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PROGRESS REPORT ON THE GEOLOGY OF THE DRUMMOND BASIN, QUEENSLAND

PARTS I & II

by

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PROGRESS REPORT ON THE GEOLOGY OF THE DRUMMOND BASIN QUEENSLAND

Part I - The geology of the eastern part of the Buchanan Sheet area.

Part II - Additions to the geology of the southern Drummond Basin.

Part III - Plates in accompanying folder.

by

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C O N T E N T S

PART I - THE GEOLOGY OF THE EASTERN PART OF THE BUCHANAN SHEET AREA.

SUMMARY

The oldest rocks in the Buchanan Sheet area are the pre-Devonian Anakie Metamorphics and the lower Middle Devonian Ukalunda Beds, which together with intrusive granite form the Anakie Inlier, a basement ridge that extends south-south-easterly for 150 miles to south of Anakie in the Emerald Sheet area.

It is not fully understood what role the Inlier played in Upper Devonian and Lower Carboniferous times following the Tabberabberan Orogeny at the close of the Middle Devonian. Shoreline deposits containing debris from the Inlier are present only in the lower part of the Devonian-Carboniferous sequence to the west, and the presence of about 4,000 feet of volcanics and sediments just east of the Inlier at Mount Rankin in the Clermont Sheet area indicates that at least part of the Inlier subsided and was covered by a considerable thickness of sedimentary rocks. The easterly extent of this fresh water sedimentation is not known.

West of the Anakie Inlier, the Drummond Basin received, during the Upper Devonian and Lower Carboniferous, up to 25,000 feet of acid volcanics and sedimentary rocks. Most of the sequence was probably laid down in a shallow non-marine environment which extended to the west and particularly to the south far beyond the present structural boundaries of the Drummond Basin. Rocks of similar affinity and age are known from the subsurface of the Adavale Basin. Most of the detritus was derived from the west and south from a hinterland probably made up of granite and low grade metamorphic rocks.

To the east of the Buchanan Sheet area, the mainly non-marine environment of the Drummond Basin merged with the marine conditions of the Yarrol Basin.

At the end of the Lower Carboniferous, the Drummond Basin

sequence was folded, and the Anakie Inlier and adjoining belt of folded Devonian-Carboniferous rocks were uplifted. To the west of this emergent block developed the Galilee Basin, a slowly subsiding meridional basin, that received Upper Carboniferous, Permian and Triassic glacial and non-marine shallow water deposits. During the Jurassic, this basin of sedimentation expanded greatly toward the west forming the Eromanga Basin.

No oil exploration work has been carried out in the east of the Buchanan Sheet area. The nearest oil well, Exoil Lake Galilee No. 1 in the north-west of the Galilee Sheet area, bottomed in the Drummond Basin sequence; a show of hydrocarbons was encountered in the Upper Carboniferous to Lower Permian Galilee Basin sequence.

INTRODUCTION

The eastern part of the Buchanan Sheet area covering parts of the Anakie Inlier and Drummond Basin, the eastern part of the Galilee Sheet area covering the Drummond Basin, and selected areas in the Emerald, Clermont and Jericho Sheet areas, were mapped during the 1966 field season. The party consisted of F. Olgers and H.F. Doutch of the BMR and J. Eftekharnezhad of the Geological Survey of Iran. Eftekharnezhad was with the BMR for one year from April 1966 under a United Nations Fellowship.

The geology of the eastern part of the Buchanan Sheet area is described here. The additions and changes to the geology of the southern part of the Drummond Basin are set out in Part II of this Record.

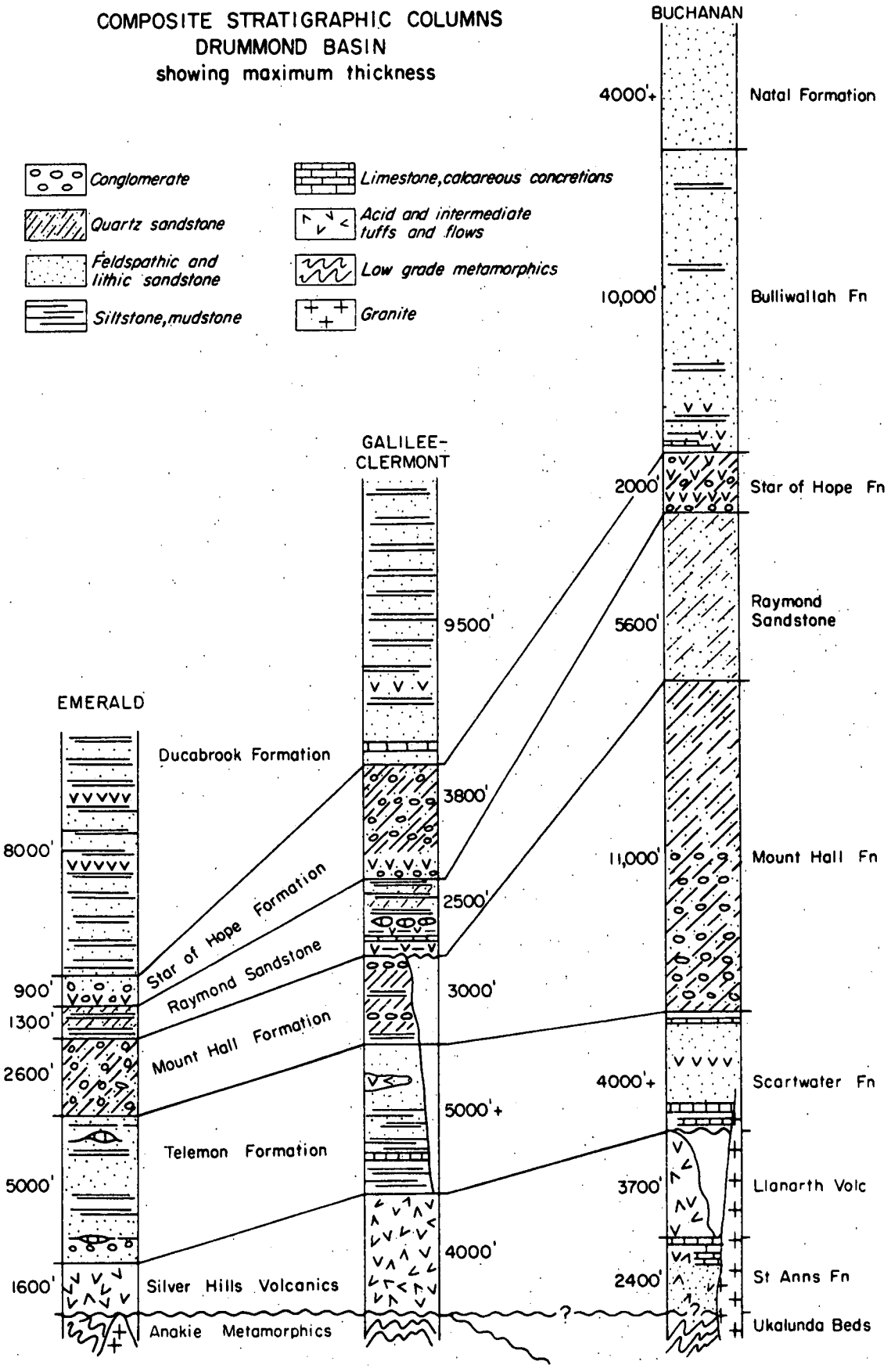
The main access road for the Buchanan Sheet area is the Gregory Developmental Road which connects Clermont and Charters Towers. It is unsealed except for a 60 mile stretch south of Charters Towers and a 13 mile stretch north of Clermont. Access within the area is reasonably good. The nearest airport is at Charters Towers.

The Sheet area is covered by air-photographs at 1:85,000 scale taken by Adastra Airways Pty Ltd in 1962. From these, the Division of National Mapping prepared uncontrolled photo-mosaic maps at a scale of 1 inch to 1 mile, principal point plots controlled by slotted templet assemblage at photo scale and a planimetric map at 1:250,000 scale. Other maps covering the area include cadastral maps at 1 inch to 4 miles and 1 inch to 2 miles published by the Department of Lands, Brisbane, and a planimetric map at 1 inch to 4 miles published by the Army in 1944.

Most of the area is wooded. Brigalow scrub is widespread in the south-east of the Sheet area, but in recent years large areas have been cleared for pasture improvement.

Beef cattle raising is the only industry in the area.

The western part of the Buchanan Sheet area was mapped in


COMPOSITE STRATIGRAPHIC COLUMNS
DRUMMOND BASIN
showing maximum thickness
Conglomerate
Quartz sandstone
Feldspathic and lithic sandstone
Siltstone, mudstone
Limestone, calcareous concretions
Acid and intermediate tuffs and flows
Low grade metamorphics
Granite
BUCHANAN
4000'+
Natal Formation
10,000'
Bulliwallah Fn
2000'
Star of Hope Fn
5600'
Raymond Sandstone
11,000'
Mount Hall Fn
4000'+
Scartwater Fn
3700'
Llanarth Volc
2400'
St Anns Fn
Ukalunda Beds
GALILEE-CLERMONT
9500'
3800'
2500'
3000'
5000'+
4000'
EMERALD
Ducabrook Formation
8000'
Star of Hope Formation
900'
Raymond Sandstone
1300'
Mount Hall Formation
2600'
Telemon Formation
5000'
1600'
Silver Hills Volcanics
Anakie Metamorphics

1964 by Vine, Jauncey, Casey, and Galloway (1965). The eastern part, comprising the Drummond Basin and Anakie Inlier, was covered by a regional survey of the whole of the Drummond Basin by geologists of the Compagnie Franco-Africaine de recherches petrolieres (Francarep) (de Bretizel, 1966). The Buchanan Sheet area is covered by BMR helicopter gravity work (Gibb, 1963 a,b, and 1966) and by an aeromagnetic survey conducted by Adastra Hunting Geophysics Pty Ltd (AHG, 1962).

STRATIGRAPHY

The Devonian-Carboniferous stratigraphy of the eastern part of the Buchanan Sheet area has been summarized in Table 1. The thickness of the sequence deposited in the Buchanan Sheet area as compared with those of the Emerald and Galilee/Clermont Sheet areas in the southern Drummond Basin is illustrated in Figure 1, and Table 2 provides a basin wide correlation of stratigraphic units.

PRE-DEVONIAN

Anakie Metamorphics.

The name Anakie Series was first used by Jensen (1921); it was later changed to Anakie Metamorphics on the Geological Map of Queensland (Hill, 1953). The type area of the unit is at Anakie in the Emerald Sheet area.

The Metamorphics crop out in a small area east of the Suttor River extending south-south-east into the Mount Coolon, Clermont and Emerald Sheet areas where they form the bulk of the Anakie Inlier. The Anakie Metamorphics consist mainly of sheared feldspathic sandstone, phyllite and rare mica schist; the Metamorphics are lithologically similar to the Ukalunda Beds which crop out further to the north, and the boundary between the units is an arbitrary one. The Ukalunda Beds contain lower Middle Devonian marine fossils; the Anakie Metamorphics

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TABLE 1 SUMMARY OF STRATIGRAPHY EASTERN BUCHANAN SHEET AREA

Age	Rock Unit and Map Symbol	Thickness (feet)	Lithology	Palaeontology	Stratigraphic Relationships	Environment of Deposition
Quaternary	(Qa)	0-50	Silt, sand, gravel			Fluvial
	(Qs)	Superficial	Sand			Aeolian/Fluvial
Undiff. Cainozoic	(Cz)	Superficial	Soil, sand, gravel			In situ weathering, aeolian and fluvial
Tertiary	(T)	0-30	Poorly sorted argillaceous sandstone, commonly lateritized	Few dicotyledonous leaves in the Bowen Sheet area (Malone et al., 1966)	Unconformably overlies Palaeozoic rocks	Commonly terrestrial (lithified soil) - extensive remnants of old land surface
Lower Carboniferous	DRUMMOND GROUP: Natal Formation (Cln)	4000 +	Alternating sequence of fine-grained feldspathic quartz sandstone and olive siltstone; concretions are common.	Poorly preserved plant material	Conformable on the Bulliwallah Formation	Shallow fresh water, possibly lacustrine
	Bulliwallah Formation (Clb)	10,000	Thin to thick bedded, fine to medium grained felspathic quartz sandstone; minor olive mudstone, pebbly feldspathic quartz sandstone and algal limestone	Poorly preserved plant fossils; algae	Conformable on the Star of Hope Formation	Shallow freshwater, possibly lacustrine
	Star of Hope Formation (Cls)	2000	Lapilli tuff, welded tuff, tuffaceous sandstone, volcanolithic sandstone, quartz pebbly sandstone	Lepidodendron veltheimianum Stbg., and Stigmaria ficoides Bgt. ?Lamellibranchs (White, 1967)	Conformable on the Raymond Sandstone	Fluvial and terrestrial
	Raymond Sandstone (Clr)	5600	Fine to medium-grained quartz sandstone, locally feldspathic; minor interbeds of clayey sandstone and mudstone.	Lepidodendron veltheimianum Stbg., and Stigmaria ficoides Bgt. (White, 1967)	Mainly conformable on Mount Hall Formation. Unconformable on the Ukalunda Beds south-east of Saint Anns homestead	Fluvial; probably mainly over bank deposits
	Mount Hall Formation (Clh)	11,000	Pebbly and conglomeratic quartz sandstone, coarse-grained quartz sandstone	Wood fragments	Conformable on the Scartwater Formation	Fluvial; mainly channel deposits
Upper Devonian or Lower Carboniferous	DRUMMOND GROUP: Scartwater Formation (D/Cc)	4000 +	Fine-grained feldspathic sandstone with interbeds of calcarenite, algal limestone, olive mudstone, lithic tuff and tuff	Lepidodendron veltheimianum Stbg., L.mansfieldense M'Coy L. Aculeatum Stbg., L.Volkmannianum Stbg. Stigmaria ficoides Bgt., Cyclostigma Australe Feist., and ?Rhacopteris digitata; (White, 1967) algae	Probably conformable on the Llanarth Volcanics and unconformable on the Saint Anns Formation and Ukalunda Beds	Fluvial; alluvial fans and overbank deposits
	Llanarth Volcanics (D/Cl)	3700	Dominantly fine-grained tuff. Some thin acid flows and locally at the base volcanolithic sandstone and conglomerate.	Lepidodendron veltheimianum Stbg. (White, 1967)	Conformable on the Saint Anns Formation; overlapped by the Scartwater Formation north of Saint Anns homestead	Shallow water, possibly partly marine, and terrestrial
Upper Devonian or Lower Carboniferous	Saint Anns Formation (D/Ca)	2400	Acid and intermediate flows, crystal tuff and lapilli tuff and algal limestone, at top. Arkosic, feldspathic and lithic sandstone, minor green mudstone and phosphatic sandstone	Lepidodendron veltheimianum Stbg., L. Volkmannianum Stbg. Stigmaria ficoides, Calamite ? (White, 1967); algae and worm casts	Unconformable on the Ukalunda Beds	Shallow water, probably partly marine; the upper volcanic part of the unit may be terrestrial
	Silver Hills Volcanics (D/Cs)	2000 +	Acid flows, breccia, crystal lithic tuff, fine-grained tuff	Unfossiliferous	Probably unconformable on the Anakie Metamorphics	Probably largely terrestrial
Middle Devonian	Ukalunda Beds (DK)		Lithic and feldspathic sandstone, mudstone, phyllite, schist. Richly fossiliferous limestone in area to the west	Rich marine fauna in south-east Bowen Sheet area (Malone et al., 1966)	Unconformable on the Anakie Metamorphics	At least partly marine
Pre - Devonian	Anakie Metamorphics (Pza)		Sheared feldspathic sandstone, phyllite, rare schistose rocks	Algae in the Mount Coolon Sheet area (Malone et al., 1964)	Oldest unit in the area	

are unfossiliferous, and isotopic age determination work on a sample of mica schist from west of Clermont indicates a Middle Ordovician age for the metamorphism in that region (A.W. Webb, pers.comm.) Also, in the Clermont area, the Metamorphics are overlain, probably unconformably, by the unmetamorphosed lower Middle Devonian Douglas Creek Limestone.

