COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1963/82

EXPLANATORY NOTES, CAIRNS 1:250,000 GEOLOGICAL SHEET. S.E.55-2

Compiled by

R.S.H. Fardon

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EXPLANATORY NOTES, CAIRNS 1:250,000 GEOLOGICAL SHEET

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INTRODUCTION

The Cairns Sheet in North Queensland covers an area bounded by latitudes 16° and 17° south, and longitudes 145°30' and 147° east; the map accompanying these notes extends only to 146°30' east. The main features of the area are a triangular land-mass of about 400 square miles in the south-west; the Continental Shelf with the Great Barrier Reef; and the deeper Queensland Trench of the Coral Sea in the north-east.

The climate is hot, wet, and tropical at Cairns and on the ranges, where the annual rainfall is about 85 inches. The ranges are still covered with jungle, but most of the coastal plain has been cleared for sugar cane. The jungle gives way to open forest on the drier tableland in the west, where the rainfall is about 35 inches, and where the country is used for grazing.

A good system of bitumen highways, metal roads, and tracks exists on the lowlands and on the plateau. Forestry roads and tracks give access to most of the jungle-covered ranges, but they are often impassable in wet weather. The Cape Grafton area can be reached only by launch, but a road suitable for four-wheel-drive vehicles may soon follow the power-line to Yarrabah Aboriginal Settlement. Cairns is connected to the south and the north by a good highway, and has regular rail, air, and sea services.

The area is covered by Runs 5-9 of the Mossman-Cairns 1:82,000 scale air-photos flown for the Division of National Mapping, Department of National Development, by Adastra Airways Pty Ltd in mid-1960. No planimetric maps are available, and geology was plotted on the Cairns and Macalister Range Army 1-mile maps, and transferred to the Cairns 4-mile base map, which has fairly accurate contours. Uncontrolled air-photo mosaics, on 1:62,000 scale, have been compiled of the Cairns and Macalister Range 1-mile sheets by the Division of National Mapping.

Mapping of the area, in May and June, 1962, was part of the programme of a combined field party from the Bureau of Mineral Resources and the Geological Survey of Queensland led by F. de Keyser.

PREVIOUS LITERATURE

Previous study of the Cairns Sheet Area has usually been incidental to broader surveys in North Queensland. Brief surveys have been made of the small mineral prospects.

Brooks (1960) gave an up-to-date summary of information available on the Barron River Metamorphics, and outlined the basis of their long-standing correlation with the Neranleigh-Ferndale Group of Southern Queensland. The most comprehensive account of the regional geology is given by White (1961).

PHYSIOGRAPHY

The land area consists of a plateau in the west, a series of roughly north-north-west trending ranges, and coastal plains continuous with the continental shelf (see Plate 1).

(a) The Plateau in the west is about 1500 feet high. It consists partly of the alluvial plain of the Barron River and its tributaries, partly of ridges of Barron River Metamorphics, which may rise to 1800 or even 2100 feet. The plateau falls away in a steep irregular scarp to the coastal plain in all places - nowhere is there a gradual transition from plateau to lowland. The plateau, as is usual in the region from Port Douglas to Townsville, is highest at or near the scarp and slopes gently westward. The divide along the Macalister Range, the eastern edge of the plateau north of Cairns, may be within a mile of the sea.

(b) The Ranges generally consist of granite, but the highest peak in the area, Chujeba Peak, west of Cairns, consists of metamorphic rocks. The three mountain blocks east of Cairns alternate with plains in striking parallelism. By contrast with the maturity of the plateau, the ranges have a young topography typified by gorges, V-shaped valleys, and waterfalls.

(c) The Coastal Plains are very flat, and consist of alluvial outwash, estuarine and lagoonal deposits, and old beach or dune sands. Trinity Inlet, set in mangrove swamps, is a tidal estuary fed now by insignificant creeks. Apart from a small break in slope along the coast due to marine erosion, the coastal plains are continuous with the shallow continental shelf, which is 600 feet deep at its edge, forty miles east.

STRATIGRAPHY

The stratigraphy is simple: folded Lower to Middle Palaeozoic Barron River Metamorphics were intruded by the (?)Lower Permian Mareeba Granite, and these rocks are now overlain by superficial Cainozoic basalt, alluvium, and beach sands.

