiss, amphibolite and quartzite

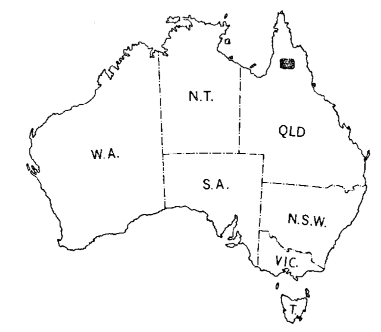
- Geological boundary, position approximate
- 15 Plunge of minor syncline
- U D Fault (D,U indicate relative movement down, up) position approximate
- Shear-zone
- 5 Strike and dip strata
- Horizontal strata
- Trend lines. Air-photo interpretation
- 75 Strike and dip of foliation
- Vertical foliation
- Strike of foliation, dip indeterminable
- Horizontal lineation
- 20 Plunge of lineation
- 40 Strike and dip of banding in igneous rock
- 10 Strike and dip of foreset beds
- Dyke, a-acid, b-basic
- WH Waterhole
- WH Waterhole on stream
- Windpump
- Road
- Vehicle track
- Telephone line
- "Bulimba" Homestead
- Landing ground
- Astronomical station
- .620 Height in feet; datum mean sea level

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



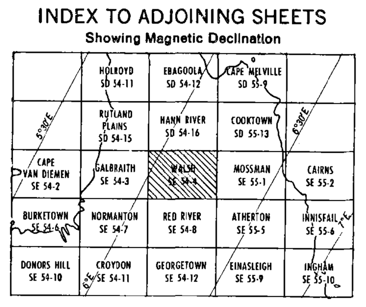
Unconformity
Gradational boundary

Compiled and issued by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Base map compiled by the Royal Australian Survey Corps and the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Aerial photography by Adastra Airways Pty. Ltd. Complete vertical coverage at 1:50,000 and 1:86,000 scale. Transverse Mercator Projection



INDEX TO ADJOINING SHEETS

Showing Magnetic Declination



AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

Scale 1:250,000

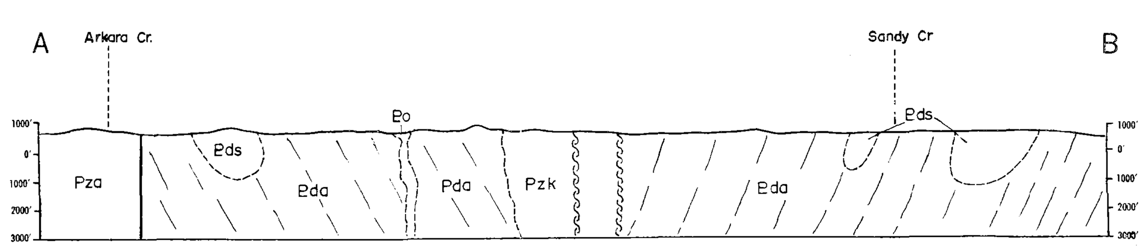
5 0 5 10 15 MILES

5 0 5 10 15 20 25 KILOMETRES

TOTAL MAGNETIC INTENSITY PROFILES

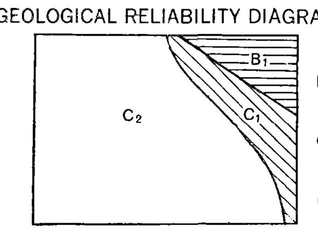
Section

Scale: $\frac{V}{H} = 4$



Geology, 1963 by: K.G.Lucas.
1966 by: D.S.Trail, I.R.Pontifex, W.D.Palfreyman, W.F.Willmott, (B.M.R.) W.G.Whitaker (G.S.Q.)
Compiled, 1966 by: D.S.Trail, W.W.Webb
Drawn, by W.W.Webb

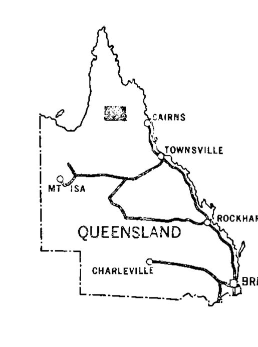
GEOLOGICAL RELIABILITY DIAGRAM



B_1 Many traverses and airphoto interpretation

C_1 Few traverses and airphoto interpretation

C_2 No traverses, limited airphoto interpretation



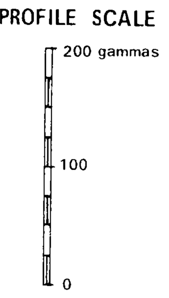
EXPLANATORY NOTES

The survey was made with a DC.3 aircraft at an altitude of 250 metres above ground level along lines spaced 1.6 kilometres apart. The flight-lines are idealized and serve as baselines to the profiles. They approximate the actual flight-path with a probable error of ±0.5 kilometres.

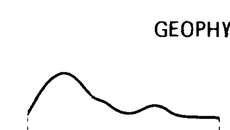
In order to avoid congestion, only every fourth profile is shown on the map.

The profiles have been corrected for the south component of a regional gradient in total magnetic intensity. This component amounts to 6.3 gammas per kilometre.

PROFILE SCALE



GEOPHYSICAL LEGEND



Total magnetic intensity profile

PRELIMINARY EDITION, 1968

SUBJECT TO AMENDMENT

WALSH

SHEET SE 54-4

Complimentary

Overlay E54/B1-53

To Accompany Record No. 1971/124

This map, with geophysical data overprint is not for sale, but available for reference in B M R Record No. 1971/124