A close study of the structure and rock types of the Anakie Inlier has not yet been attempted. Parts of the Inlier have been described by Malone et al. (1964) and Veevers et al. (1964 a & b).

DEVONIAN

Ukalunda Beds (Reid, 1929)

Reid collected fossils from beds in the Ukalunda area in the south-west of the Bowen 1:250,000 Sheet area which Jack (1889) previously assigned to the 'Gympie Beds'. The fauna of Reids 'Ukalunda Beds' was assigned by Whitehouse (1929) 'probably to the early Middle Devonian,' mainly on the evidence of Calceola, sp.nov Reid (1930) included the Ukalunda Beds in the 'Star Formation' (=Star Group).

Hill and Denmead (1960) regarded the unit as unconformable on the Anakie Metamorphics and included it with the Devonian to Carboniferous sediments of the Drummond Basin. Recent mapping has shown that the Drummond Basin sequence unconformably overlies the Ukalunda Beds which are now regarded as part of the Anakie Inlier.

The type locality of the unit is in Gordon Gully, Ukalunda district, in the south-west of the Bowen Sheet area.

The Ukalunda Beds crop out in a small area in the north-east of the Buchanan Sheet area, extending north-east and east into the Bowen and Mount Coolon Sheet areas. The unit forms moderately to densely timbered hilly terrain. In the Buchanan Sheet area, the Ukalunda Beds consist mainly of interbedded sandstone and mudstone. The sandstone is

Age \ 1:250,000 Sheet	CHARTERS TOWERS	BOWEN	BUCHANAN	MT. COOLON	CLERMONT (East)	CLERMONT (Central)	CLERMONT (West)	EMERALD (West)	EMERALD (Central)	SPRINGSURE
Upper Carb. – Permian	Galilee Basin sequence and Bulgonunna Volcs	Bulgonunna Volcanics	Galilee Basin sequence	Bulgonunna Volcanics	Bowen Basin sequence	Bowen Basin sequence	Galilee Basin sequence	Galilee and Bowen Basin sequences	Bowen Basin sequence	Galilee and Bowen Basin sequences
Lower Carboniferous	Natal Fm.	? ?	Natal Fm.	? ? ? ?	? ? ? ?	? ?	Ducabrook Formation	Ducabrook Formation		Ducabrook Formation (Star of Hope Fm not differentiated)
	Bulliwallah Fm.		Bulliwallah Fm.							
	Star of Hope Fm.	Star of Hope Fm.	Star of Hope Fm.				Star of Hope Fm	Star of Hope Fm.		
	Raymond Sst.		Raymond Sst.				Raymond Sst.	Raymond Sst.		Raymond Sst.
	Mt. Hall Fm.	Mt. Hall Fm.	Mt. Hall Fm.					Mt. Hall Fm.		Mt. Hall Fm.
Lower Carboniferous or Upper-Devonian	Scartwater Fm.	Scartwater Fm.	Scartwater Fm.	Mt. Rankin Beds ? ? ?	Mt. Rankin Beds	? ?		Telemon Fm.		Telemon Fm.
	St. Anns Fm	Mt. Wyatt Beds	Llanarth Volcs / St. Anns Fm.	Mt. Wyatt Beds	Silver Hills Volcs.	Silver Hills Volcs.	Silver Hills Volcs.	Silver Hills Volcs.	? ? Volcanics and foss. limestone at Glendarriwell Hs	Silver Hills Volcs.
Middle-Devonian	Ukalunda Beds	Ukalunda Beds	Ukalunda Beds	Ukalunda Beds	Volcanics and limestone (On)	Douglas Ck Lst. and Theresa Ck. Volcs.				Dunstable Fm.
Pre-Devonian			Anakie Mets.	Anakie Mets.	Anakie Mets.	Anakie Mets.	Anakie Mets.	Anakie Mets.	Anakie Mets.	Anakie Mets.

Table 2 – Drummond Basin – Correlation chart

Wedge out Overlap obscures section //// Section removed by erosion ~~~ Unconformity

fine to medium-grained, lithic, and commonly feldspathic. The sediments are in places tightly folded and have undergone mild regional metamorphism. They are commonly cleaved and slightly schistose; this is most apparent in the fine-grained sediments. The schistosity has a north-north-west to north-north-east trend and steep dip.

The Ukalunda Beds are intruded by granite and in the contact zones, have been spotted and metamorphosed to phyllite and schist, mainly quartz-muscovite schist. Large roof pendants of schistose and granitised sediments occur in the granite.

In the Bowen Sheet area, the Ukalunda Beds include richly fossiliferous limestone. The marine fauna includes Favosites, Mesophyllum, Keriophyllum?, and Atrypa, and probably indicates a Middle Devonian Age (Malone, Jensen, Gregory, and Forbes, 1966).

The Ukalunda Beds probably unconformably overlie the Anakie Metamorphics in the Mount Coolon Sheet area, and are unconformably overlain by the Saint Anns Formation in the north-east of the Buchanan Sheet area.

The thickness of the unit is unknown.

Devonian - Carboniferous

Silver Hills Volcanics.

The Silver Hills Volcanics were named by Veevers et al. (1964 b) after Silver Hills homestead 13 miles west-north-west of Anakie in the Emerald Sheet area. The type area is 1 mile west-south-west of the homestead in a gap through which Spring Creek traverses the range formed by the volcanics.

The Silver Hills Volcanics crop out in the core of an anticline in the south-east corner of the Buchanan Sheet area and adjoining portions of the Mount Coolon, Clermont and Galilee Sheet areas.

The volcanics, consisting of acid flows, rhyolite breccia, crystal lithic tuff and fine-grained tuff are similar to the volcanics that crop out to the south-east on and along the western margin of the Anakie Inlier.

The outcrop in the south-east of the Buchanan Sheet area is the most northerly occurrence of the Silver Hills Volcanics. The tuffs of the Saint Anns Formation and Llanarth Volcanics in the Saint Anns homestead area farther to the north are probably the pyroclastic and in part water-laid equivalents of the Silver Hills Volcanics.

Saint Anns Formation.

The Saint Anns Formation is a new unit defined here as the sequence of rocks unconformable on the Ukalunda Beds and overlain, probably conformably, by the Llanarth Volcanics. The name is derived from Saint Anns homestead in the north-east of the Buchanan Sheet area. The type area of the formation is directly south and south-east of the homestead.

The Saint Anns Formation crops out mainly in an arcuate belt of low relief, 14 miles long and 2 miles wide from Saint Anns homestead on the Suttor River south-west to Mount Hope homestead. Smaller isolated areas of outcrop occur 35 miles to the north, north-east of Scartwater homestead. The formation dips westerly under younger sediments and its westerly extent is not known.

In the type area the formation is about 2400 feet thick and can roughly be subdivided into 2 parts: a dominantly sedimentary sequence about 1400 feet thick, at the base, and a sequence of about 1000 feet of volcanics at the top. The sediments are generally thin-bedded and fine to medium-grained and they include arkosic, feldspathic and lithic sandstone interbedded with minor green mudstone. Most of the sediments have a partly calcareous matrix. The lithic sandstones contain fragments of metamorphic, sedimentary and igneous (mostly volcanic) rocks. At the top of the sedimentary sequence are two thin

beds of phosphatic sandstone containing up to 15% P_2O_5 separated by siliceous rocks which are probably altered acid volcanics (Doutch, 1966).

The upper part of the Saint Anns Formation consists mainly of volcanic rocks including acid and intermediate flows, crystal tuff and lapilli tuff. The lithic fragments in the tuffs are rhyolite, rhyodacite, trachyte and microdiorite. Algal limestone interfingers with the volcanics. North-east of Scartwater homestead, the Saint Anns Formation includes, from the base upwards, conglomerate containing fragments of the Ukalunda Beds, tuffaceous sediments containing primary and reworked volcanic material, oolitic limestone, blue-grey chert containing abundant wormcasts, limestone containing fragments of Ukalunda Beds and worm casts, agglomerate, and volcanolithic sandstone containing plant fragments. The top of the unit in this area consists mainly of volcanic rocks, including agglomerate, tuff and crystal tuff with minor limestone and lithic sandstone.

The Saint Anns Formation contains scattered plant material including Lepidodendron veltheimianum Stbg., Lepidodendron volkmannianum Stbg., Stigmaria ficoides and Calamite? (White, 1967). The flora indicates an Upper Devonian or Lower Carboniferous age for the formation.

The Saint Anns Formation is the oldest unit in the Drummond Basin sequence in the Buchanan Sheet area. The formation unconformably overlies the Ukalunda Beds, and the basal beds of the unit contain abundant material derived from the Ukalunda Beds. Boulders of granite, presumably derived from the granite that intrudes the Ukalunda Beds, were observed in basal conglomerates north-east of Scartwater homestead. The lower part of the Saint Anns Formation was laid down in shallow water to the west of a land mass consisting of Ukalunda Beds, granite, and acid volcanic rocks. (Acid volcanic detritus is abundant in the sediments, however the source rocks were completely removed or are now covered by the Upper Carboniferous Bulgonunna Volcanics or Permian Bowen Basin sequence farther to the east. They are not exposed in the Anakie Inlier). The phosphatic beds and abundant worm tubes indicate that the environment

was perhaps partly marine. Marine Upper Devonian sediments (Mount Wyatt Beds) occur 25 miles to the east-north-east of Scartwater homestead at Mount Wyatt in the Bowen Sheet area (Malone et al., 1966). The upper dominantly volcanic part of the formation is probably partly terrestrial.

Rocks cropping out in Rosetta Creek in the Mount Coolon Sheet area, 20 miles east of Saint Anns homestead, which were mapped as Mount Wyatt Beds (Malone et al., 1966) but do not contain the Upper Devonian marine fossils characteristic of the Mount Wyatt Beds, are lithologically similar to the Saint Anns Formation, and are probably equivalent to it.

The Saint Anns Formation is overlain, probably conformably, by the Llanarth Volcanics.

Llanarth Volcanics.

The Llanarth Volcanics is a new unit defined here as the sequence of dominantly volcanic rocks that conformably overlies the Saint Anns Formation and is overlain and overlapped by the Scartwater Formation. The name is derived from the Llanarth Range in the north-east of the Buchanan Sheet area, where the type area is.

The volcanics crop out in only one area, an arcuate belt 11 miles long and 1 to 1.5 miles wide extending south-westerly from the Suttor River at Saint Anns homestead, to where the volcanics are faulted against the Mount Hall Formation, 3 miles north of Mount Hope homestead (The small areas mapped as Llanarth Volcanics east of the Suttor River are now included in the Saint Anns Formation). The volcanics dip north-westerly under younger sediments of the Drummond Basin; the structures farther to the west are all closed in younger sediments and the westerly extent of the Llanarth Volcanics is therefore not known.

The Volcanics, which are about 3700 feet thick south-west

of Saint Anns homestead, consist mainly of thin to thick-bedded fine-grained tuff. Some of the tuffs are poorly graded. Interbedded are some thin acid flows and at the base of the formation near Saint Anns homestead are fine to coarse-grained volcanolithic sandstone and conglomerate, consisting of boulders of algal limestone, quartz pebbles, and angular fragments of acid volcanic rocks in a matrix of coarse-grained poorly sorted volcanolithic sandstone.

The only fossil found in the Llanarth Volcanics is a branch of Lepidodendron veltheimianum Stbg. bearing fine leaves in bottle-brush fashion. It was found near the base of the formation and indicates a Lower Carboniferous age (White, 1967).

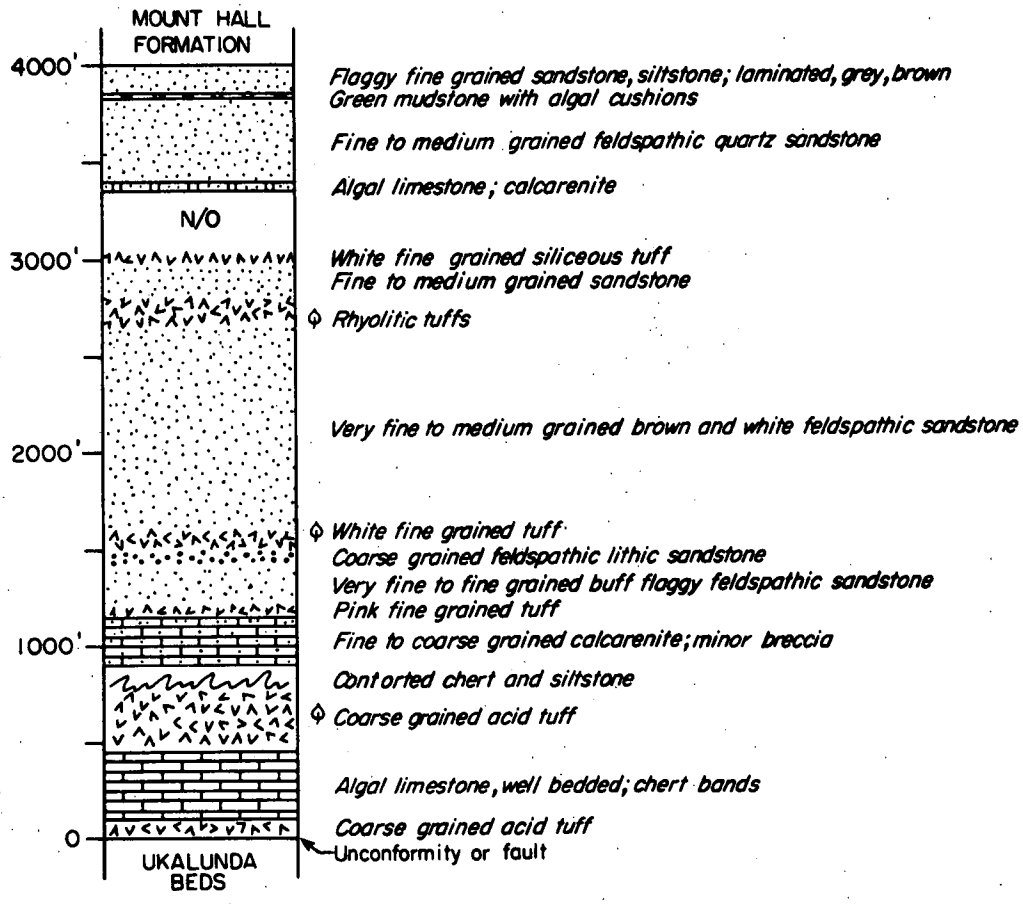
The environment in which the Llanarth Volcanics were deposited was similar to that of the upper part of the Saint Anns Formation. Vulcanism continued and acid volcanics, mainly very fine-grained tuffs were deposited on land and in shallow water. The Saint Anns Formation and the Ukalunda Beds farther to the east were being eroded as indicated by the boulders of algal limestone, angular fragments of acid volcanic rocks and quartz pebbles in the conglomerate near the base of the formation.