Middle Palaeozoic : Barron River Metamorphics

De Keyser (1961) considered the Barron River Metamorphics to be metamorphic equivalents of the Middle Devonian to (?)Lower Carbiniferous Hodgkinson Formation, the boundary being "arbitrary, gradational and ill-defined". They had previously for many years been correlated with the (?)Silurian Neranleigh-Fernvale Group of Southern Queensland because of similar lithologies and "coincidence of regional strike and degree of deformation" (Brooks, 1960).

Although these rocks are certainly continuous with the Hodgkinson Formation immediately to the west of the sheet area, the Barron River Metamorphics, of unknown thickness, could well contain pre-Hodgkinson sediments that are the deeper-water time-equivalents of the Upper Silurian to Lower Devonian Chillagoe and Mount Garnet Formations which form shelf deposits in the western part of the Hodgkinson Basin. Therefore the Barron River Metamorphics are separated from the Hodgkinson Formation for two reasons: they are, as a group, a distinct metamorphic facies; and they may contain sediments of Silurian to Lower Carboniferous age. No fossils have yet been found in them.

The Barron River Metamorphics consist of phyllite, slate, micaceous schist, greywacke and sub-greywacke, chert, quartzite, greenstone, and conglomerate; the rocks are strongly silicified in many places.

The slate and phyllite, as exposed on the coast along the Cook Highway, are commonly finely laminated, and include black carbonaceous beds. They are sericite-chlorite-biotite-feldspar-quartz rocks. Graded beds from 1 inch to 1 foot thick are common, and the coarsest grade is usually silt.

Biotite and muscovite-bearing schists with mica flakes about 2 mm. long occur in many places, and seem to have formed from original impure sandstone and greywacke.

Large areas near the granites consist of black biotite-quartz-feldspar hornfelses containing a little garnet in places.

Throughout the sequence subgreywacke and greywacke occur in beds up to at least 100 feet thick; subgreywackes are more common than greywackes; they contain a few lithic fragments and grains of feldspar, only a little clay, and angular grains of quartz. These rocks are generally schistose. North of Cairns the greywackes include conglomerates, in which fragments two or three inches long are stretched to five or six inches by bedding-plane shearing and the stresses responsible for the regional schistosity.

Near Black Mountain in the north, at Rainy Mountain north-west of Kuranda, and especially at Mount Formantine in the Macalister Range, are masses of sheared or crushed rock of doubtful origin. They are massive, dark grey rocks with enough fine chlorite to give a phyllitic sheen on surfaces of schistosity. In hand-specimen it is not clear whether they have a coarsely arenitic but recrystallized texture, or a medium-grained igneous texture. Under the microscope their appearance is that of a crushed, granulated, and altered adamellite, but there are patches rich in biotite, epidote, chlorite, and sericite or muscovite that might represent original sedimentary material. In the field these rocks seem to grade into hornfels and schist, and they may have originated in one (or more) of three ways: by crushing and recrystallization of arkose - which is unlikely; by feldspathization and crushing of an arenaceous rock; by crushing and alteration of adamellite; or they may have been formed by a combination of the last two processes. The rocks probably occur on a major fault-zone.

A little pink, grey, and white quartzite occurs throughout the metamorphics. Banded cherts show close isoclinal folds whose axes plunge at moderate angles, generally north-west and south-east along the regional strike.

Only the main areas of greenschist are shown on the map, and the actual extent of even these is unknown. The major outcrops are in the lower Barron Gorge, where two massive bodies, 1500 to 2000 feet and 1000 feet thick, respectively, are separated by about 600 feet of phyllite and transitional phyllite-greenschist rock. These thicknesses may be actual, or duplicated; the two masses may be limbs of a fold. In several places further up the gorge irregular masses of greenstone occur in plastically deformed quartzites and slates; these may be flows or sills, but the transitional rocks suggest that some of the greenstones were pyroclastics, consisting of a mixture of sedimentary and igneous material. A few small, straight, north-west trending dykes of greenschist up to four feet wide cut across the crumpled sediments, and they are obviously later intrusives.

The greenschists of the Barron Gorge, at Kuranda Range lookout, and at the Freshwater Creek intake dam, are pyrite-calcite-magnetite-albite-epidote-chlorite rocks. Either epidote or chlorite may predominate in the rocks, and may also occur in patches and veins. Other greenstones consist of tremolite-actinolite, chlorite, and albite, and some may contain talc.