1971/24

FIRST EDITION 1963

PLATE 4

AUSTRALIA 1:250.000

MOSSMAN

QUEENSLAND

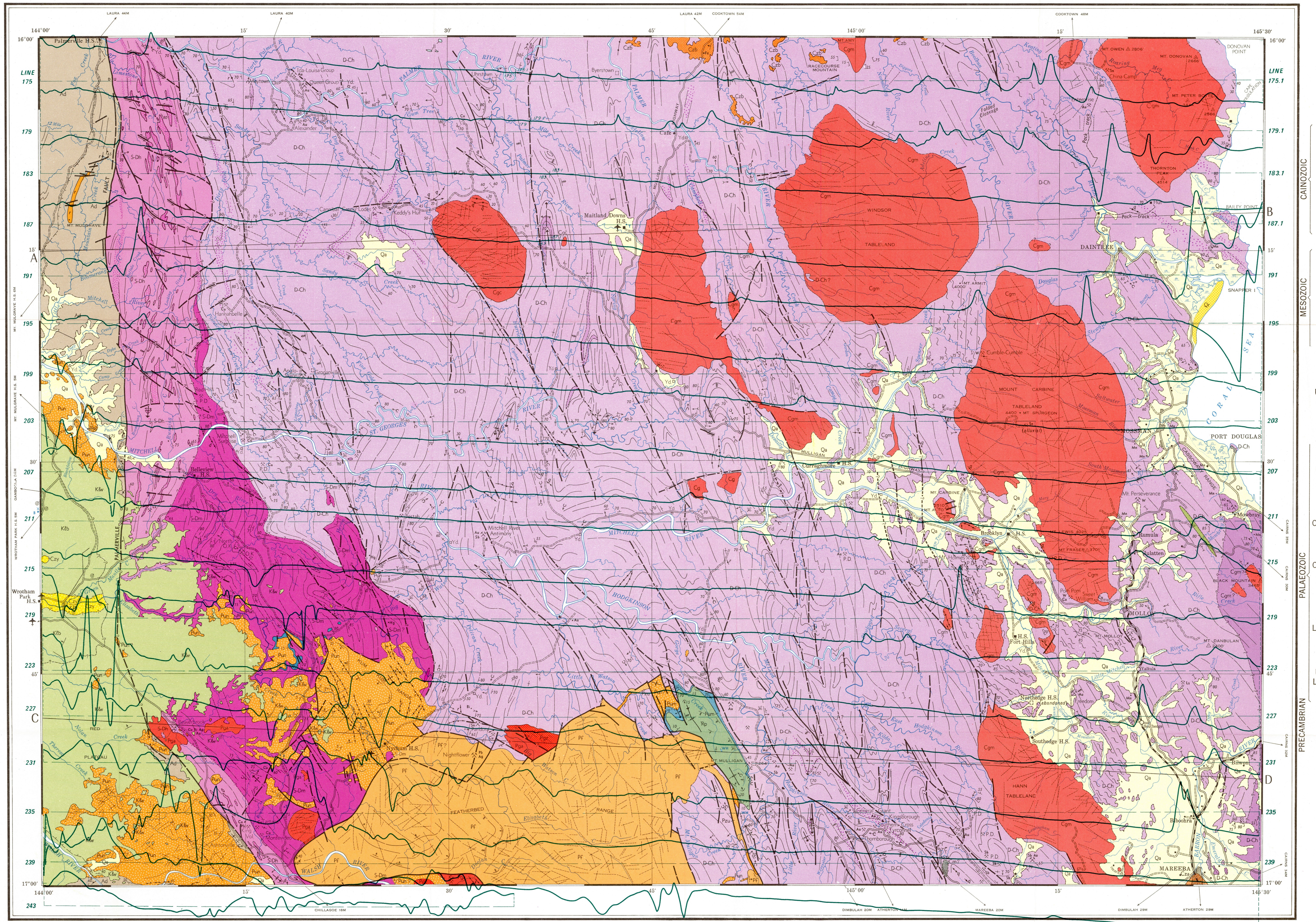
1:250.000 GEOLOGICAL SERIES SHEET SE 55-1

Reference

- Geological boundary
- Geological boundary with dip
- Fault
- Relative horizontal movement
- Relative vertical movement: U-up, D-down.
- Anticline, showing plunge
- Syncline, showing plunge

Where location of boundaries, folds and faults is approximate, line is broken, where inferred or indefinite queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes.

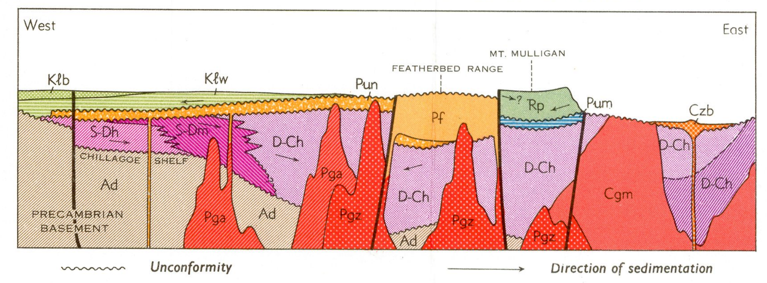
- Strike and dip of strata
- Overturned strata
- Vertical strata
- Horizontal strata
- Generalized strike and dip of folded strata
- Top of strata
- Direction of transport of sediments
- Dip > 15° (air-photo interpretation)
- Dip 15°-45°
- Dip < 45°
- Trend of bedding
- Joint pattern
- Strike and dip of foliation
- Vertical foliation
- Strike and dip of cleavage
- Vertical cleavage
- Apparent dip of bedding on cleavage
- Apparent dip of cleavage on bedding
- Main areas of very strong cleavage and/or shearing
- Plunge of lineation
- Horizontal lineation
- Dyke or vein; d-dolerite, gr-granite, q-quartz, r-rhyolite
- Volcanic vent
- Macrofossil locality
- Microfossil locality
- Plant fossil locality
- •Ag Minor mineral occurrence
- Prospect
- Mine, quarry, large open cut, or group of mines and prospects
- P.D. Prospect, position doubtful
- Ag Silver
- As Arsenic
- Au Gold
- Bi Bismuth
- C Coal
- Co Cobalt
- Cu Copper
- Hg Cinnabar
- Ls Limestone
- Mn Manganese
- Pb Lead
- Sb Antimony
- Sn Tin
- W Tungsten
- Old battery, smelter, or treatment plant
- WH Waterhole
- B Water bore with windpump
- T Tank
- Dam
- Swamp
- Highway or road
- Vehicle track
- Railway with siding
- Telegraph line
- Fence
- Town
- Site of former village, now abandoned or non existent
- H.S. Homestead
- Dwelling
- Yd Yard
- Landing ground
- 2566′ Trig.station, height in feet (datum: mean sea level)
- 4025′ Spot height in feet (datum: mean sea level)