Scartwater Formation (de Bretizel, 1966)

The name Scartwater Formation was first used by de Bretizel for the sequence of rocks between the Llanarth Volcanics below, and the Mount Hall Formation above. The name is derived from Scartwater homestead in the north-east of the Buchanan Sheet area. The type area of the formation is 10 miles south of Scartwater homestead.

The Scartwater Formation crops out mainly in a north-trending belt near the eastern margin of the Drummond Basin, and in isolated areas of outcrop west of Scartwater homestead (The area mapped as Scartwater Formation east of the Suttor River is now included in the Saint Anns Formation).

REFERENCE SECTION
SCARTWATER FORMATION
west of St Anns Homestead



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The formation is at least 4000 feet thick in the type area and consists mainly of thin to thick-bedded fine-grained brown and grey feldspathic sandstone; interbedded are grey calcarenite, olive green mudstone, algal limestone, and some lithic tuff and tuff (Fig.2). North of the type area, the feldspathic sandstone is in places micaceous or green, and beds of quartz sandstone are not uncommon; some cross-stratification was noted in this area.

West of Scartwater homestead, the formation crops out in scattered inliers in the Mount Hall Formation, and consists of brown, mauve, white or green fine-grained feldspathic sandstone, occasionally micaceous or clayey, interbedded with algal limestone and green mudstone. The mudstone is more common in this area than in the type area.

Only plant fossils have been found in the Scartwater Formation. They include: Lepidodendron veltheimianum Stbg., L.mansfieldense M'Coy L.aculeatum Stbg., L.volkmannianum Stbg., Stigmaria ficoides Bgt., Cyclostigma australe Feist., and ?Rhacopteris digitata, and indicate a Lower Carboniferous age (White, 1967). The nature of the boundary between the Scartwater Formation and the underlying units is not known because of widespread alluvium, however the air-photographs suggest that the formation probably conformably overlies the Llanarth Volcanics south-west of Saint Anns homestead, and unconformably overlies the Saint Anns Formation and Ukalunda Beds in the Suttor River area between Saint Anns homestead and the northern boundary of the Buchanan Sheet area.

The Scartwater Formation is overlain, apparently conformably, by the Mount Hall Formation. The boundary is faulted south-west of Saint Anns homestead.

The Scartwater Formation is on lithological and stratigraphical grounds correlated with the Telemon Formation of the southern Drummond Basin.

The Scartwater and Telemon Formations are the oldest form-

ations in the Drummond Basin that contain abundant lithic and feldspathic quartz sandstones and green mudstone, rock types that are characteristic of the greater part of the sedimentary sequence deposited in the Drummond Basin. During the history of the Drummond Basin, there were only twc major breaks in this type of sedimentation marked by the deposition of completely different rock types, namely the pebbly quartz sandstone/ conglomerate sequence of the Mount Hall Formation, and the acid volcanics/ conglomerate sequence of the Star of Hope Formation.

LOWER CARBONIFEROUS

Mount Hall Formation (Hill, 1957)

The Mount Hall Formation was named the Mount Hall Conglomerate by geologists of Shell (SQD, 1952) after Mount Hall in the Telemon Anticline in the Springsure Sheet area. The type area of the formation is in the Telemon Anticline.

In the Buchanan Sheet area, where the formation has previously been informally referred to as the 'Bingeringo Conglomerates' (de Bretizel, 1966), the Mount Hall Formation crops out in a north-north-west trending belt up to 9 miles wide, from the south-east corner of the Sheet area to its northern boundary, and in the core of the Bingeringo Anticline. (Mapping in 1967 established the presence of the formation in the core of the Hopkins Anticline.).

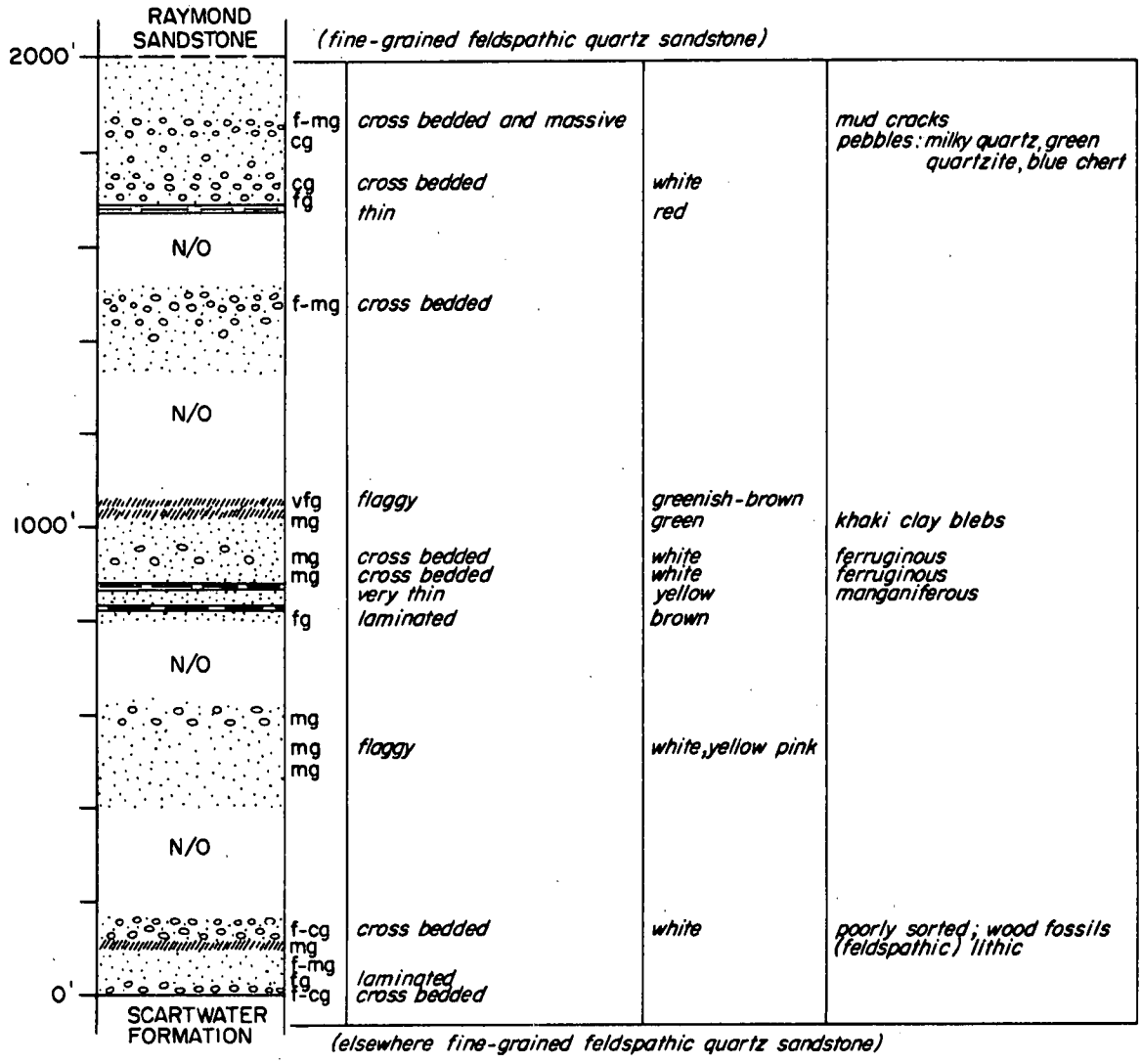
In the eastern belt, the Mount Hall Formation is tightly folded (Fig.5) and gives rise to practically impenetrable terrain made up of densely timbered strike ridges and less densely timbered sandy valleys. The resulting air-photo pattern is characteristic. In the Bingeringo Anticline, the formation forms densely timbered cuestas outlining an elongate dome.

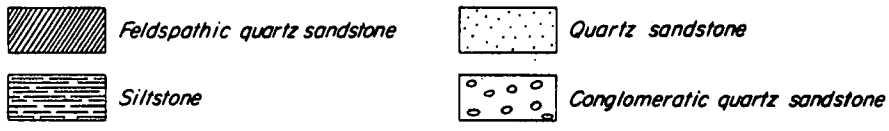
The characteristic rock type of the formation in the Buchanan Sheet area is coarse-grained quartz sandstone, which is locally pebbly or conglomeratic. Little kaolinitic matrix is present and the pebbles consist mainly of milky quartz, chert, rhyolite, and jasper pebbles occur also.

MOUNT HALL FORMATION

Section west of Scartwater Homestead

Scale 1 inch : 400 feet





The prominent strike ridges are made up of pebbly sandstone. Interbedded with the coarse-grained quartz sandstone, and generally poorly exposed in the intervening valleys, are more friable and finer-grained quartz sandstone and minor mudstone and lithic sandstone (Fig.3). The formation is up to 11,000 feet thick

In the north-east of the Buchanan Sheet area, the Mount Hall Formation is tightly folded into a large number of anticlines and synclines. Flank dips, ranging from 25 degrees to vertical, average about 60 degrees. The fold axes are generally sinuous and the axial planes mostly dip easterly. Most of the folds are small, however 2 major anticlinoria and 2 major synclinoria, roughly arcuate in shape, can be recognized (Fig.5). The folding is less tight east of the Belyando River, and in the core of the Bingeringo Anticline.

The Mount Hall Formation has also been extensively faulted. A major fault separates the formation and the underlying Scartwater Formation south-west of Saint Anns homestead. Most of the faults are in the north-east of the Sheet area along the western margin of the main outcrop belt.

The only fossils found in the formation are large wood impressions. The age is Lower Carboniferous on stratigraphic grounds.

The Mount Hall Formation is overlain, apparently conformably by the Raymond Sandstone.

Raymond Sandstone (Hill, 1957)

The Raymond Sandstone (Veevers et al., 1964 b) was originally named the 'Flaggy Sandstone Group' by Shell (SQD, 1952) and renamed the 'Raymond Flaggy Sandstone' by Hill (1957). The type area is in the southern nose of the Telemon Anticline in the vicinity of Raymond Creek in the Springsure Sheet area.

In the Buchanan Sheet area, the Raymond Sandstone crops out

mainly in the flanks of the Bingeringo and Hopkins Anticlines and in the eastern limb of the Bulliwallah Syncline; isolated areas of outcrop occur north of these structures and north-west of Scartwater homestead. The outcrop is poor in the northern part of the Sheet area due to widespread Cainozoic cover.

The Raymond Sandstone, which is about 5,600 feet thick in the central region of the Sheet area, consists mainly of thin bedded flaggy, fine to medium-grained grey, brown and green feldspathic quartz sandstone; it is lithologically very similar to the sandstone in the type area. The sandstone is well-sorted and consists of up to 75 percent fairly angular grains of quartz; the remainder is made up of grains of feldspar, rock fragments and fine-grained matrix. In the Hopkins Anticline and in the isolated areas of outcrop north of the Bingeringo Anticline and Bulliwallah Syncline, the sandstone is more feldspathic. Interbedded with the sandstone are thin beds of clayey sandstone and mudstone.

In the area north-west of Scartwater homestead and west of the main outcrop belt of the Mount Hall Formation, the Raymond Sandstone conformably overlies the Mount Hall Formation.

In these areas, the units are lithologically very similar except that the Raymond Sandstone is finer grained throughout and does not contain any conglomerate or pebbly sandstone. The boundary of the formations is in places gradational. The Raymond Sandstone was derived from the same provenance area as the Mount Hall Formation and was laid down by gentle currents in a shallow, slowly subsiding freshwater basin.

The formation contains plant fossils only, including Lepidodendron veltheimianum Stbg. and Stigmaria ficoides Bgt. indicating a Lower Carboniferous age (White, 1957). The formation is overlain, apparently conformably, by the Star of Hope Formation.

Star of Hope Formation (de Bretizel, 1966)

The name was first used by de Bretizel for the sequence of

rocks between the Raymond Sandstone and Ducabrook Formation in the south-east of the Galilee 1:250,000 Sheet area. The unit was named after the Star of Hope Holding which covers the greater part of the Star of Hope Syncline west of the Narrien Range. In the type area, the formation consists mainly of pebbly quartz sandstone, but in the Buchanan Sheet area it varies from place to place, from pebbly sandstone to acid tuffs. In some areas it is composed of roughly equal amounts of both rock types in alternate beds.

In the Buchanan Sheet area, the Star of Hope Formation crops out in the flanks of the Blowhard Syncline, Bingeringo Anticline and Bulliwallah Syncline; in a broad area between these structures and the Cape River near the northern boundary of the Sheet area; in two small synclines north-west of Scartwater homestead; and in small isolated areas of outcrop at Twin Hills and Mount Hope (The areas of outcrop near Mount Hope are, as a result of later mapping, now included in the Saint Anns Formation).

In the flanks of the Blowhard Syncline, Bingeringo Anticline and Bulliwallah Syncline, the Star of Hope Formation is about 2000 feet thick and consists of acid tuff, including lapilli tuff and welded tuff, and tuffaceous sandstone and volcanolithic sandstone. A minor pebbly quartz sandstone, sometimes associated with a red or green coarse-grained volcanolithic sandstone and fossil wood occurs at or near the base of the volcanic sequence.

To the north of this area and south of the Cape River, the Star of Hope Formation is extensively folded and consists of a sequence of interbedded pebbly quartz sandstone and thin-bedded acid tuff. The pebbly sandstones predominate to the west and the acid volcanics to the east.