Near the western margin of the area 5000 feet of conglomerate and pebbly sandstone occur within slate and phyllite. Most fragments are of phyllite, quartzite, hornfels, and fine volcanic rocks; they are up to 9 inches long, and are elongated parallel to the schistosity. The structure and extent of this conglomerate were not determined.

Lower Permian : Mareeba Granite

The most typical outcrops of Mareeba Granite in the area are those east and west of Cairns. They consist of coarse- to medium-grained porphyritic or even-grained biotite adamellite. The proportion of biotite is variable, and some rocks are quite leucocratic. Most of them contain a little muscovite, and there are a few remnants of hornblende. Myrmekite and micropegmatite are common. About the margins of the mass south-west of Cairns small lenses of pegmatite are common, and tourmalinisation of the country rocks may culminate in a black tourmaline-biotite rock at the contact. In places, such as Davies Creek, angular biotite-rich xenoliths are plentiful; many are shadowy and half digested. A few roof pendants of slate are found on the granite hills.

In the Murray Prior Range porphyritic granite contains small segregations and "suns" of tourmaline, and some interstitial fine quartz-feldspar intergrowths. Small, shadowy, biotite-rich xenoliths are especially plentiful south of Yarrabah Aboriginal Settlement. Pink and grey biotite granites south of Cape Grafton and on Fitzroy Island have the same mineralogy, and show the usual slight shearing.

The pink and grey granite about Hartley's Creek in the north is variable, and includes biotite, tourmaline, and muscovite granite, greisen, aplite, silicified granite, and small pegmatite and aplite veins. Microcline phenocrysts are aligned in many directions, notably north-west. The granite is locally gneissic along its margin; both gradational and sharp intrusive boundaries occur against the hornfelses and schists.

Along the Cook Highway, north of Hartley's Creek, towards White Cliff Point, a coarse, porphyritic granite has swirled foliation, and within about a chain changes to a white, fine- to medium-grained tourmaline granite. This is the attractive white rock of White Cliffs. Though tourmaline prisms are uniformly disseminated throughout the rock, a few tourmaline schlieren also occur. The tourmaline has replaced feldspar in places. Garnet may be associated with the tourmaline, and some biotite and muscovite remain. At the contact with country rock quartz veins are abundant, and irregular feldspathisation has taken place. A strong system of curved joints which dip steeply north-east to north may indicate that a granite contact parallel to the joints formerly existed just out from the present coast.

At Black Mountain and at Mount Formantine no granite has been found in place, but grey biotite granite boulders were found in the area of crushed rock that itself looks like an altered granodiorite. The granite boundary on Black Mountain does not fit with that shown on the Mossman Sheet, where some of the area mapped as granite is biotite schist and greywacke.

The Mareeba Granite, once considered Upper Carboniferous in age (Morgan, 1961), has been shown to be Lower Permian at the Gillies Highway, just south of the Cairns area, by recent age determinations; its symbol has therefore been changed tentatively from Cgm to Pgm.

Dykes and Veins of unknown age.

Aplite dykes, the many quartz veins, and zones of silicification north-east of Mareeba and elsewhere are probably associated with the late stages of the Mareeba Granite intrusion.

Loose blocks of dolerite in the Murray Prior Range are probably derived from large dykes in the granite. The creeks contain pieces of fine porphyry that resemble Permian extrusive porphyries elsewhere, so that they could be derived either from roof pendants of such porphyry or from porphyry dykes.

Cainozoic : Atherton Basalt.

A thin layer of olivine basalt lies in the Davies Creek valley, on the Mareeba Plain. Its thickness ranges from 6 to 50 feet, and it has come from small vents just south of the Cairns Sheet area. It is part of the Atherton Basalt of uncertain Pliocene to Recent age.

Alluvium

Quaternary alluvium may overlie Tertiary sediment along the Clohesy and Barron Rivers - it is possible that the basalt along Davies Creek overlies the earliest alluvium. The present cycle is one of erosion, and some of the incised streams have cut up to three terraces in the alluvium. Coastal deposits include alluvial outwash, estuarine, and possibly lagoonal deposits, and their lowermost sediments may be of late Tertiary age. Small cusps of thick boulder deposits remain at the foot of the Macalister Range. They show torrential cross-bedding and cut-and-fill structures. Imbricate structures indicate current directions away from the present range, where the deposits are being eroded by steep creeks.