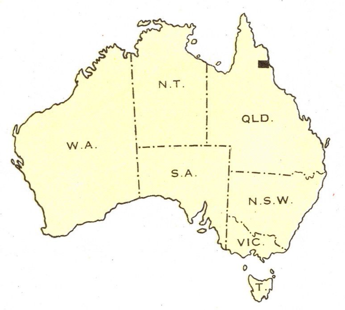
Reference

Era	Period	Formation	Symbol	Description
CAINOZOIC	QUATERNARY		Qa	Alluvium, soil
			Qr	Beach sands
		Atherton Basalt	Cza	Olivine basalt
			Czb	Olivine basalt
			Czy	Quartz gravel and silicified quartz sandstone ("billy")
MESOZOIC	LOWER CRETACEOUS	Blackdown Formation	Klb	Grey shale, siltstone, sandy shale; some lenticular sandstone; calcareous concretions
		Wrotham Park Sandstone	Klw	Pebble conglomerate, feldspathic and pebbly sandstone; glauconitic sandstone
	JURASSIC	Dalrymple Sandstone	Jl	Conglomerate, sandstone
	TRIASSIC ?	Pepper Pot Sandstone	Rp	Flaggy argillaceous sandstone and siltstone overlying massive red conglomerate and sandstone
PALAEOZOIC	UPPER PERMIAN–TRIASSIC ?	Elizabeth Creek Granite	Pgz	Pink leucocratic biotite granite
		Featherbed Volcanics	Pf	Massive grey ignimbrites; subordinate acid lavas
		Almaden Granite	Pga	Grey biotite — hornblende granite
		Undifferentiated	Pzu	Hornblende granodiorite, rhyolite
	UPPER PERMIAN	Mount Mulligan Coal Measures	Pum	Conglomerate, sandstone, siltstone, shale, volcanic conglomerate, coal
		Nychum Volcanics	Pun	Acid lavas, pyroclasts, ignimbrites; Subordinate basalt and andesite; Arkose, siltstone, impure coal, tuffaceous sediments
	CARBONIFEROUS ?	Cannibal Creek Granite	Cgc	Cream, muscovite-biotite-microcline granite
		Mareeba Granite	Cgm	Grey porphyritic, muscovite-biotite, microcline granite
		Undifferentiated	Cg	Diorite
	CARBONIFEROUS	Montalbion Sandstone	Cm	Quartz sandstone
				Greenschist, serpentine, talc-carbonate rock
	M. DEVONIAN–L. CARBONIFEROUS	Hodgkinson Formation	D-Ch	Micaceous greywacke siltstone slate, chert, basic volcanics; Main areas of chert and basic volcanics; Limestone; Main conglomerate lenses; Low grade metamorphic greywacke, slate, siltstone, formerly "BARRON RIVER METAMORPHICS"
	UPPER SILURIAN–LOWER DEVONIAN	Mount Garnet Formation	S-Dm	Quartz greywacke arkose, siltstone, chert, basalt; Limestone; Main conglomerate lenses
		Chillagoe Formation	S-Dh	Chert, quartz greywacke, siltstone, conglomerate, breccia, basalt; Reef limestone; Main areas of basic volcanics
PRECAMBRIAN	ARCHAEAN ?	Dargalong Metamorphics	Ad	Schist, gneiss, augen gneiss, granulite, quartzite, amphibolite

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



Compiled and published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development, in conjunction with the Geological Survey of Queensland. Topographic base compiled by the Royal Australian Survey Corps. Aerial photography by Adastra Aerial Survey; complete vertical coverage at 1 : 80,000 scale. Transverse Mercator Projection.



EXPLANATORY NOTES

The survey was made with a DC.3 aircraft at an altitude of 250 metres above ground level along lines spaced 1.6 kilometres apart. The flight-lines are idealized and serve as baselines to the profiles. They approximate the actual flight-path with a probable error of ±0.5 kilometres.

In order to avoid congestion, only every fourth profile is shown on the map.

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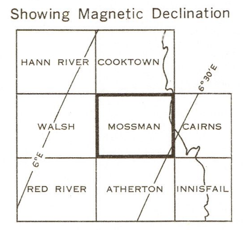
INDEX TO ADJOINING SHEETS

Showing Magnetic Declination



ANNUAL CHANGE 2′ E

AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

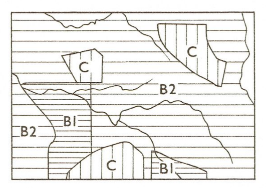
Scale 1 : 250,000

5 0 5 10 15 MILES

5 0 5 10 15 20 25 KILOMETRES

TOTAL MAGNETIC INTENSITY PROFILES

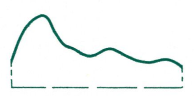
GEOLOGICAL RELIABILITY DIAGRAM



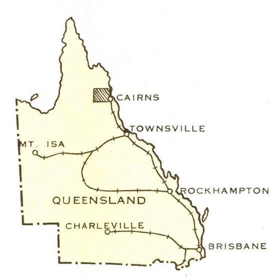
- B1 Detailed reconnaissance — numerous traverses and air-photo interpretation
- B2 Reconnaissance — traverses and air-photo interpretation
- C Air-photo interpretation

Geology by: F. de Keyser, K. G. Lucas, W. R. Morgan, B. J. Amos, R. M. Tucker.
Compiled May, 1961, by: F de. Keyser.
Drawn 1962 by: Mercury Press Pty. Ltd.

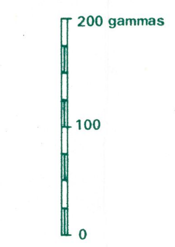
GEOPHYSICAL LEGEND



Total magnetic intensity profile

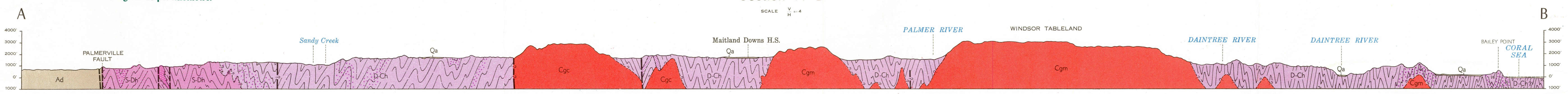


PROFILE SCALE



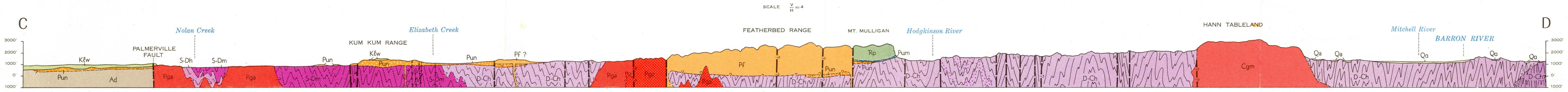
Section A - B

SCALE V/H = 4



Section C - D

SCALE V/H = 4



MOSSMAN

SHEET SE 55–1

Overlay E55/B1–26

To Accompany Record No. 1971/124

This map, with geophysical data overprint is not for sale, but available for reference in B M R Record No. 1971/124.