The basal beds of the formation north-west of Scartwater homestead consist of pebbly quartz sandstone and feldspathic lithic sandstone containing fossil wood and green or brown fine-grained feldspathic sandstone. They are overlain by acid tuffs which are interbedded with

minor green or black mudstone and rare thin beds of limestone. The exposed thickness of the formation in this area is about 1800 feet; the top of unit has been removed by erosion.

At Twin Hills, the formation consists of thick beds of acid volcanics and minor olive green mudstone and lithic sandstone.

The Star of Hope Formation is poorly fossiliferous and contains in most places only indeterminable Lepidodendroid remains. Lepidodendron veltheimianum Stbg. and Stigmaria ficoides Bgt., indicating a Lower Carboniferous age (White, 1967), were found in the syncline north-west of Scartwater homestead. ?Lamellibranchs were also observed.

The Star of Hope Formation conformably overlies the Raymond Sandstone and is conformably overlain by the Bulliwallah Formation.

The formation has been recognized throughout the Drummond Basin; it is an excellent marker unit which, because it contains fine-grained tuff, is thought to have been laid down contemporaneously throughout the basin. The close association of conglomerate, lithic sandstones and volcanic rocks, suggests that the Star of Hope Formation was laid down at a time when tectonism and vulcanism occurred.

Bulliwallah Formation (de Bretizel, 1966)

The name Bulliwallah Formation was first used by de Bretizel (1966) for the sequence of rocks conformable on the Raymond Sandstone in the Bulliwallah Syncline in the east of the Buchanan Sheet area. During the 1966 regional mapping programme, de Bretizel's Bulliwallah Formation was subdivided into 2 units. The name Bulliwallah Formation is retained for the lower part of the formation and comprises about 10,000 feet of sedimentary rocks. The upper unit comprises 1000 feet of sediments in the centre of the Bulliwallah Syncline and more than 4000 feet in the area north-east of Natal Downs homestead. The proposed name for this upper unit is Natal Formation.

The Bulliwallah Formation derives its name from the Bulliwallah Range in the east of the Buchanan Sheet area where the type area is.

The formation crops out in the Bulliwallah and Blowhard Synclines, in an isolated area south of Natal homestead, and in a north-trending belt between Natal homestead and the Gregory Developmental Road extending northward into the Charters Towers Sheet area. The formation is lightly wooded and has a characteristic light-toned air-photo pattern.

The Bulliwallah Formation consists mainly of thin to thick-bedded, fine to medium-grained green, brown and khaki feldspathic quartz sandstone; interbedded are minor olive green mudstone, pebbly feldspathic quartz sandstone, lithic sandstone and algal limestone. Thin beds of tuff and lithic tuff occur throughout the sequence but particularly at the base. Ripple markings and mudcracks were observed in places, and cross-stratification occurs particularly toward the top of the formation.

Only poorly preserved plant material including Stigmaria ficoides Bgt., has been found in the formation (White, 1967). The age of the unit is Lower Carboniferous.

The abundance of plant debris and the presence of mudcracks and current structures indicates that the unit was probably laid down in a shallow fresh water environment, possibly in lakes.

Natal Formation.

The Natal Formation is defined here as the sequence of rocks conformable on the Bulliwallah Formation. The name is derived from Natal Downs homestead in the central north of the Sheet area. The reference area of the formation is directly north-east of the homestead along the track to Peggurrimma yard.

The formation crops out in the trough of the Bulliwallah Syncline and in the area north-east of Natal Downs homestead and extending northerly into the Charters Towers Sheet area. The formation is

lightly wooded and has a light-toned air-photo pattern similar to that of the underlying Bulliwallah Formation.

The Natal Formation is very well bedded and consists of an alternating sequence of fine-grained feldspathic quartz sandstone, commonly clayey, and olive green siltstone and mudstone. The sandstones are well sorted and ripple markings are common.

In the Bulliwallah Syncline, the Natal Formation is about 1000 feet thick; the top of the unit has been removed by erosion. A considerable thickness, of the order of 4000 feet, is present in the area northeast of Natal Downs homestead.

The formation is of Lower Carboniferous age, and contains poorly preserved plant material only. It was laid down by gentle currents in a shallow fresh water environment.

Tertiary.

No formal name has been proposed for deposits thought to be of Tertiary age in the Buchanan Sheet area. They are probably equivalent to unnamed Tertiary sediments in the Charters Towers Sheet area (A.G.L. Paine, pers. comm.) and the Suttor Formation in the Mount Coolon Sheet area (Malone et al., 1964).

The Tertiary deposits are widely distributed and occur mainly as cappings on tablelands and mesas of all sizes. These remnants of an old landsurface are easily recognised on air-photos by their morphology.

The deposits consist of up to 30 feet of poorly consolidated, poorly sorted, friable, poorly bedded to massive white argillaceous sandstone, with vertical structure probably pedological in origin. They have mostly been lateritized. The pisolitic horizon is found in only a few localities although thin ironstone gravels are common; the mottled horizon has been more frequently preserved. Some silcretes and large irregular siliceous bodies within the sandstone have been noted.

No Tertiary fossils were found in the Buchanan Sheet area, and dating depends on tentative correlation with the Suttor Formation, for which a dicotyledonous leaf established a Tertiary age. Abundant fossil wood, ranging from poorly silicified to partly opalised, occurs in many places close to the Tertiary deposits, but was not observed within them.

The deposits are flat-lying or gently dipping and unconformably overlie most of the Drummond Basin formations. Regional dips are probably original depositional dips of soils in an ancient landscape characterised by extensive plains.

Quaternary.

Quaternary deposits including sand, alluvium and soil, cover large areas in the south-east and west of the area mapped.

Sand deposits are most widespread in the west between the outcrop belts of the Galilee Basin to the west and the Drummond Basin to the east. The sand overlies in many places Tertiary deposits and was derived from Tertiary and older rocks.

Alluvium is widespread in the more mature south-east corner of the Sheet area along the braided channels of the Belyando and Suttor Rivers and their tributaries.

Older alluvial deposits, now slowly being eroded, occur in isolated areas between the main rivers in the south-east; they have been mapped as Cz.

INTRUSIONS

The Ukalunda Beds and Saint Anns Formation in the north-east of the Sheet area are intruded by a large and several small granite bodies. The main intrusion is east of the Suttor River. It is surrounded by a narrow contact aureole in the Ukalunda Beds and a baked zone in the Saint Anns Formation. Roof pendants of schistose Ukalunda Beds occur.

Two porphyritic tongues extend south from the main granite body and concordantly intrude the Saint Anns Formation south of the Suttor River. Rocks in these tongues range from medium-grained granite to more basic holocrystalline varieties and porphyries.

Between Saint Anns and Mount Hope homesteads, a number of somewhat altered hornblende microdiorite, porphyry and ?dolerite pods concordantly intrude the Saint Anns Formation, Llanarth Volcanics, and Scartwater Formation. The granite, porphyritic tongues, pods, and country rock are intruded by small basalt dykes. This suite of rocks resembles the appenite satellitic association of Joplin (1964).

The porphyritic tongues appear to have intruded the Saint Anns Formation after clockwise rotation had taken place along the Saint Anns Fault. This movement may be one of the latest in the deformation of the Drummond Basin, and the oldest possible age of the granite and its satellites is probably Upper Carboniferous.

At Twin Hills, in the south-east corner of the Buchanan Sheet area, intrusions of andesitic feldspar porphyry into the Star of Hope Formation, and of granite into the Mount Hall Formation are probably related to the same plutonic episode.

STRUCTURE

The north-east of the Buchanan Sheet area is dominated by parts of two major tectonic features, the Anakie Inlier and the Drummond Basin (Fig.4). The Anakie Inlier is a basement ridge consisting of the pre-Devonian Anakie Metamorphics, Middle Devonian rocks, and intrusive granite, and extends from the Bowen Sheet area in the north to the Anakie region in the Emerald Sheet areain the south and extending southward under the Bowen and Great Artesian Basins as the Nebine Ridge. The Drummond Basin is an Upper Devonian - Lower Carboniferous meridional basin exposed both west and east of the Anakie Inlier and known to have overlapped the Inlier locally and possibly completely during at least part of its history.

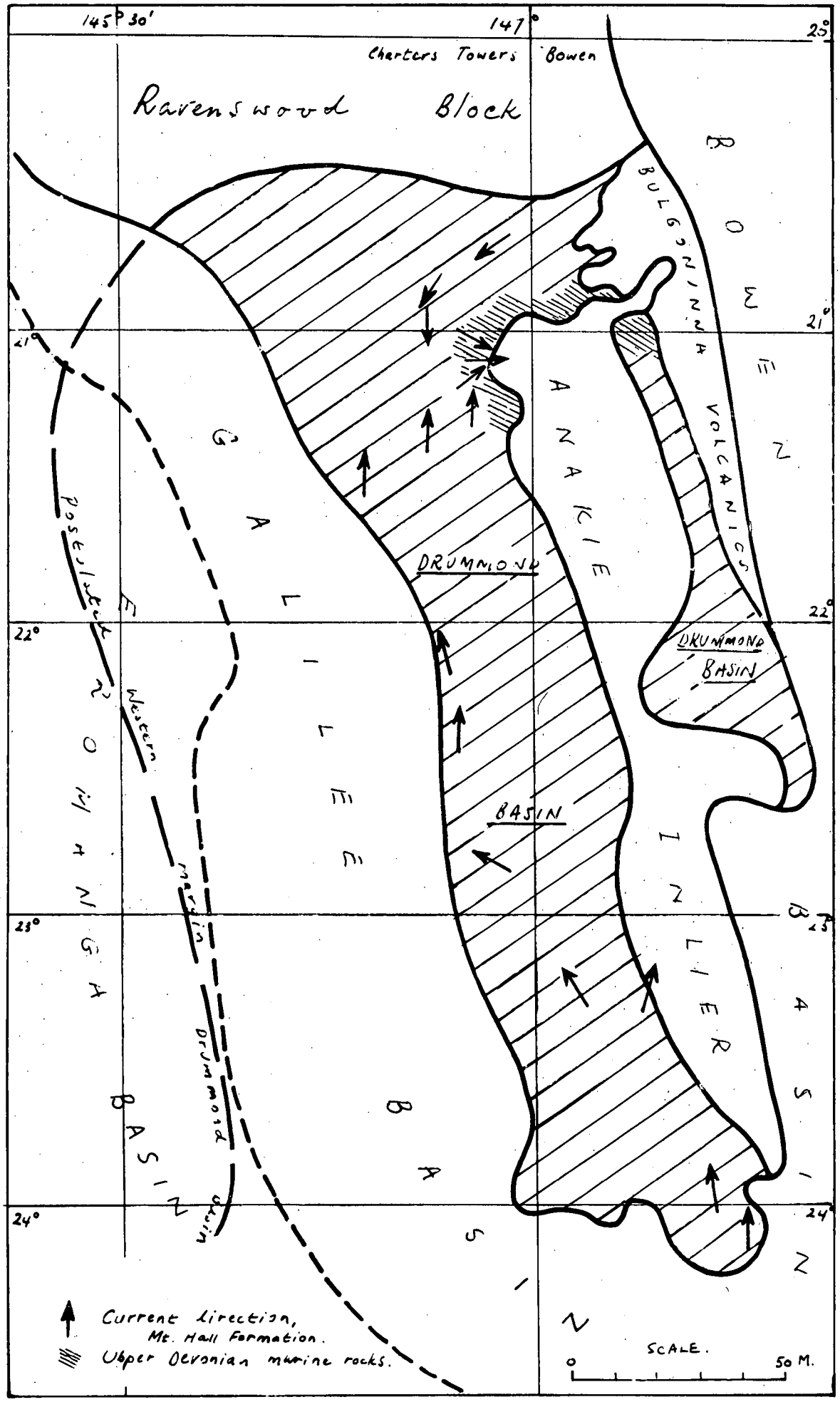


Figure 4 : Drummond Basin _ Tectonic setting.

The basin laps onto the Ravenswood Block of the Charters Towers Sheet area in the north, extends westerly under the Galilee and Eromanga Basins to approximately 145°30', and is to the south-west in the sub-surface probably contiguous with the Adavale Basin. East of the Anakie Inlier, the Drummond Basin is overlapped by the Bowen Basin sequence and its easterly extent is unknown.

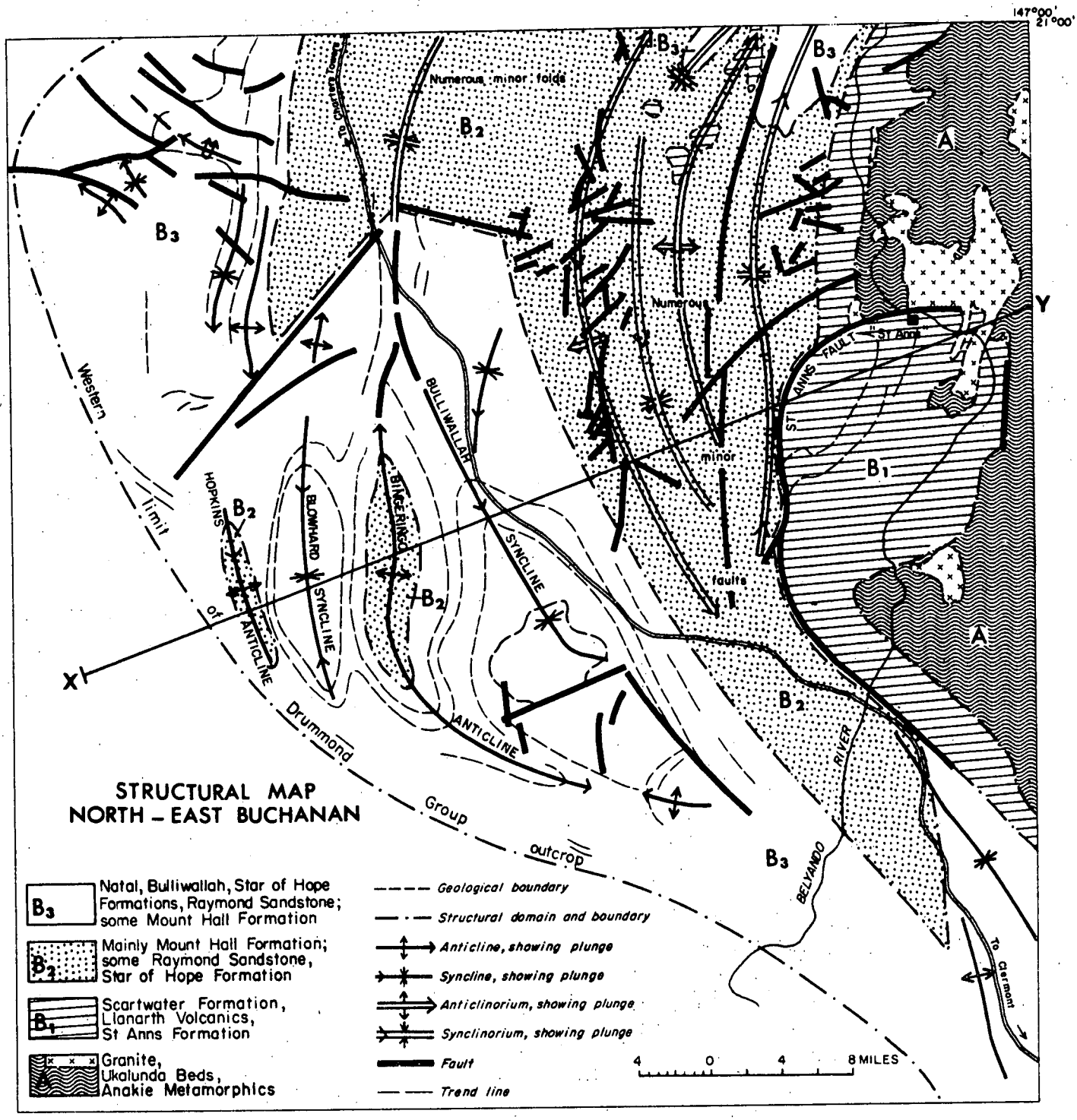
Structures in the Drummond Basin are probably responses to epeirogenic and orogenic movements. Instability of the bordering continental areas during the deposition of the Drummond Basin sequence is indicated by the presence of volcanic rocks, mainly tuffs, throughout the sedimentary pile, the evidence for offlap and onlap along the western margin of the Anakie Inlier and southern margin of the Ravenswood Block, and the presence of a small unconformity between the Mount Hall Formation and Raymond Sandstone in the Narrien Range in the Galilee Sheet area (Plate 1).