Old Beach and Dune Sands.

Beach sands, and dune sands derived from them, occur along the southern shores of the swampy flats between the granite ranges east of Cairns. The dunes are best developed on Wide Bay, where they form parabolic and longitudinal ridges parallel to the prevailing south-south-easterly wind direction, and have been blown inland for distances ranging up to nearly two miles.

Marine Shelf Deposits.

Marine shelf deposits, which naturally are not exposed, are known to be at least 300 to 400 feet thick (Fairbridge, 1950). They are mainly terrigeneous, but locally include numerous lenses of organogenic reef sands and limestone which increase proportionally towards the Great Barrier Reef. A bore on Michaelmas Cay, north-east of Cairns, has penetrated more than 600 feet of reef sand, limestone, and underlying Pleistocene glauconitic quartz sand without reaching bottom (Richards and Hill, 1942).

STRUCTURE

The regional trend of the tightly folded metamorphics and the granite masses is north-north-west. The metamorphics mostly dip steeply west, and are commonly overturned.

Bedding and schistosity are generally at small angles to each other; some of the larger angles are shown on the map.

Plastic deformation and "swirling" are common, so that attitudes of minor plications are irregular. On a small scale, boudinage structures are common, incompetent beds being attenuated about the competent lenses. These structures could also occur on a regional scale.

In the jagged outcrops of phyllite in the west of the area, small en echelon secondary folds plunge steeply west to north-west on the cleavage surfaces. Some of them are chevron folds. Along with these, a micro-lineation, formed by very fine plications of the micas, pitches from 40° to 90° to the north on the cleavage surface, and may swing round to the south.

Amos (1961, 1962) has shown that in the Mossman and Cooktown 1:250,000 Sheet areas adjoining the Cairns area, the Palaeozoic geosynclinal sediments of the Barron River Metamorphics and Hodgkinson Formation were affected by four distinct folding phases with or without associated axial-plane cleavage, and all belonging to the same, major, Carboniferous orogeny. They are not equally well developed from place to place, and one phase at least is confined to a certain belt outside of which it does not occur at all. Amos labelled the four fold systems B1, B2, B3, and B4, in chronological order.

The existence of multiple deformation has also been proved for the Cairns Sheet area, but a firm correlation with Amos' system has not been established because of the scarcity of outcrop information and the difficulty of photo-interpretation in the jungle-covered country. However, it is thought, and has been partly borne out by field observations, that an earlier phase of folding, setting the regional north-north-west trend, but rarely discernible in field exposures, was followed by one or more phases which folded earlier axial-plane cleavages or schistosities; this process may have taken place on a macroscopic as well as a mesoscopic scale. The folds seen in outcrop probably belong to these later phases.

Later faulting of undefined age has affected all fold structures. Small normal faults and low-angle thrust faults cut across the strike in a variety of attitudes in which no system has as yet been found. A variety of directions of movement is also found on slickensided surfaces.

GEOMORPHOLOGY

Most geologists have considered that the tablelands of Queensland were formed by uplift of peneplains or mature erosional surfaces during or after the Tertiary. This theory best explains the tablelands of the Cairns Sheet. The Barron River probably captured the headwaters of the Mitchell as a consequence of an upwarp along an axis about Mareeba, and then maintained its eastward course by cutting a gorge through the edge of the rising tableland.

The slight westward tilt of the Tableland could help to explain why it is bounded by such a steep scarp along its eastern margin; the west-bound streams would have little erosive power, and therefore would not greatly modify the topography of the Tableland, whereas erosion by the numerous, small, east-bound creeks along the edge of the plateau is strong, but acts mainly vertically owing to the very steep gradient. Furthermore, the westward tilt has prevented any significant east-bound drainage on the Atherton Tableland which, if it had been present, would have worn down the scarp by a combination of lateral and vertical erosion. To conclude, it seems that a fault scarp may have retreated westward irregularly by advance of a flat coastal pediment.