Printed by Mercury Press, Hobart

Rec. 1971/124

AUSTRALIA 1:250,000

CAIRNS
QUEENSLAND

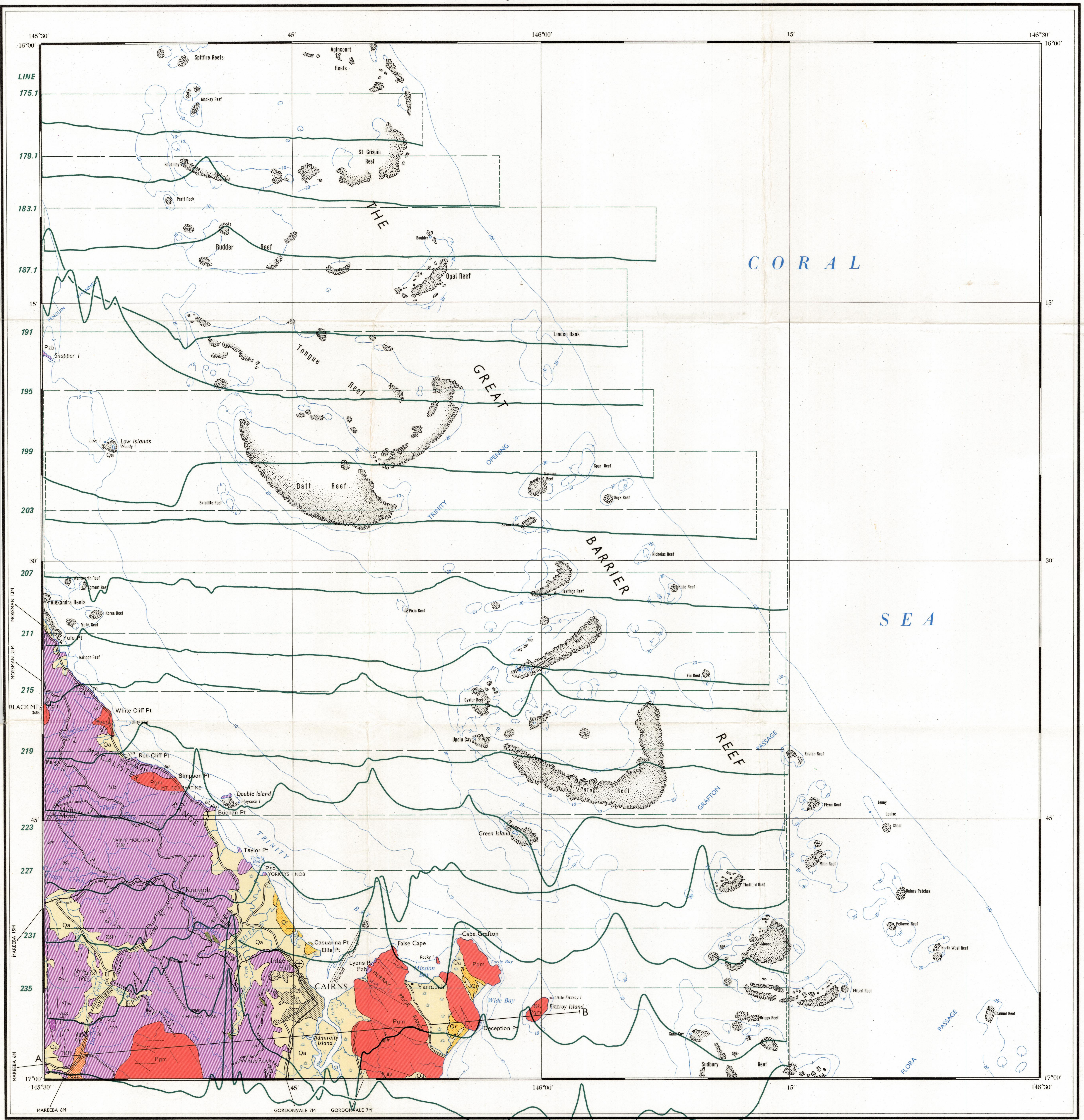
1:250,000 GEOLOGICAL SERIES SHEET SE 55-2

FIRST EDITION 1964

PLATE 5

AIRBORNE SURVEY,
SOUTHERN CAPE YORK PENINSULA, QLD 1969

TOTAL MAGNETIC INTENSITY PROFILES



Reference

CAINOZOIC	QUATERNARY		Qa	Alluvium and recent beach sand
			Qr	Old beach sand
	UNDIFFERENTIATED	Atherton Basalt	Cza	Olivine basalt
PALAEOZOIC	LOWER PERMIAN	Mareeba Granite	Pgm	Coarse grey biotite granite, usually contains muscovite, tourmaline-rich in places
	MIDDLE PALAEOZOIC	Barron River Metamorphics	Pzb	Slate, phyllite, quartzite, chert, greywacke (Metamorphic equivalent of the Hodgkinson Formation)
				Main conglomerate lenses
				Main areas of greenstone

- Geological boundary: where position is approximate, line is broken; where inferred, queried
- Strike and dip of strata
- Vertical strata
- Strike and dip of cleavage
- Vertical cleavage
- Cleavage, showing plunge of lineation
- Plunge of lineation
- Joints } air-photo interpretation
- Trend lines } air-photo interpretation
- Vein or dyke: q — quartz, ap — aplite
- Mine
- Prospect
- Alluvial workings
- Au Gold
- Cl Clay (bricks, etc.)
- Gr Aggregate
- Mn Manganese
- Sn Tin
- W Wolfram
- (PD) Position doubtful

- Road
- Vehicle track
- Railway line with station
- Town
- Mission or Government Aboriginal Settlement
- Airport
- Swamp
- Mangroves
- Coral reef
- Rocky reef
- Fathom line
- Bore hole
- •3375′ Height in feet, barometric: datum-mean sea level