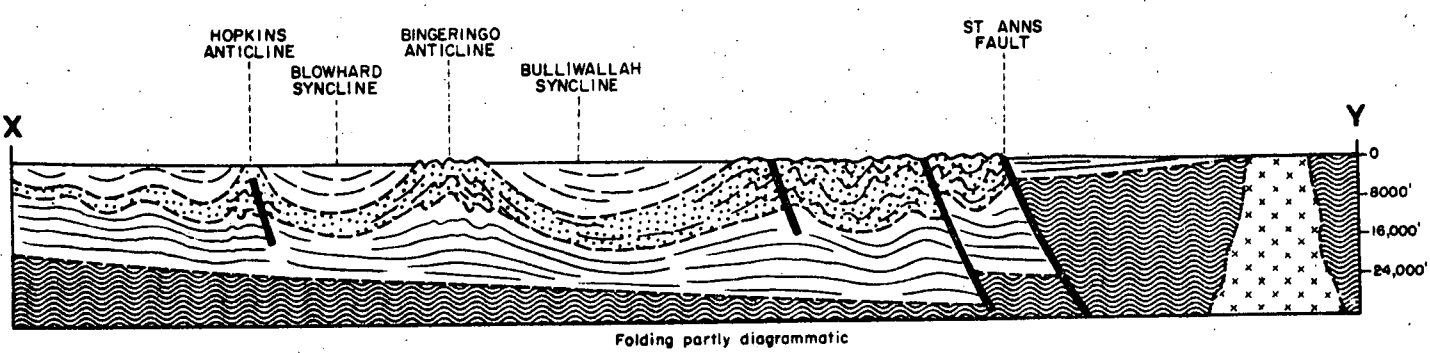
Folding may have been initiated early in the history of the basin, but the main folding episode was at the end of the Lower Carboniferous when the Anakie Inlier was uplifted. The area of greatest deformation is in the north-east of the Buchanan and south-east of the Charters Towers Sheet areas, directly to the west of, and draped around an area of Upper Carboniferous plutonic intrusion and acid volcanic extrusion which is centred in the Bowen and Mount Coolon Sheet areas.

Three well defined structural domains, all arcuate in shape, can be recognized west of the Anakie Inlier (Fig.5). Deformation is most pronounced at the apex of each domain. The relationships between the domains is evident on the cross section of Figure 5.

The Anakie Inlier (Fig.5, Domain A) is characterised by tight folds and well developed cleavages. In some places only one set of cleavages has developed, and the rocks are not metamorphosed. In others at least two sets are present, often associated with kink folds and low grade regional metamorphism. No systematic examination of this domain has been made.

FIG.5.





Folding partly diagrammatic

To accompany Record 1967/153

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Deformation of the rocks of the Anakie Inlier took place at the end of the Middle Devonian. Little deformation occurred at the end of the Lower Carboniferous during the folding of the Drummond Basin sequence when the Inlier moved more or less as a block.

Domain B_1 directly west of the Anakie Inlier, is a narrow zone with a bulge in the central area south of Saint Anns homestead. It mainly consists of the Saint Anns Formation, Llanarth Volcanics, and Scartwater Formation. The rocks are generally tilted to the west. Bedding trends on the air-photographs suggest that the central area has undergone some clockwise rotation in addition to upward movement along the Saint Anns Fault, an arcuate fault separating the area from domains A and B_2.

The units in domain B_1 are relatively thin and not folded. During the orogeny, domain B_1 behaved in unity with the Anakie Inlier.

Domain B_2 coincides largely with the outcrop of the Mount Hall Formation; the western part of the domain is in the Raymond Sandstone and Star of Hope Formation. The characteristic feature of domain is tight folding and extensive faulting. The folds are concentric and angular, and their amplitude decreases to the west.

The north-eastern part of the domain is well exposed with relief up to 700 feet; structural detail is much obscured by Cainozoic deposits in the remainder of the area. This contrast probably reflects a structural high in the north-east. The folds in the north-east belong to two anticlinoria and two synclinoria which are draped around domains A and B_1, plunge to the north and south, and, in the Charters Towers and south-eastern Buchanan Sheet areas, grade into large simple anticlines and synclines of domain B_3. A major north-south discontinuity, made up of faults for the most part, separates the eastern synclinorium from the rest of the domain. It is cut by at least one fault paralleling the Saint Anns Fault. Numerous faults are present along the western margin of the outcrop belt of the Mount Hall Formation within domain B_2 and particularly at the apex of this arcuate belt.

The cores of the Bingeringo and Hopkins Anticlines are faulted and the crest of the Hopkins Anticline is crumpled by minor tight folding. The cores of both anticlines can be considered to be inliers of domain B_2 within the less deformed rocks of domain B_3.

Domain B_2 consists largely of the coarse-grained thickly bedded conglomerate - pebbly sandstone - sandstone sequence of the Mount Hall Formation, rocks which are considered to be more competent than the generally finer grained sequences below and above. Their more incompetent behaviour under stress can perhaps be attributed to the presence of large quantities of connate water, and their greater depth of burial.

Domain B_3, west of domain B_2, and extending north-easterly into the Charters Towers Sheet area, is characterised by gentle folding and extensive faulting, particularly in the north where the genereal trend of fold axes swings from north-westerly to north-easterly. The main structures are the Bulliwallah and Blowhard Synclines and the Bingeringo and Hopkins Anticlines. The synclines are symmetrical and the anticlines asymmetrical with steeper west flanks. Folding becomes progressively tighter toward the west. The area north of the Bingeringo Anticline is block faulted. The apex of the domain is more intensely folded and faulted than the areas to the north and south. One anticline is overturned and several axes trend north-north-westerly, nearly at right angles to the prevalent northerly trend of the region.

SUMMARY OF GEOLOGICAL HISTORY

The oldest rocks in the area are the pre-Devonian Anakie Metamorphics and the lower Middle Devonian Ukalunda Beds. They are intruded by granite and regionally metamorphosed and are part of the Anakie Inlier.

Deposition of the Drummond Basin sequence commenced in the Upper Devonian with the outpouring of acid volcanics (Silver Hills volcanics) in the south of the area as part of a vast sheet that extends southward to the Springsure area and dips easterly under the Permian Bowen Basin and westerly under the Drummond Basin. Fine-grained tuffs

were deposited in the north of the Sheet area north of this volcanic province (Saint Anns Formation and Llanarth Volcanics). Deposition took place on land and in water. The Anakie Inlier in the east was being eroded and algal limestone was deposited in shallow water west of the Inlier. Marine incursions may have taken place. Marine Upper Devonian sediments were deposited 20 miles to the north-east at Mount Wyatt, in the Bowen Sheet area (Mount Wyatt Beds). The initial volcanic phase was followed by slow subsidence and up to 25,000 feet of Upper Devonian and Lower Carboniferous fresh water sediments were laid down in a mainly fluvial environment. Minor vulcanism occurred throughout sedimentation. The sequence is characterised by interbedded feldspathic quartz sandstone and olive green mudstone; algal limestone and plant material occur throughout the sequence. This association of sediments, first appearing in the Scartwater Formation in the Buchanan Sheet area and the Telemon Formation in the southern part of the Drummond Basin, makes up the bulk of the Drummond Basin sequence. Important changes in the provenance area occurred twice and the characteristic sedimentation was interrupted by the deposition of the pebbly quartz sandstone of the Mount Hall Formation and the conglomerate and acid volcanic sequence of the Star of Hope Formation. Cross bedding measurements were made in the Mount Hall Formation in the Buchanan Sheet area and in the southern part of the Drummond Basin. They strongly indicate a southerly source for the formation.

Folding may have occurred during sedimentation, but the main period of deformation of the Drummond Basin sediments was at the end of the Lower Carboniferous. The eastern part of the folded sequence was, with the Anakie Inlier, uplifted, and formed during the Upper Carboniferous, Permian and Mesozoic a stable area which supplied detritus to the Galilee, Bowen, and Eromanga Basins. The Upper Carboniferous Bulgonunna Volcanics were extruded over the truncated structures in the northern part of the basin, north-east of the Buchanan Sheet area.

ECONOMIC GEOLOGY

Phosphate.

A small floater of black sedimentary rock containing 15% P_2O_5

was found south of Saint Anns homestead in the area where the Saint Anns Formation is exposed. Close investigation revealed two calcareous feldspathic sandstone beds, 35 and 80 feet thick, containing up to 4% P_2O_5 (Doutch, 1966)

Samples collected from the Saint Anns Formation 2 miles north-east of Scartwater homestead gave moderate to strong reactions with Ammonium Molybdate but only traces of Phosphate were indicated by the Shapiro test.

The potential of the whole area can be evaluated only by detailed mapping and sampling.

Water.

Very few bores have been sunk in the north-east of the Sheet area. Most are shallow and produce water from alluvium along creeks. Several bores have been sunk in the south-east and central parts of the area where superficial deposits overlie the Devonian-Carboniferous sequence. Water is also in these areas obtained from superficial deposits. Land holders largely rely on permanent waterholes in the rivers and earth dams and tanks on small creeks for stock water.

Oil.

No oil exploration work has been carried out in the north-east of the Buchanan Sheet area, presumably because it is regarded as having a low potential for hydrocarbon accumulation. The Drummond Basin sequence is probably largely of non-marine shallow water origin. Marine conditions prevailed farther to the north-east in the Bowen Sheet area, but these rocks are extensively intruded by granite. The nearest oil exploration well is Exoil Lake Galilee No. 1, 120 miles to the south-west of the area in the Galilee Sheet area, in which a show of gas was encountered in the Upper Carboniferous to Lower Permian Galilee Basin sequence. The well bottomed in the Devonian to Carboniferous Drummond Basin sequence. The potential of the area can be tested only by further drilling.

PART II - ADDITIONS TO THE GEOLOGY OF THE SOUTHERN PART OF THE DRUMMOND BASIN.

The geology of the Mount Gregory-Narrien-Mistake Creek area.

The area covers the eastern part of the Galilee and western part of the Clermont Sheet areas. The Mistake Creek Syncline in the east has been reported on by Veevers et al. (1964 a), and de Bretizel (1966) covered the whole area in some detail. No mineral deposits or oil shows have been discovered in the area; oil reservoirs and traps are possible but source rocks are negligible. No quarries operate, although there is a variety of rock types suitable for building purposes.

Stratigraphy.

All the sedimentary formations of the southern part of the Drummond Basin are present in the area. Maximum thicknesses of formations are shown in Fugure 1, and gross facies changes within the formations are shown on Plate I, which is synthesised by air-photo extrapolation from widely scattered observation points. As in the Buchanan Sheet area to the north, characteristic olive green and brown mudstone and fine-grained feldspathic sandstone sedimentation was twice interrupted by the incursion of quartz-pebble conglomerate and quartz sandstone of The Mount Hall and Star of Hope Formations. Likewise, the Star of Hope Formation consists mainly of pebbly sandstones in the west, and acid volcanics in the east. Minor tuffs in other formations above the Silver Hills Volcanics are also thicker and more frequent towards the eastern margin of the basin. No plutonic rocks intrude the Drummond Basin sequence in this area.

The Anakie Metamorphics in the east of the area form the basement to the Drummond Basin sequence.

The oldest formation in the basin is the Silver Hills Volcanics consisting largely of terrestial deposits including flow-banded and spherulitic rhyolite, welded tuff, tuff breccia, and tuffaceous sandstone.

The Silver Hills Volcanics are overlain by the fluvial deposits of the Telemon Formation which crop out in the core of the Narrien Dome and north and north-east of the Star of Hope Syncline. The formation was previously thought to be also present in the east limb of the Mistake Syncline (Veevers et al., 1964 a), however, the volcanics and sediments so attributed by them are now recognized as Star of Hope Formation and Raymond Sandstone respectively. In the core of the Narrien Dome, the formation consists of acid volcanics, olive green mudstone and feldspathic sandstone. North and north-east of the Star of Hope Syncline it consists of a thick sequence of olive green and brown mudstone with rare limestone and no volcanics, overlain by 2000 feet of interbedded quartz sandstone and mudstone, which can be regarded as transitional between the Telemon and Mount Hall Formations. (These transition beds are not present in the Narrien Dome). The Lower Carboniferous plants Lepidodendron volkmannianum Stbg. and L.mansfieldense M'Coy and fish teeth and scales have been recovered from mudstone in this transition zone.

The Telemon Formation is overlain by the fluvial deposits of the Mount Hall Formation. In the Narrien Dome, the formation consists mainly of quartz pebble conglomerate with minor quartz sandstone. In the hills north of the Star of Hope and Springvale Synclines, three major beds of conglomerate are separated by sandstone and olive and brown mudstone; the lowest conglomerate bed continues as isolated outcrops north-westward past Beresford homestead.

At Mount Donnybrook, a sequence resembling that of Figure 3 suggests cyclic deposition of the formation; part of this sequence is repeated down plunge at The Nunnery. The ranges at Mount Gregory consist entirely of quartz sandstone with two major conglomerate beds. Lepidodendroid fossils were found near the base of the succession at Mount Donnybrook. Crossbedding indicates that the formation was derived from the south.