The ranges of the Cape Grafton peninsula simulate parallel fault blocks, and Süssmilch (1938) and others thought they were. However, small areas of metamorphic rocks on the sides of many of these granite ranges suggest that the present topographic slopes closely approach the actual shapes of the granitic intrusions - that is, the granite ranges could have been formed by differential erosion. Possibly a combination of differential erosion and faulting is responsible for the present land-forms.

The existence of the Cape Grafton promontary opposite the heights west of Cairns suggests a transverse upwarp across this area, countering the foundering of the area of the continental shelf.

Trinity Inlet is probably the old mouth of the Mulgrave River, which has been diverted south, probably not by a flow of basalt from Green Hill south of the inlet as has been commonly thought (e.g., by Jack in 1888, Danes in 1911, and Jardine in 1925), but probably by some slight upwarp, perhaps associated with this vulcanism.

GEOLOGICAL HISTORY

The geological history of the area can be summarized as follows. During the Middle Palaeozoic, probably from Silurian to Upper Devonian time, pelitic and arenitic sediments and a few basic volcanics were deposited in the area, which was part of that section of the Tasman Geosynclinal system known as the Hodgkinson Basin. Several phases of folding and faulting during a major Carboniferous orogeny, accompanied by regional metamorphism, transformed the geosynclinal pile into the low-grade Barron River Metamorphics. Postkinematic, Upper Carboniferous to Permian granite (Mareeba Granite) intruded these rocks, and was responsible for the mineralization. A long period of denudation and non-deposition lasted during the Mesozoic and most of the Tertiary, but may now and then have been disturbed by faulting. Strong block faulting, probably during the Pliocene, broke up the Tertiary peneplain and caused the uplift of the plateau in the west, and the subsidence of the continental shelf and possibly of the coastal plain, and the depressions between the granite ranges of the Cape Grafton Peninsula. The few lavas of the Atherton Basalt occurring in the Cairns Sheet area are probably of Quaternary age. The Main Divide shifted westwards as a result of the re-adjustment of the drainage system to the new physiographic conditions. Finally, Pleistocene to Recent alluvial deposits have filled the sunken coastal plain area, and littoral-marine sediments have been laid down on the shelf platform along the edge of which the Great Barrier Reef has been formed.

ECONOMIC GEOLOGY

No major mineral deposits have as yet been found, but the area has produced small amounts of gold, tin, and clay.

The only relatively important gold prospects were at the Clohesy River and at Kamerunga, eight miles north-west of Cairns. Between 1894 and 1898 attempts were made to mine low-grade quartz lodes at the Clohesy River, and a battery was set up. One shaft was sunk below 100 feet, but ore averaged only ½ oz per ton, and the prospect was abandoned. Similarly, at Kamerunga in 1933 and 1934 a shaft was sunk to 135 feet, with a 50 foot drive at the

100-foot level, in a persistent 4-5 foot quartz reef. Values ranged from less than 1 dwt to 2 oz, but water in the shaft was always a problem, so the mine soon closed.

A little gold, manganese, wolfram, and tin have been found at White Rock, south of Cairns, and in the hills south-west of it. The wolfram and tin were present only in traces, and the small 2-foot quartz-psilomelane lode did not warrant any further development. Thin quartz-manganese lodes are abundant in the Cairns Sheet area (A.G.G.S.N.A., 1941, and Jensen, 1919), generally along north-south shear-zones. Some of the manganese may be of sedimentary origin. Though prospecting has been done at Edge Hill, near Cairns, and north of Mona Mona Mission, there is no recorded production. Larger manganese lodes occur just south of the Cairns Sheet area between White Rock and Mount Peter.

Small, unrecorded amounts of tin were recovered from Hartley's Creek, Tin Creek, and others nearby, and a few small pits have been sunk on quartz veins in greisen and granite south of Hartleys Creek.

The Clohesy River Brickworks, once the Mareeba Brickworks, has, since September, 1951, operated two clay pits that have together produced 4000 to 6000 tons a year - 5000 tons in 1961.

Recently a sand and gravel deposit has been opened up two miles upstream from the clay pits.