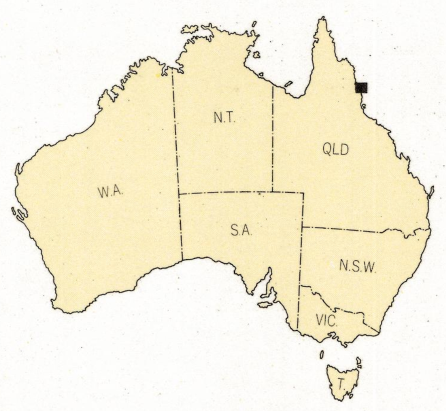
GEOPHYSICAL LEGEND

Total magnetic intensity profile

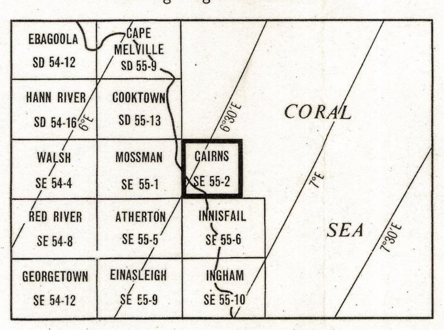
PROFILE SCALE

200 gammas
100
0

Compiled and published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development, in conjunction with the Geological Survey of Queensland. Topographic base compiled by the Royal Australian Survey Corps; off-shore information compiled by the Division of National Mapping from Admiralty Charts. Aerial photography by Adastra Airways Pty. Ltd.; complete vertical coverage at 1: 80,000 scale. Transverse Mercator Projection



INDEX TO ADJOINING SHEETS
Showing Magnetic Declination



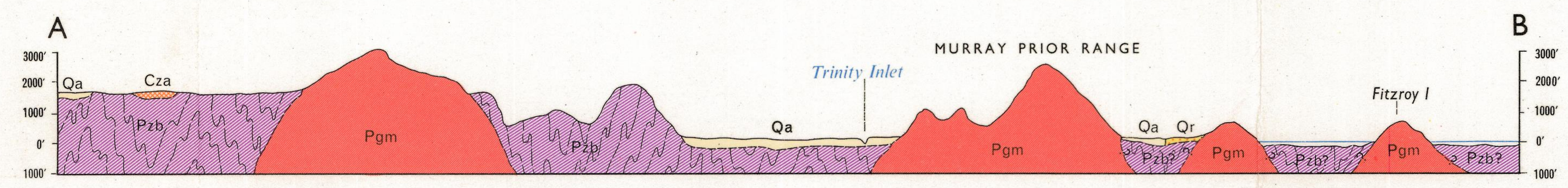
ANNUAL CHANGE 2′E

Scale 1: 250,000

5 0 5 10 15 MILES

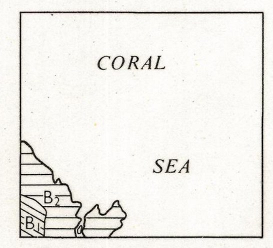
5 0 5 10 15 20 25 KILOMETRES

Section
SCALE: $\frac{V}{H} = 4$

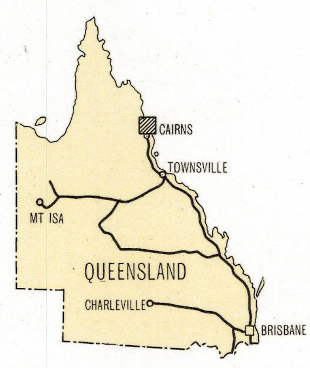


GEOLOGICAL RELIABILITY DIAGRAM

Geology, 1962, by: R. S. H. Fardon, F. de Keyser
Compiled, 1962, by: R. S. H. Fardon, F. H. Peniguel
Drawn, 1964, by: Queensland Aerial Survey Company Pty. Ltd.



B_1 Detailed reconnaissance — numerous traverses and air-photo interpretation
B_2 Reconnaissance—traverses and air-photo interpretation



This map, with geophysical data overprint is not for sale, but available for reference in B M R Record No. 1971/124.

EXPLANATORY NOTES

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CAIRNS
SHEET SE 55-2

To Accompany Record No. 1971/124   Overlay E55/B1—29

Printed by Mercury Press Pty. Ltd. Hobart.

WALSH

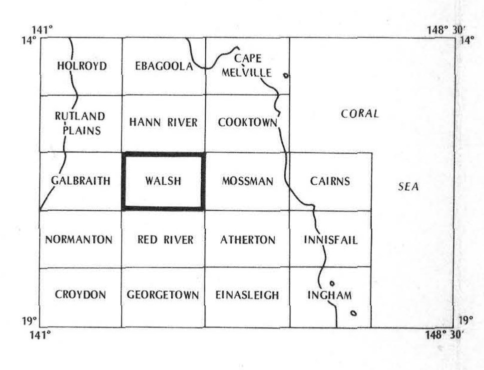
Rec. 1971/124

PLATE 6

Based on E54/B0-33, E54/B1-54

Topography by the Royal Australian Survey Corps.