The Mount Hall Formation is overlain and in the east limb of the Mistake Syncline overlapped by the Raymond Sandstone which consists mainly of feldspathic quartz sandstone and olive green and brown mudstone.

Basal tuffs and a marker bed of limestone or calcareous sandstone are thickest in the east flank of the Mistake Creek Syncline and in part lie unconformably on older formations. The formation has not been examined west of the Star of Hope Syncline. No fossils have been found.

The Star of Hope Formation consists of acid tuffs and tuffaceous sandstones in the east flank of the Mistake Creek Syncline, and pebbly feldspathic quartz sandstone and minor conglomerate further west around the Narrien Dome and in the Springvale and Star of Hope Synclines. The Star of Hope Syncline is de Bretizel's type area for the formation (de Bretizel, 1966). The equivalence of the two facies is demonstrated by: their common stratigraphical position conformably below the Ducabrook Formation; the occurrence of a pebbly sandstone at the top of the volcanics in the east and the occurrence of occasional volcanics near the base of the pebbly sandstones in the west; and the association of green or red lithic coarse-grained sandstone or grit with both pebbly sandstones and volcanics over the whole of the Drummond Basin. East and south of the Narrien Dome the formation is more difficult to recognise, and consists mainly of brown quartz sandstone with a few pebbly beds and occasional tuffaceous sandstone. It interfingers with the Ducabrook Formation, of which the lower part could alternatively be mapped as an upper mudstone facies of the Star of Hope Formation. No fossils have been found in the formation.

The Ducabrook Formation consists of olive green and brown mudstones and fine-grained feldspathic sandstone. Minor lithic and tuffaceous sandstones occur. Calcarenite or calcareous sandstone with occasional algae occurs near the base of the formation, and is thickest in the east limb of the Mistake Creek Syncline. The trend of the limestone in the western limb of this syncline indicates thickening of the lower part of the Ducabrook Formation to the south. A thin conspicuous pink feldspathic (tuffaceous?) siltstone forms a marker bed higher in the sequence (Plate I). The formation has not been examined west of the Star of Hope Syncline. Veevers et al. (1964 a) report Lepidodendroid plants and Stigmaria ficoides from various levels in the sequence, indicating a Carboniferous age.

Structure and tectonic history.

The pre-Drummond Basin structures in the Anakie Metamorphics were not examined. Structures within the Drummond Basin in this area can be related to modification of the original depositional trough by up-and-down-warping which started at the beginning of the deposition of the Raymond Sandstone. In contrast to the several structural domains of the Buchanan Sheet to the north, the only style of deformation in this area is open folding with accompanying small faults. The geometry of individual folds is easily derived from Plate I.

Deformation of the Mount Hall and Telemon Formations in the Narrien Dome, and of the Silver Hills Volcanics on the eastern margin of the Basin is thought to have started at about the time of deposition of the Raymond Sandstone. This postulate is based on the following evidence (Plate I):

1. The Mount Hall and Telemon Formations are missing in the eastern limb of the Mistake Creek Syncline, where the Raymond Sandstone rests unconformable on the Silver Hills Volcanics; trends above and below the unconformity are discordant.

2. Trends in the Raymond Sandstone around the margins of the Narrien Dome are discordant with those in the Mount Hall Formation below, and an unconformity between the two formations is indicated. (The Raymond Sandstone is not recognisably unconformable on the Mount Hall Formation elsewhere).

It is concluded that the Telemon and Mount Hall Formations were deposited in a basin the shoreline of which was roughly where the axis of the Mistake Creek Syncline later developed. Initial upwarping of the Narrien Dome was coincident with the beginning of Raymond Sandstone deposition and the renewal of vulcanism. Doming continued gently, perhaps more actively during Star of Hope vulcanism, accompanied by minor tensional faulting in the south, until the climax of tectonism at the end of the Lower Carboniferous. Gibb (1966) has named the Beresford Gravity Ridge, which coincides with the broad upwarp between the Narrien Dome and Mount Gregory. Complementing the overall upwarp was the slow sinking of the

Mistake Creek Syncline.

At the end of the Lower Carboniferous normal torsional faulting occurred in the Buchanan Sheet area. The only fault of this episode recognisable in the Galilee Sheet area runs north from Narrien homestead. It is a normal fault. There is a possible discontinuity across the "Beresford High" between Mount Gregory and the rest of the area, and a wrench fault is suspected. Faults in the "Beresford High" may have been initiated at any time during its creation.

After the Lower Carboniferous the area was uplifted with the Anakie Inlier and supplied sediment to the west into the Galilee and Eromanga Basins.

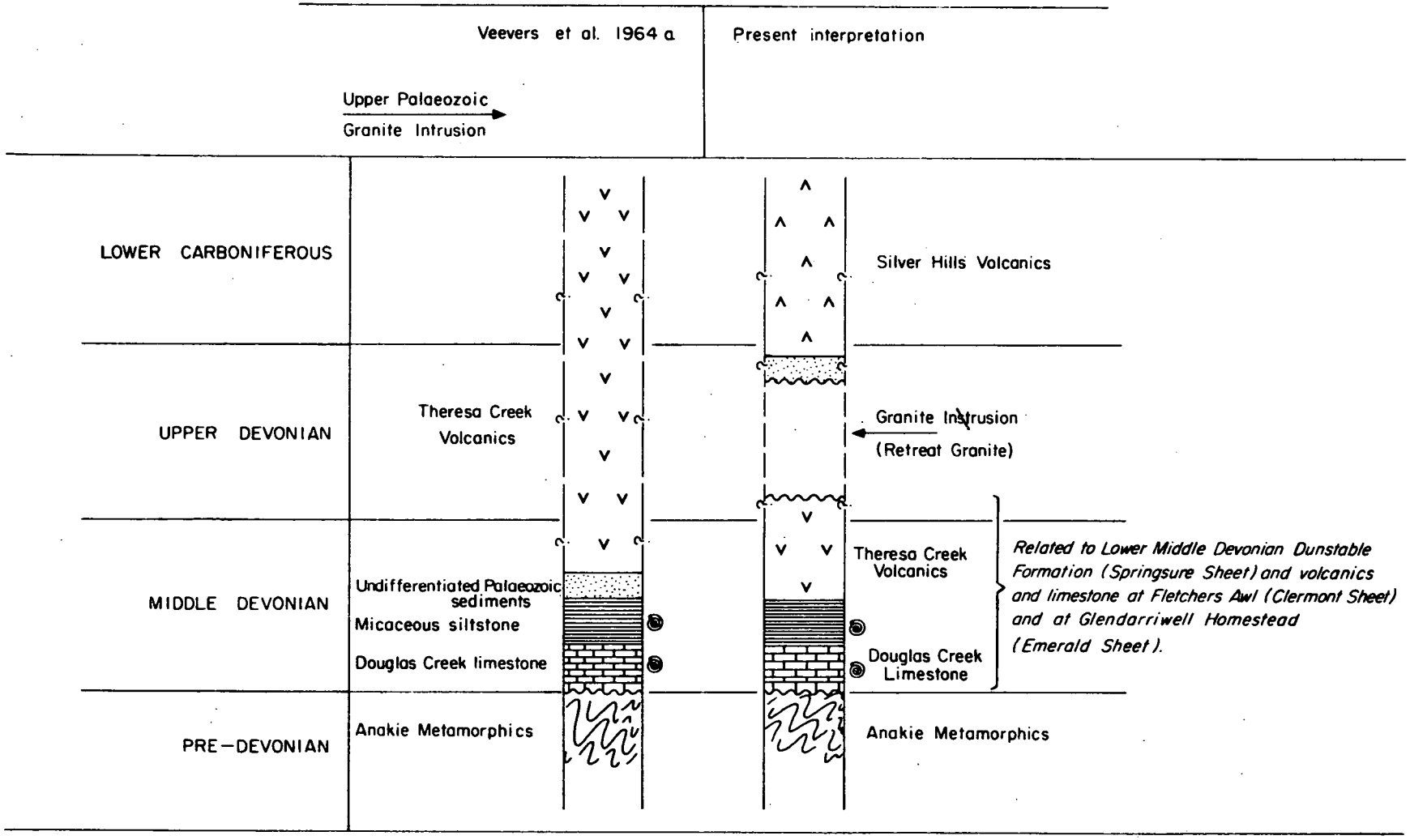
The geology of the Douglas Creek/Theresa Creek area, south-west of Clermont.

The Douglas/Theresa Creek area south-west of Clermont is an outlier of volcanics and some sedimentary rocks on the Anakie High. Most of the outlier is in the Clermont Sheet area; it was mapped on a regional scale in 1960 (Veevers et al., 1964 a). The Emerald Sheet south of Clermont was mapped in 1961 (Veevers et al., 1964 b). The Douglas/Theresa Creeks area was visited in 1966 to re-examine the stratigraphic relationships between the units mapped in the outlier and those mapped farther to the west and south-west along the western margin of the Anakie High.

Volcanic rocks make up the bulk of the outlier. They were named Theresa Creek Volcanics by Veevers et al., (1964 a). Detailed mapping has shown that the Theresa Creek Volcanics consist of two distinct suites of volcanic rocks, one intermediate, consisting mainly of pyroxene andesite, andesitic basalt, and basic crystal tuff and tuff breccia; the other acid, and comprising moderately to densely welded tuff, spherulitic rhyolite and quartz feldspar porphyry (Fig. 6). Both units contain minor sediments. The acid volcanics are lithologically identical to the Silver Hills Volcanics cropping out 15 miles to the west along the western edge of the Anakie Inlier, and are now mapped as such. The name Theresa Creek Volcanics is

FIG.6

STRATIGRAPHY: DOUGLAS-THERESA CREEKS AREA SOUTH-WEST OF CLERMONT



To accompany Record No 1967/153

F55/A11/38

retained for the andesitic volcanics.

The Theresa Creek Volcanics are, at Theresa Creek, north of Mount Wallaby, intruded by granite; the granite is contiguous in outcrop with the Upper Devonian Retreat Granite of the Emerald Sheet area. The Theresa Creek Volcanics may be closely related to the lower Middle Devonian Douglas Creek Limestone which crops out nearby on the eastern edge of the Douglas/Theresa Creeks outlier; the volcanics and limestone can possibly be correlated with the lower Middle Devonian volcanics and limestone at Glendarriwell Homestead in the Emerald Sheet area, and the Dunstable Formation of the Nogoa Anticline in the Springsure Sheet area.

The Silver Hills Volcanics in the outlier unconformably overlie the Theresa Creek Volcanics and granite. The unconformity with the Retreat Granite is well exposed west of Mount Wallaby and 1 mile north-west of Sunny Park homestead. At the unconformity, the granite is deeply weathered and overlain by up to 100 feet of arkose, feldspathic quartz sandstone and minor tuff. These sediments are overlain by ignimbrite and spherulitic rhyolite. The basal sedimentary sequence of the Silver Hills Volcanics as described above occurs only locally. It has not been reported from the Emerald Sheet area.

The geology of the area in the vicinity of Fletchers Awl, north-east of Clermont.

The area in the direct vicinity of Fletchers Awl was remapped to establish the relationship between the Palaeozoic volcanics previously mapped there (Veevers et al., 1964 a) and those of the Douglas/Theresa Creeks area south-west of Clermont. The area is an inlier roughly circular in plan with a diameter of about six miles. It is surrounded by Tertiary acid plugs, dykes, and flows and is probably largely bounded by faults. The elsewhere horizontal Permian rocks east of the area dip away from the Fletchers Awl area at angles up to 30 degrees indicating that at least some of the movement took place in post-Permian time and possibly as early as Tertiary.

Detailed mapping showed that the Palaeozoic volcanics could be sub-divided into two units which are comparable with the Theresa Creek Volcanics and Silver Hills Volcanics of the area south-west of Clermont.

The Theresa Creek Volcanics consist mainly of pyroxene andesite and andesitic basalt. Some sediments including olive green micaceous shale and siltstone and dark grey recrystallized limestone containing poorly preserved fossils probably including corals, are interbedded with the volcanics.

The upper volcanic unit consists mainly of well-bedded acid tuff and crystal tuff. It unconformably overlies the Theresa Creek Volcanics; at the unconformity is a conglomerate containing pebbles of Theresa Creek Volcanics, Anakie Metamorphics, granite and shale. The upper volcanic unit has been mapped as Silver Hills Volcanics.

The central part of the area is occupied by Anakie Metamorphics and granite. The relationship between the granite and Theresa Creek Volcanics in this area is not known. The granite is older than the Silver Hills volcanics and has tentatively been mapped as Retreat Granite.

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PLATE 1.