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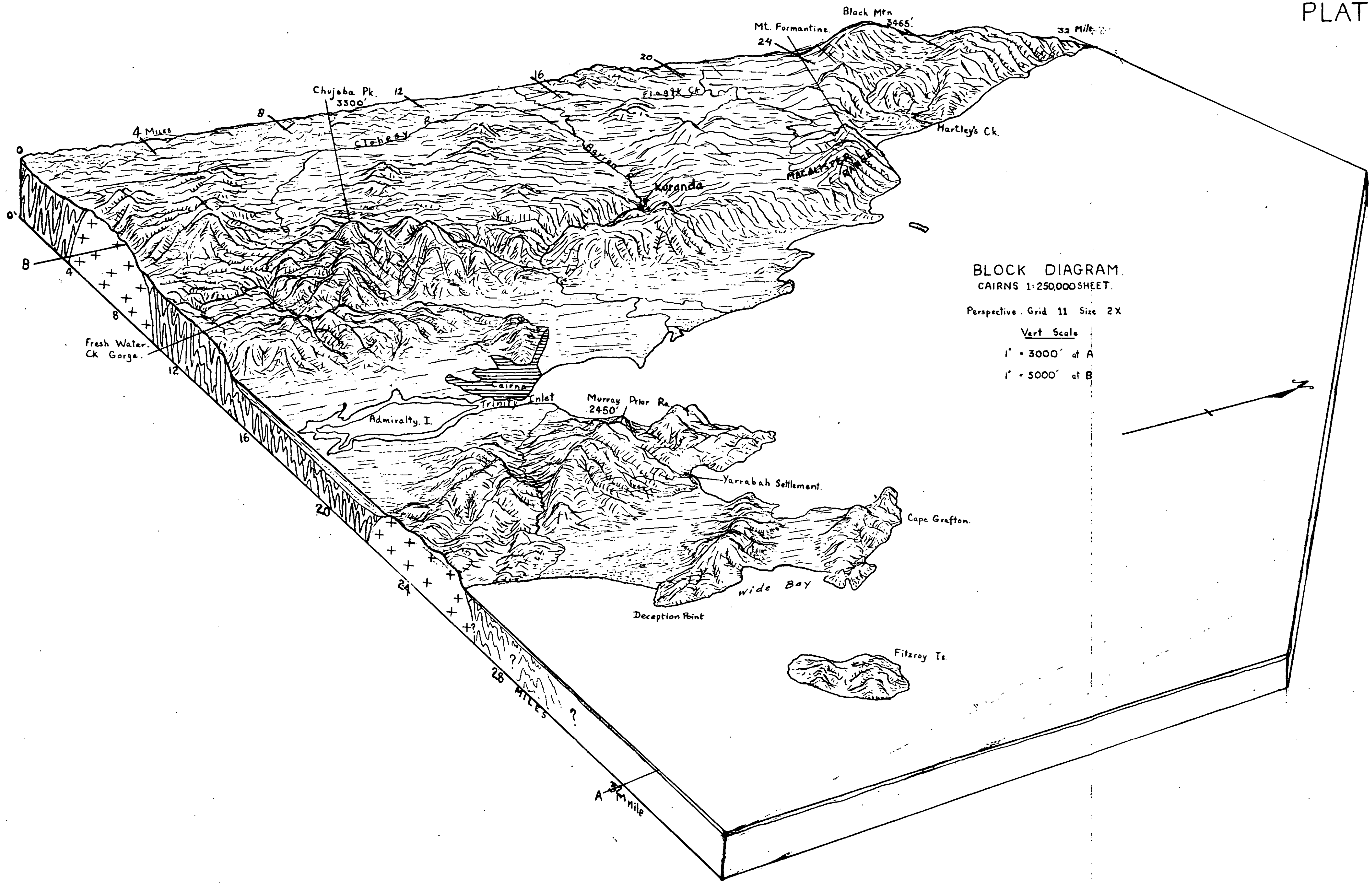
PLATE 1


BLOCK DIAGRAM.
CAIRNS 1:250,000 SHEET.
Perspective. Grid 11 Size 2X
Vert Scale
1" = 3000' at A
1" = 5000' at B
Black Mtn
3465'
Mt. Formantine.
32 Mile
Chujeba Pk.
3300'
4 Miles
Flaggy Ck
Hartley's Ck.
Barron R.
Kuranda
Macalister Range
Fresh Water Ck Gorge.
Cairns
Trinity Inlet
Admiralty I.
Murray Prior Ra.
2450'
Yarrabah Settlement.
Cape Grafton.
Wide Bay
Deception Point
Fitzroy Is.
28 MILES
A
B
32 Mile