LOCATION DIAGRAM



AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

GEOPHYSICAL INTERPRETATION

5 0 5 10 15 20 25 30 KILOMETRES

5 0 5 10 15 MILES

GEOPHYSICAL LEGEND

5 Zone boundary
Number for text reference only

Magnetic trend

600 Magnetic basement contours (Metres below sea level)

250 Depth of magnetic basement (metres)

335 Depth of basement from seismic survey (Metres)

To Accompany Record No. 1971/124

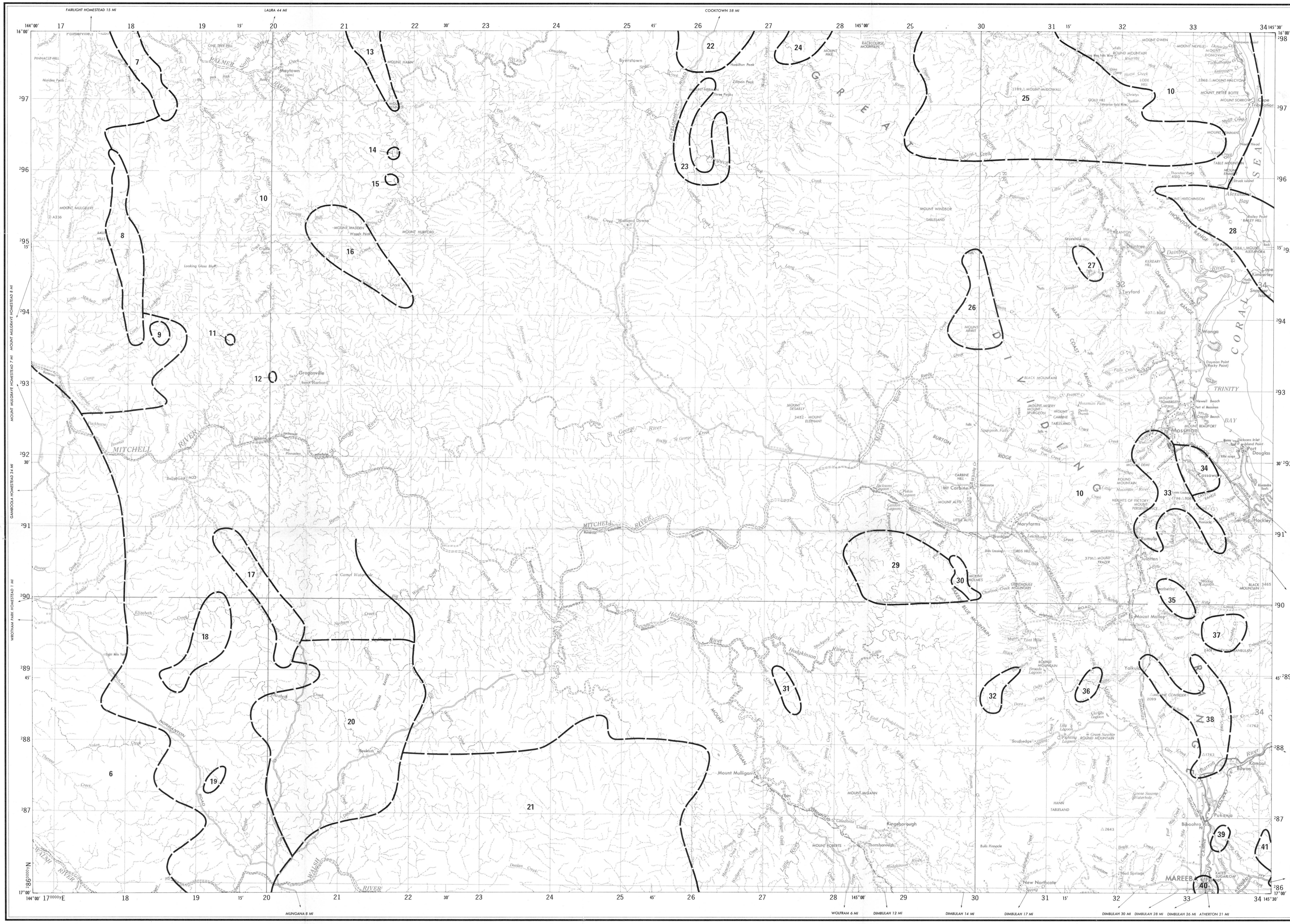
E54/B1-58

Rec. 1971/124

AUSTRALIA 1:250,000

MOSSMAN

PLATE 7



Based on E55/B0-20, E55/B1-27

Topography by the Royal Australian Survey Corps.

LOCATION DIAGRAM

HOLROYD	EBAGOOLA	CAPE MELVILLE	
RUTLAND PLAINS	HANN RIVER	COOKTOWN	CORAL
GALBRAITH	WALSH	MOSSMAN	CAIRNS
NORMANTON	RED RIVER	ATHERTON	INNISFAIL
CROYDON	GEORGETOWN	EINASLEIGH	INGHAM

AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

GEOPHYSICAL INTERPRETATION

5 0 5 10 15 20 25 30 KILOMETRES

5 0 5 10 15 MILES

GEOPHYSICAL LEGEND

10 Zone boundary
Number for text reference only

Interpreted fault

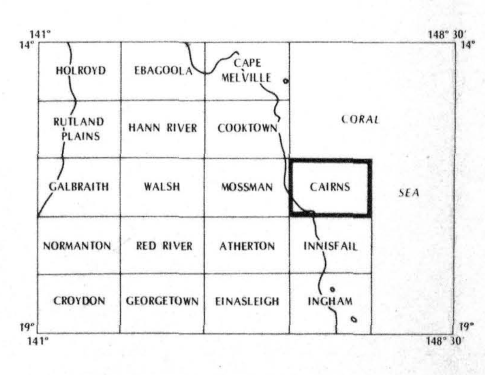
To Accompany Record No. 1971/124

E55/B1-35

Based on E55/B0-21, E55/B1-30

Topography by the Royal Australian Survey Corps.

LOCATION DIAGRAM



AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

GEOPHYSICAL INTERPRETATION

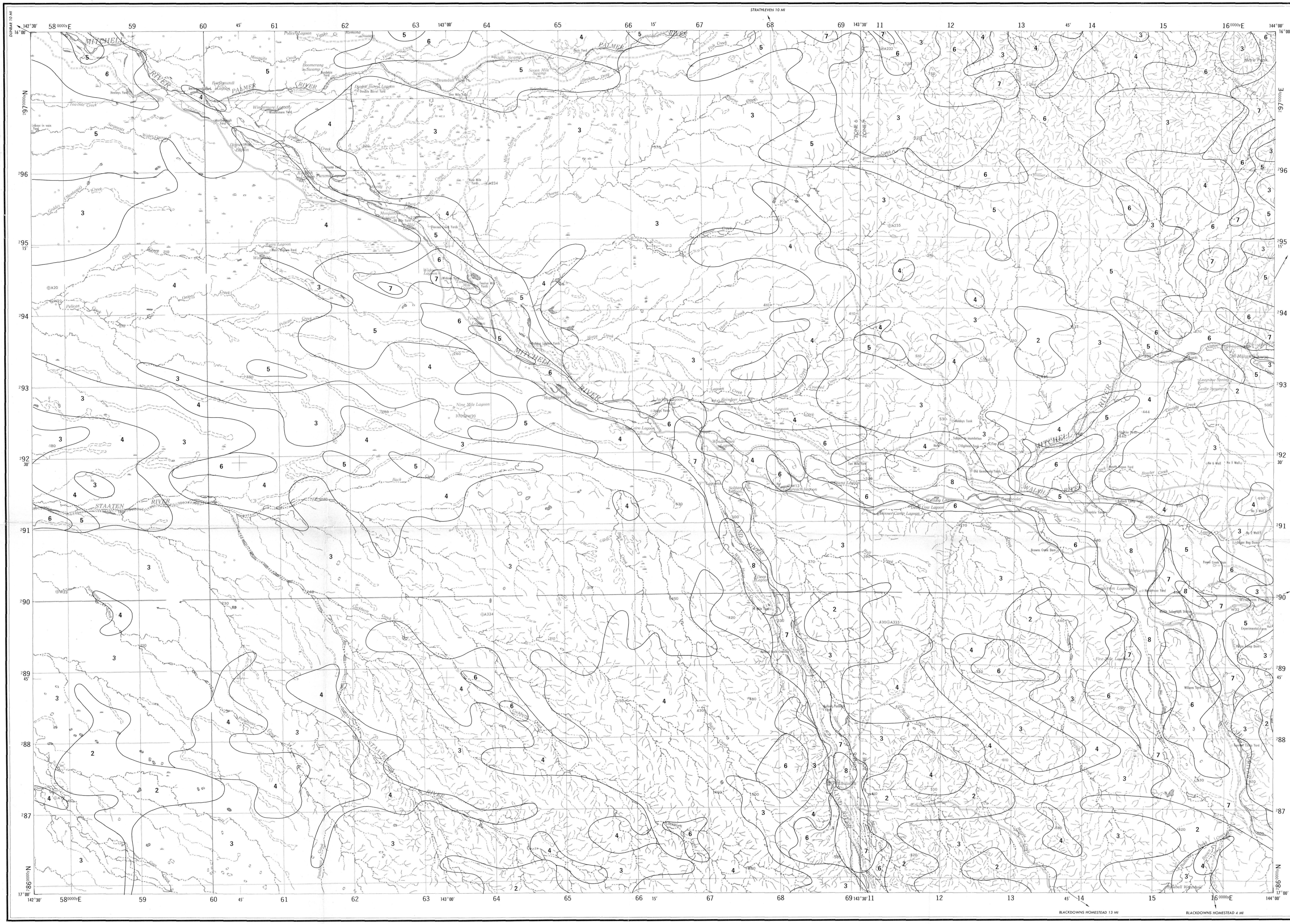
5 0 5 10 15 20 25 30 KILOMETRES
5 0 5 10 15 MILES