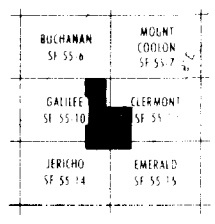
MOUNT GREGORY - NARRIEN - MISTAKE CREEK AREA

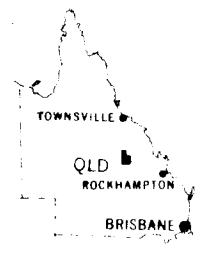
DRUMMOND BASIN

Scale 1:250,000

5 0 5 10 15 MILES

5 0 5 10 15 KILOMETRES

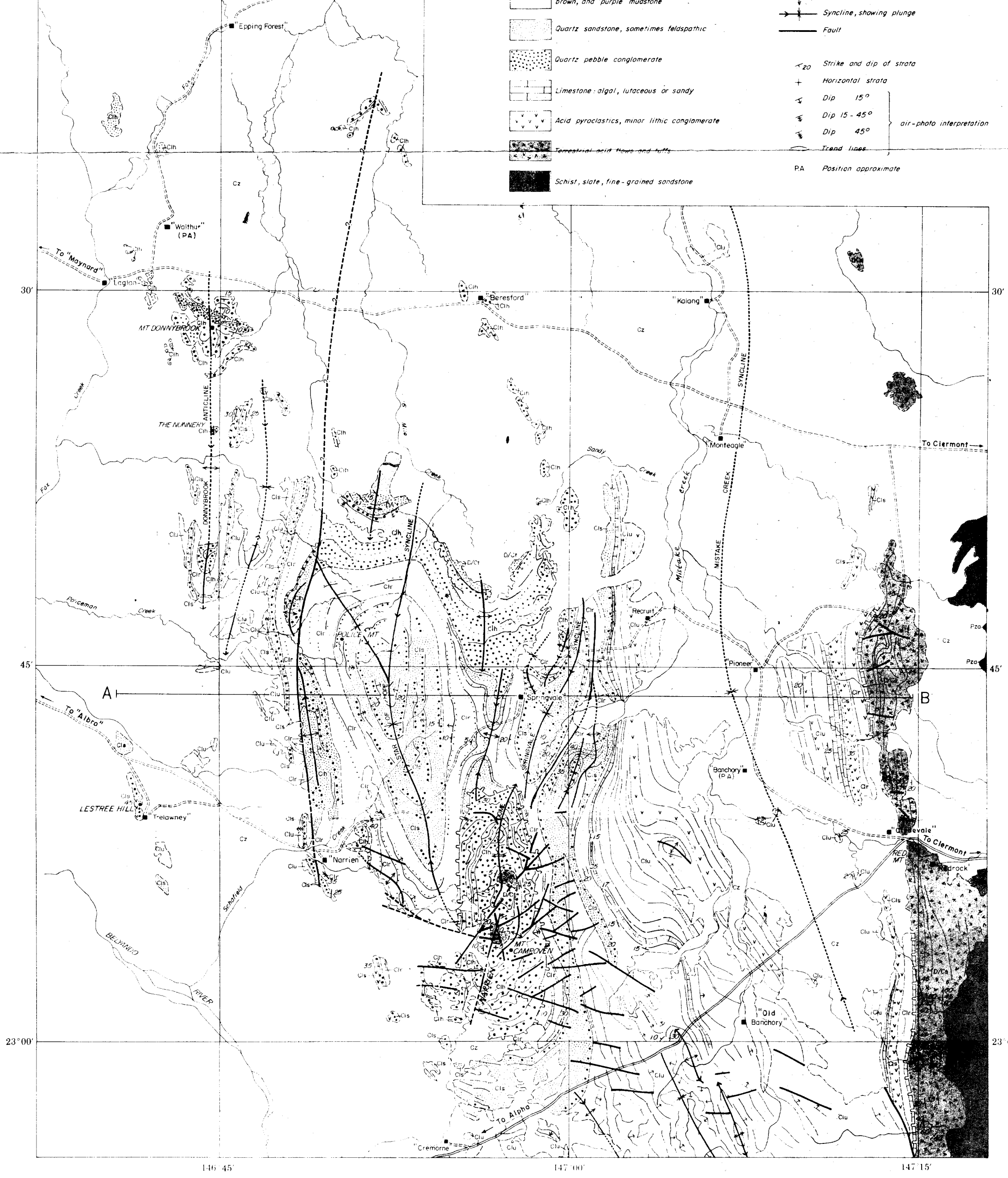




CAINOZOIC	Cz	ALLUVIUM, SAND, LATERITE
LOWER CARBONIFEROUS (DRUMMOND GROUP)	Clu	DUCABROOK FORMATION
	Cls	STAR OF HOPE FORMATION
	Clr	RAYMOND SANDSTONE
	Clh	MOUNT HALL FORMATION
UPPER DEVONIAN - LOWER CARBONIFEROUS	D/Ct	TELEMON FORMATION
	D/Cs	SILVER HILLS VOLCANICS
PRE - DEVONIAN	Pza	ANAKIE METAMORPHICS

- River alluvium, older soils and sand, laterite
- Feldspathic and lithic sandstones and olive, brown, and purple mudstone
- Quartz sandstone, sometimes feldspathic
- Quartz pebble conglomerate
- Limestone: algal, lutaceous or sandy
- Acid pyroclastics, minor lithic conglomerate
- Terrestrial acid flows and tuffs
- Schist, slate, fine-grained sandstone

- Geological boundary
- Unconformity
- Anticline, showing plunge
- Syncline, showing plunge
- Fault
- 20 Strike and dip of strata
- + Horizontal strata
- Dip 15°
- Dip 15 - 45°
- Dip 45°
- Trend lines
- } air-photo interpretation
- P.A Position approximate



Section

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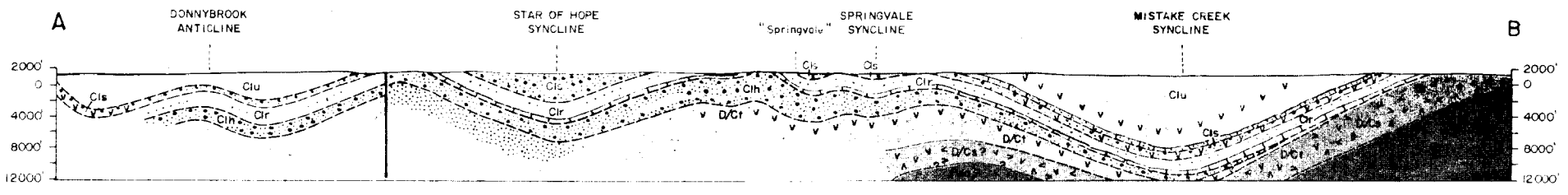
Cainozoic sediments omitted from section



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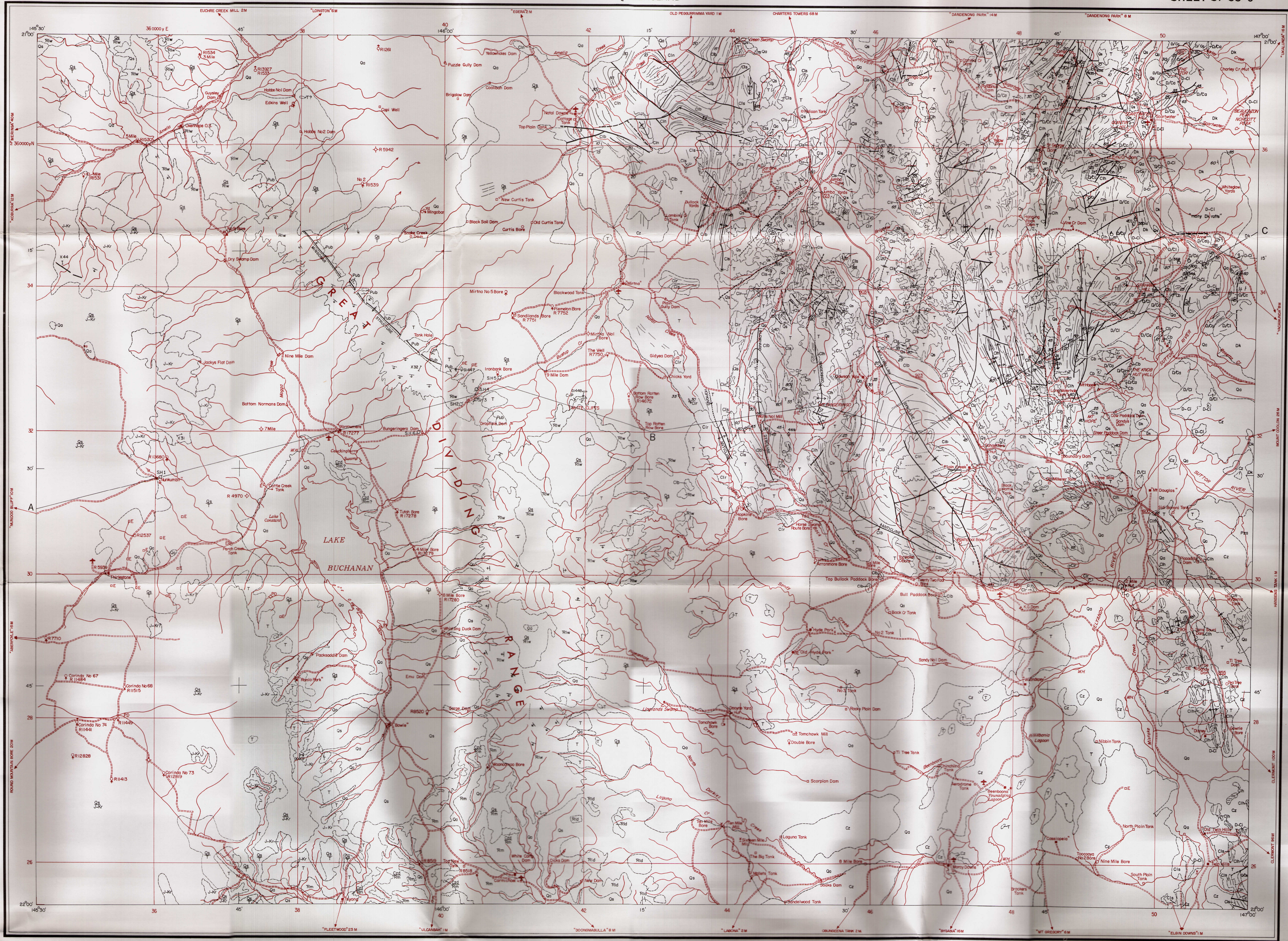


Reference

Era	Period	Unit	Symbol	Lithology
CAINOZOIC	QUATERNARY		Qa	Alluvium
			Qs	Sand, sandy soil, colluvium
	UNDIFFERENTIATED		Cz	Soil and alluvium
			Czd	Duricrust (silcrete, ferricrete)
	TERTIARY		T	Argillaceous sandstone, frequently lateritized
MESOZOIC	JURASSIC – LOWER CRETACEOUS	Ronlo Beds	J-Kr	Quartz sandstone, siltstone, mudstone
	MIDDLE UPPER TRIASSIC	Moolayember Formation	Rm	Mudstone, lithic sandstone, quartz sandstone
	LOWER TRIASSIC	Warang Sandstone	Rlw	Kaolinitic quartz sandstone, siltstone, mudstone
		Dunda Beds	Rld	Lithic sandstone, quartz sandstone, siltstone, mudstone
		Rewan Formation	Rlr	Mudstone, lithic sandstone, siltstone (section only)
PALAEOZOIC	UPPER PERMIAN	Betts Creek Beds	Pub	Siltstone, lithic sandstone, mudstone, carbonaceous shale
	UPPER CARBONIFEROUS– LOWER PERMIAN		C-P	Lithic sandstone, mudstone, siltstone
	CARBONIFEROUS ?		Cb	Diorite, gabbro, dolerite
	LOWER CARBONIFEROUS	Natal Formation (Drummond Group)	Cln	Fine grained feldspathic quartz sandstone, olive siltstone and mudstone
		Bulliwallah Formation (Drummond Group)	Clb	Feldspathic quartz sandstone, minor olive mudstone, pebbly sandstone, lithic sandstone, and algal limestone
		Star of Hope Formation (Drummond Group)	Cls	Acid tuffs and flows; pebbly sandstone and conglomerate
		Raymond Sandstone (Drummond Group)	Clr	Quartz sandstone, minor green siltstone and feldspathic lithic sandstone
		Mount Hall Formation (Drummond Group)	Clh	Pebbly quartz sandstone, quartz sandstone, conglomerate, minor mudstone and lithic sandstone
	UPPER DEVONIAN –LOWER CARBONIFEROUS	Scartwater Formation	D/Cc	Feldspathic sandstone, algal and sandy limestone, minor tuff and green siltstone
		Llanarth Volcanics	D/Cl	Acid tuffs, minor flows, conglomerate and green sandstone
		St Anns Formation	D/Ca	Conglomerate, sandstone, acid and intermediate flows, and tuff, minor siltstone, phosphatic sandstone, algal limestone, and oolitic limestone
		Silver Hills Volcanics	D/Cs	Rhyolite, and fine-grained tuff
	DEVONIAN – CARBONIFEROUS		D-Ci	Granodiorite; porphyry
	MIDDLE DEVONIAN	Ukalunda Beds	Dk	Lithic sandstone, shale, phyllite, fossiliferous limestone and conglomerate
	PRE – DEVONIAN	Anakie Metamorphics	Pza	Schist, slate, fine-grained sandstone, shale

Geological boundary
Anticline, showing plunge
Syncline, showing plunge
Monocline
Overturned anticline
Fault
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes

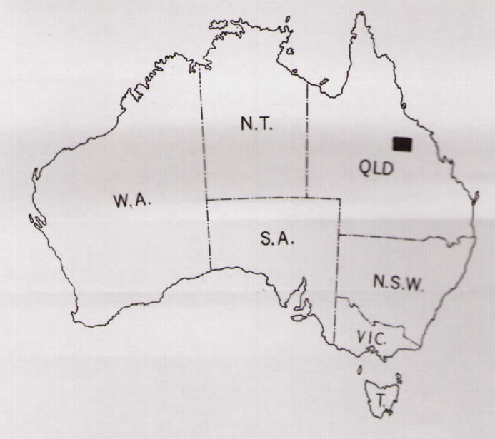
20 Strike and dip of strata
Unmeasured dip
Vertical strata
Horizontal strata
Dip < 15° } air-photo interpretation
Trend of bedding } air-photo interpretation
Joints } air-photo interpretation

Fossil locality, general (algae, wormholes)
Plant fossil locality with reference number
Wood fossil locality
Measured section locality
Type section locality
Dyke, b - basalt, q - quartz
Abandoned B.M.R stratigraphic scout hole

Bore
Abandoned bore
Artesian bore, flowing
Artesian bore, ceased to flow
Sub-artesian bore or well
R 8520 Refers to bore registered number of Queensland Irrigation and Water Supply Commissions record.
Well
E Earth tank
Windpump
Dam
W.H Waterhole

Road
Vehicle track
"Scartwater" Homestead
Building
Yd Yard
Landing ground
827 Height in feet; datum mean sea level
P.D Position doubtful

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 Airways Pty Ltd.; complete vertical coverage at 1:85,000 scale.
Transverse Mercator Projection.



INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

GILBERTON SE 54-16	CLARKE RIVER SE 55-13	TOWNSVILLE SE 55-14	AYR SE 55-15	
RICHMOND SF 54-4	HUGHENDEN SF 55-1	CHARTERS TOWERS SF 55-2	BOWEN SF 55-3	PROSERPINE SF 55-4
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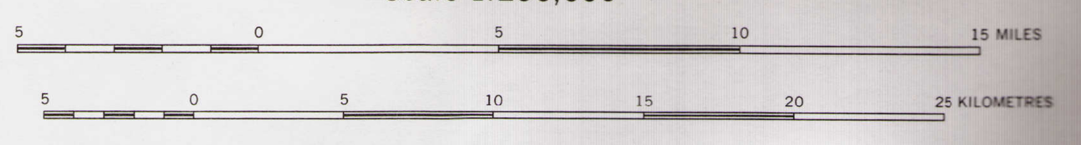
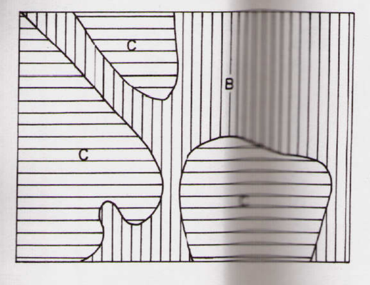
ANNUAL CHANGE 1'30"E

Scale 1:250,000



GEOLOGICAL RELIABILITY DIAGRAM



B Detailed reconnaissance, general reconnaissance, reconnaissance and air-photo interpretation

C Air-photo interpretation

Geology, 1964 (Great Artesian Basin), by: R.R. Vine (B.M.R.), D.J. Casey (G.S.Q.).
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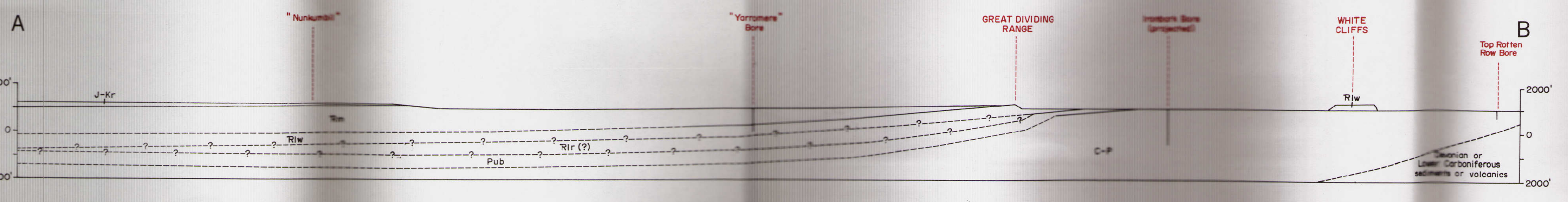
J. Eftekharnezhad (Geological Survey of Iran).
Compiled, 1964, by: R.R. Vine (B.M.R.), D.J. Casey (G.S.Q.).
1966, by: J.G.A. Den Hertog.
Drawn by: J.G.A. Den Hertog.