AUSTRALIA 1:250,000

CAIRNS

QUEENSLAND

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

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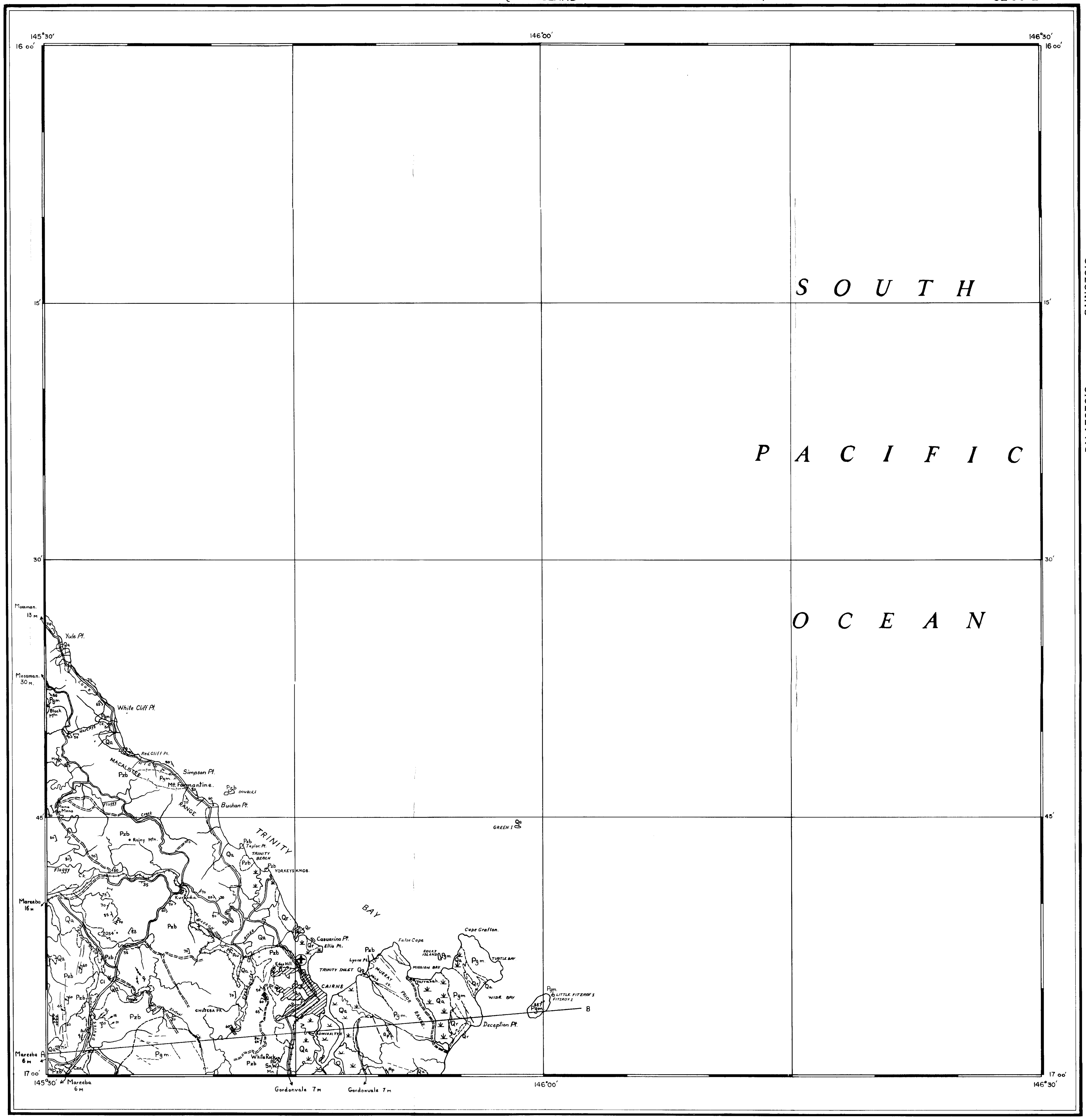
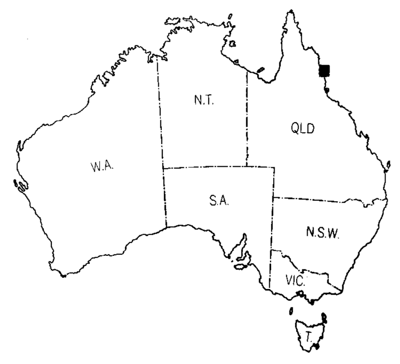