GEOPHYSICAL LEGEND

10 Zone boundary
Number for text reference only

Magnetic trend

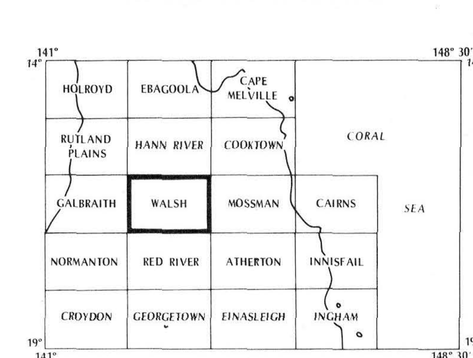
Rec. 1971/124



Based on E54/B0 33 E54 B1 55

Topography by the Royal Australian Survey Corps.

LOCATION DIAGRAM



AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

RADIOMETRIC RESULTS

5 0 5 10 15 20 25 30 KILOMETRES

5 0 5 10 15 MILES

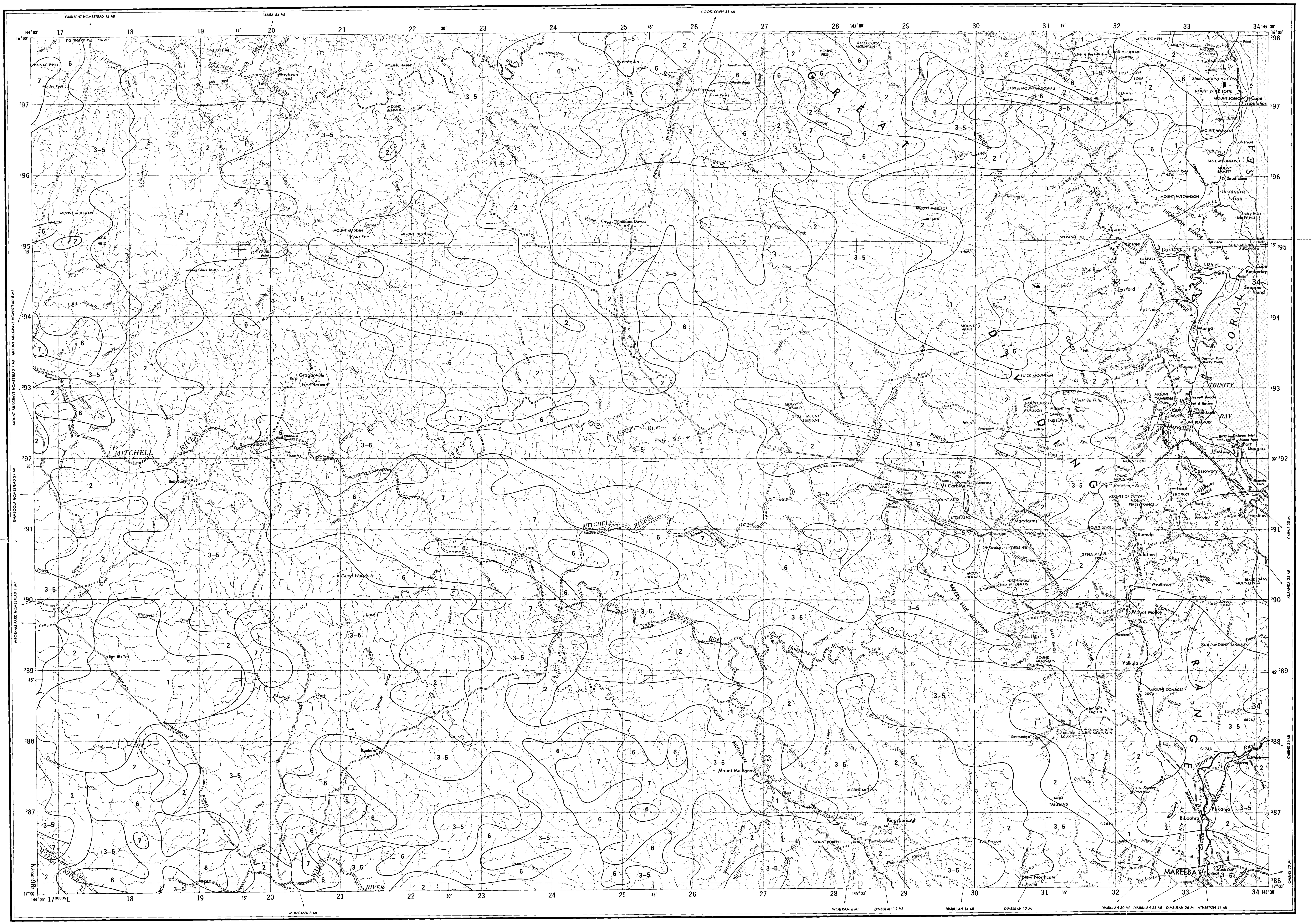
GEOPHYSICAL LEGEND

Zone boundary
Number for text reference only

AUSTRALIA 1:250,000

MOSSMAN

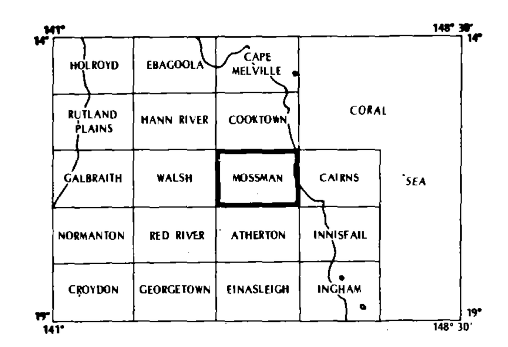
PLATE 10



Based on E55/B0-20, E55/B1-28

Topography by the Royal Australian Survey Corps.

LOCATION DIAGRAM



AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

RADIOMETRIC RESULTS

5 0 5 10 15 20 25 30 KILOMETRES

5 0 5 10 15 MILES

GEOPHYSICAL LEGEND

2 Zone boundary
Number for text reference only

To Accompany Record No. 1971/124

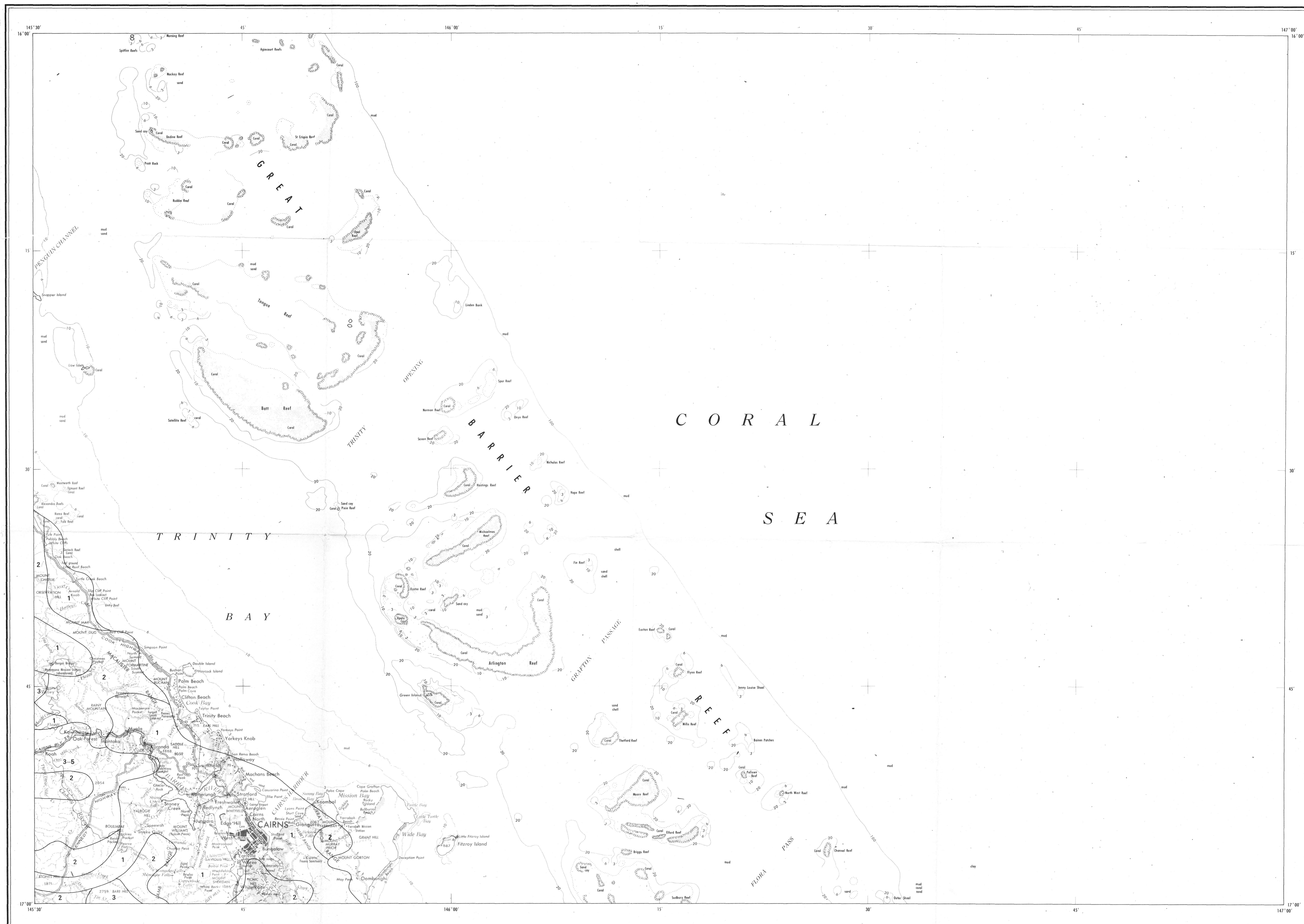
E55/B1-33

Rec. 1971/124

AUSTRALIA 1:250,000

CAIRNS

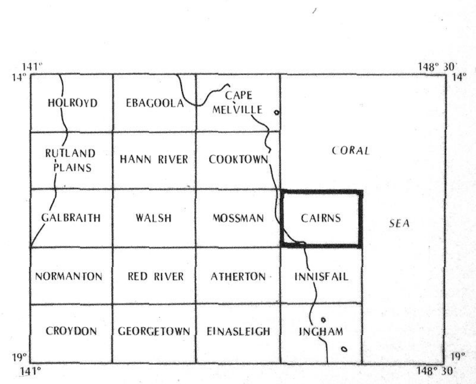
PLATE 11



Based on E55/B0-21, E55/B1-31

Topography by the Royal Australian Survey Corps.

LOCATION DIAGRAM



AIRBORNE SURVEY, SOUTHERN CAPE YORK PENINSULA, QLD 1969

RADIOMETRIC RESULTS

5 0 5 10 15 20 25 30 KILOMETRES

5 0 5 10 15 MILES

GEOPHYSICAL LEGEND

1 Zone boundary
Number for text reference only

To Accompany Record No. 1971/124

E55/B1-34