Reference

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

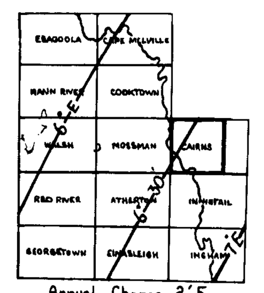
- Geological boundary: where position is approximate, line is broken; where inferred, queried
- Strike and dip of bedding
- Vertical strata
- Strike and dip of cleavage
- Vertical cleavage
- Joints. } air-photo interpretation
- Trend lines. } air-photo interpretation
- Plunge of lineation.
- Vein or dyke — q = quartz. ap = aplite.
- Prospect — Agg = Aggregate, Au = Gold, Cl = Clay, Mn = Manganese, Sn = Tin, W = Wolfram
- Alluvial workings
- Height in feet, barometric: datum - mean sea level
- Road
- Vehicle track
- Railway line
- Town
- Mission or Government Aboriginal Settlement
- Airport
- Swamp
- Mangroves

Compiled and issued by the Bureau of Mineral Resourses, Geology and Geophysics, Department of National Development. Topographic base compiled by the Royal Australian Survey Corps. Aerial photography by Adastra Airways Pty Ltd: complete vertical coverage at 1:80,000 scale. Transverse Mercator Projection.



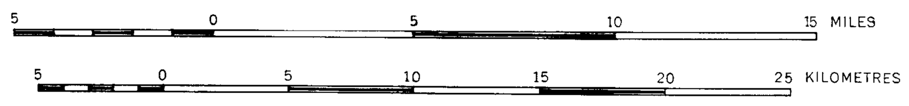
INDEX TO ADJOINING SHEETS

Showing Magnetic Declination.

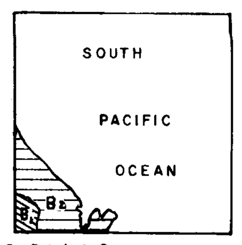


Annual Change 2' E.

Scale 1 : 250,000



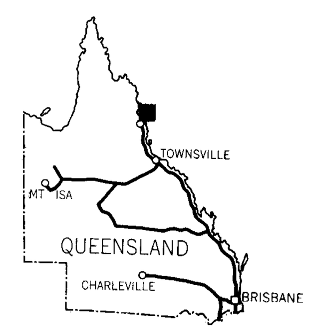
GEOLOGICAL RELIABILITY DIAGRAM



B_1 Detailed Reconnaissance: numerous traverses and air-photo interpretation.

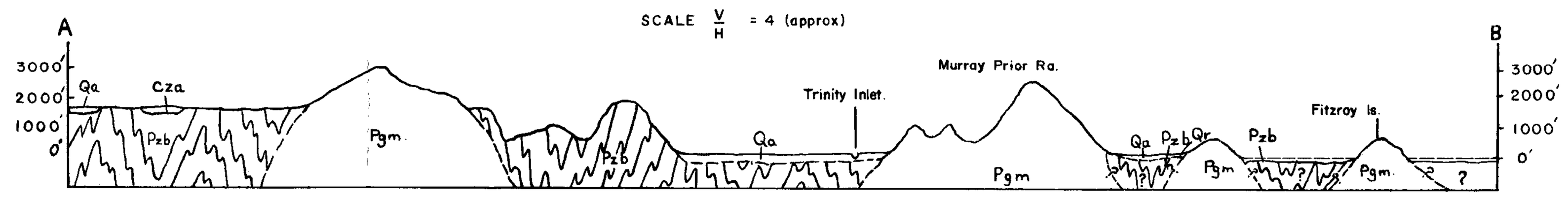
B_2 Reconnaissance: traverses and air-photo interpretation.

Geology by : R.S.H. Fardon, F. de Keyser. 1962.
Compiled by : R.S.H. Fardon, F.H. Peniguel Jr. 1962.
Drawn by : F.H. Peniguel Jr.



SECTION A – B

SCALE $\frac{V}{H}$ = 4 (approx)



CAIRNS

SE 55-2