Sections
Cainozoic sediments omitted from sections
Scale: $\frac{V}{H} = 4$



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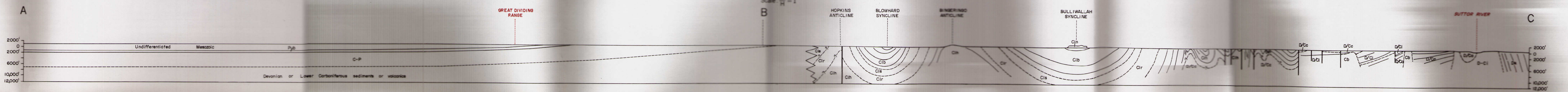

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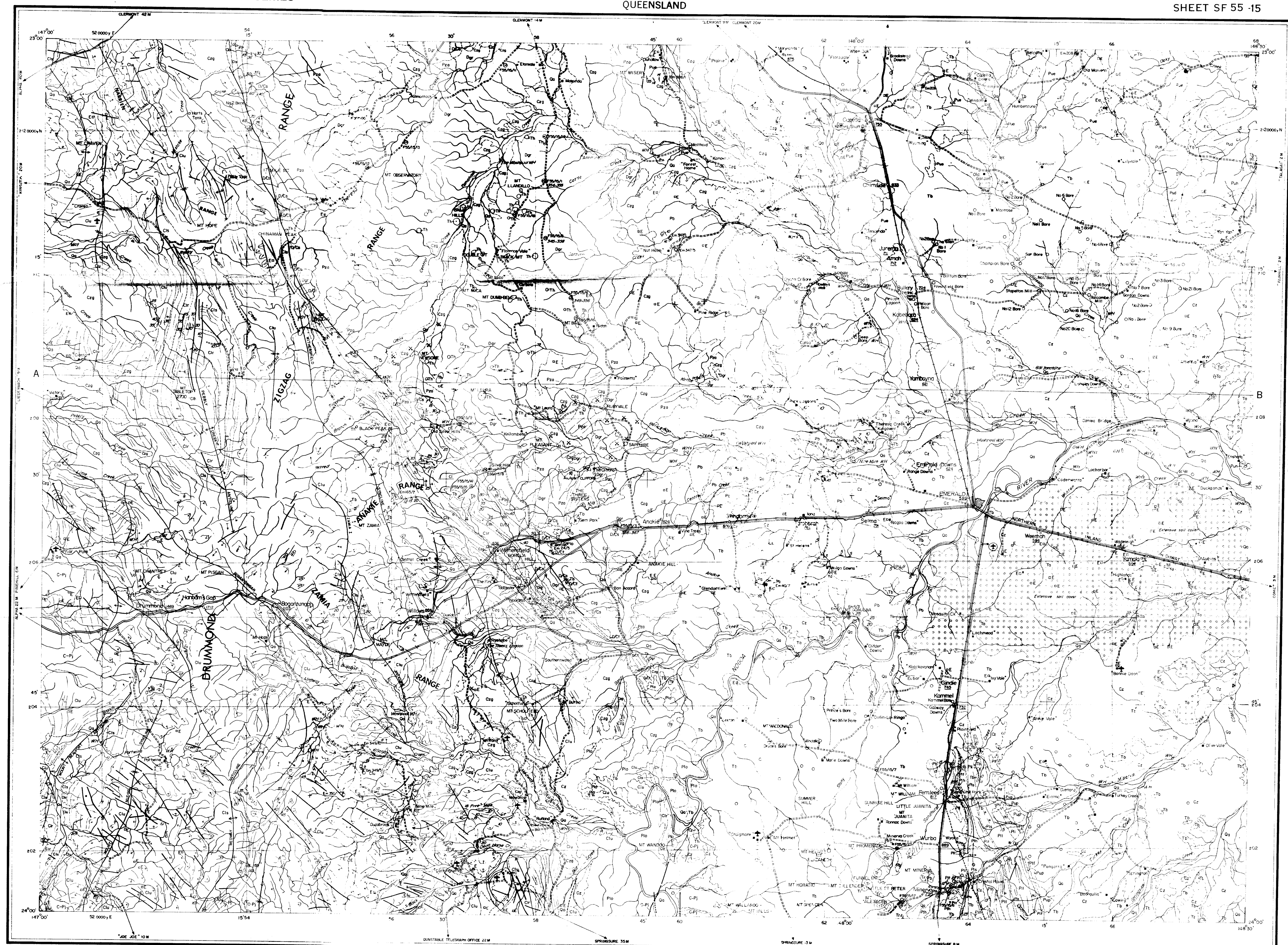


Reference

Era	Period	Unit	Symbol	Description
CAINOZOIC	QUATERNARY		Qa	Alluvium
	UNDIFFERENTIATED		Cz	Soil and alluvium
			Czg	Gravel and sand
	TERTIARY			Laterite (coloured as parent rock)
			Ta	Claystone, siltstone, sandstone, conglomerate
		Minerva Hills Volcanics	Tr	Plugs, domes and dykes of alkaline quartz trachyte and rhyolite
			Tb	Olivine basalt, trachy basalt, minor agglomerate and tuff
		Hoy Basalt	Th	Plugs of porphyritic olivine basalt
PALAEOZOIC	UPPER PERMIAN	Blackwater Group: Fair Hill Formation	Puh	Lithic and feldspathic sandstone, conglomerate, tuff and tuffaceous sandstone, mudstone
		Undifferentiated	Pb	Quartz sandstone, pebbly quartz sandstone, feldspathic sandstone, mudstone, coal
		Back Creek Group, Blenheim Sub-Group: Undifferentiated	Pue	Quartz sandstone, lithic quartz sandstone, conglomerate, siltstone, micaceous and carbonaceous mudstone
		German Cr Coal Measures	Pud	Quartz sandstone, sandstone, carbonaceous siltstone and mudstone, coal, conglomerate
		Peawaddy Formation	Pup	Lithic quartz sandstone, carbonaceous siltstone
	LOWER PERMIAN	Gebbie Sub-Group: Catherine Sandstone	Plf	Feldspathic quartz sandstone
		Ingelara Formation	Pli	Sandy siltstone and mudstone, in places pebbly; minor conglomerate, calcareous concretions common
		Aldebaran Sandstone	Pll	Conglomeratic quartz sandstone, some shale, siltstone, coal
		Colinlea Sandstone	Plo	Quartz sandstone, pebbly quartz sandstone, conglomerate minor siltstone
		Tiverton Sub-Group: Sirius Formation	Pls	Shale, siltstone, in places pebbly, lithic quartz sandstone
		Staircase Sandstone	Plt	Quartz sandstone, pebbly in places, siltstone, shale
		Stanleigh Formation	Plh	Lithic quartz sandstone, dark shale, siltstone, minor limestone
	PERMIAN - CARBONIFEROUS	Joe Joe Formation	C-Pj	Tillitic conglomerate, lithic quartz sandstone, siltstone, minor shale
	CARBONIFEROUS		Ci	Hornblende - biotite adamellite
	LOWER CARBONIFEROUS	Drummond Group: Ducabrook Formation	Clu	Feldspathic lithic sandstone, siltstone, shale, tuff, minor algal limestone
		Star of Hope Formation	Cls	Lithic conglomerate, acid flows and tuffs, lithic sandstone, siltstone, minor limestone
		Raymond Sandstone	Clr	Flaggy quartz sandstone, olive green siltstone, minor lithic sandstone, tuff and limestone
		Mt Hall Formation	Clh	Quartz sandstone, pebbly quartz sandstone, quartz pebble conglomerate, siltstone, lithic sandstone
	UPPER DEVONIAN - LOWER CARBONIFEROUS	Telemon Formation	D/Ct	Lithic conglomerate, sandstone, siltstone, algal limestone, basalt, agglomerate, tuff
		Silver Hills Volcanics	D/Cs	Flow-banded and spherulitic rhyolite, agglomerate, tuff, minor sediments
	UPPER DEVONIAN	Retreat Granite	Dgr	Monzonite porphyry, granodiorite
	LOWER MIDDLE-DEVONIAN		Dm	Limestone, rhyolite, tuff, sandstone, shale
	PRE-DEVONIAN	Anakie Metamorphics	Pza	Quartz - mica schist, knotted schist, phyllite, quartzite, slate, limestone

Geological boundary

Anticline, showing plunge

Syncline

Monocline

Fault

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

Strike and dip of strata

Unmeasured dip

Vertical strata

Horizontal strata

Dip < 15°

Dip 15°-45°

Dip > 45°

Horizontal strata } air-photo interpretation

Dip slope

Trend of bedding

Lineament

Fossil locality, general (algae, fish scales, bone)

Macrofossil locality

Plantfossil locality

Microfossil locality

Fossil wood locality

Em 830 Fossil locality number

F55/15/8 450 Sample locality for isotopic age determination showing register number and age in millions of years (in italics)

Dyke b-basalt; rh-rhyolite

Alluvial workings for gemstones

Mine, abandoned Au-gold; Ag-silver; Cu-copper

Shaft

Bore

Well

Earth tank

Dam on stream

WH Waterhole

Road

Vehicle track

Railway with siding

"Nogoa Downs" Homestead

Building

Yd Yard

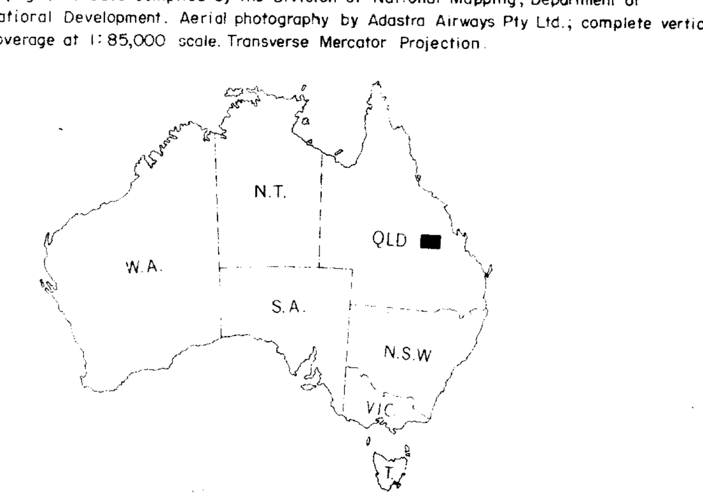
Airport

Landing ground

589 Height in feet, instrument levelled; datum: mean sea level

PD Position doubtful

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 Division of National Mapping, Department of National Development. Aerial photography by Adastra Airways Pty Ltd.; complete vertical coverage at 1:85,000 scale. Transverse Mercator Projection.



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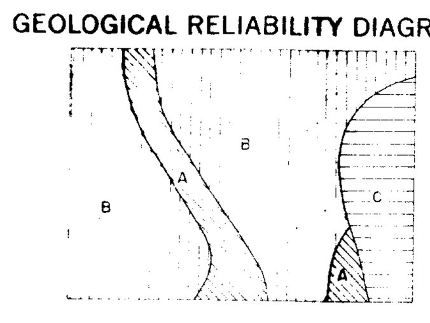
BLACKALL SG 55-1	TAMBO SG 55-2	SPRINGSURE SG 55-3	BARALABA SG 55-4	MONTO SG 56-1
ADAVALE SG 55-5	AUGATHELLA SG 55-6	EDDYSTONE SG 55-7	TAROOM SG 55-8	MUNDUBBERA SG 56-5

ANNUAL CHANGE 2'30"E

Scale 1:250,000

GEOLOGICAL RELIABILITY DIAGRAM



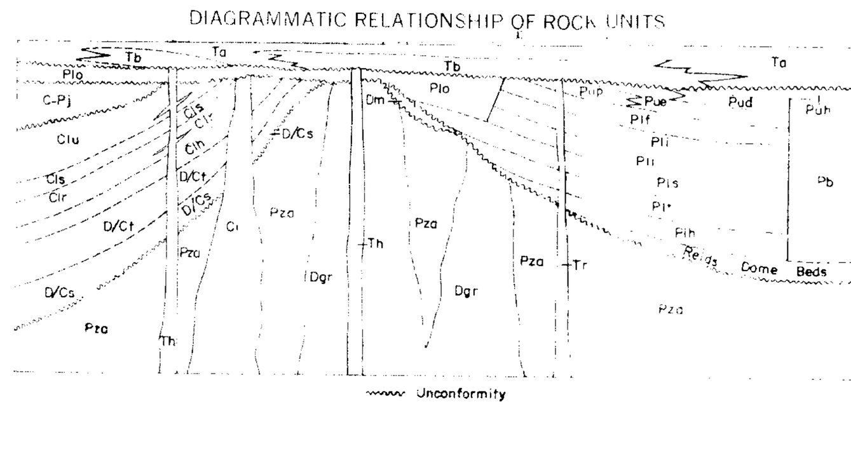
A Detailed reconnaissance, numerous traverses

B Reconnaissance, many traverses

C Some traverses and air-photo interpretation

Geology, 1963, by J.J. Veevers, R.G. Mollan, F. Olgers (B.M.R.); A.G. Kirkegaard (G.S.Q.)
Revised, 1966, by F. Olgers, H.F. Doutch (B.M.R.); J. Eftekharnezhad (Geological Survey of Iran)
Drawn by

Section
(Cainozoic sediments omitted from section)
Scale $\frac{V}{H} = 1$



EMERALD

SHEET SF 55-15

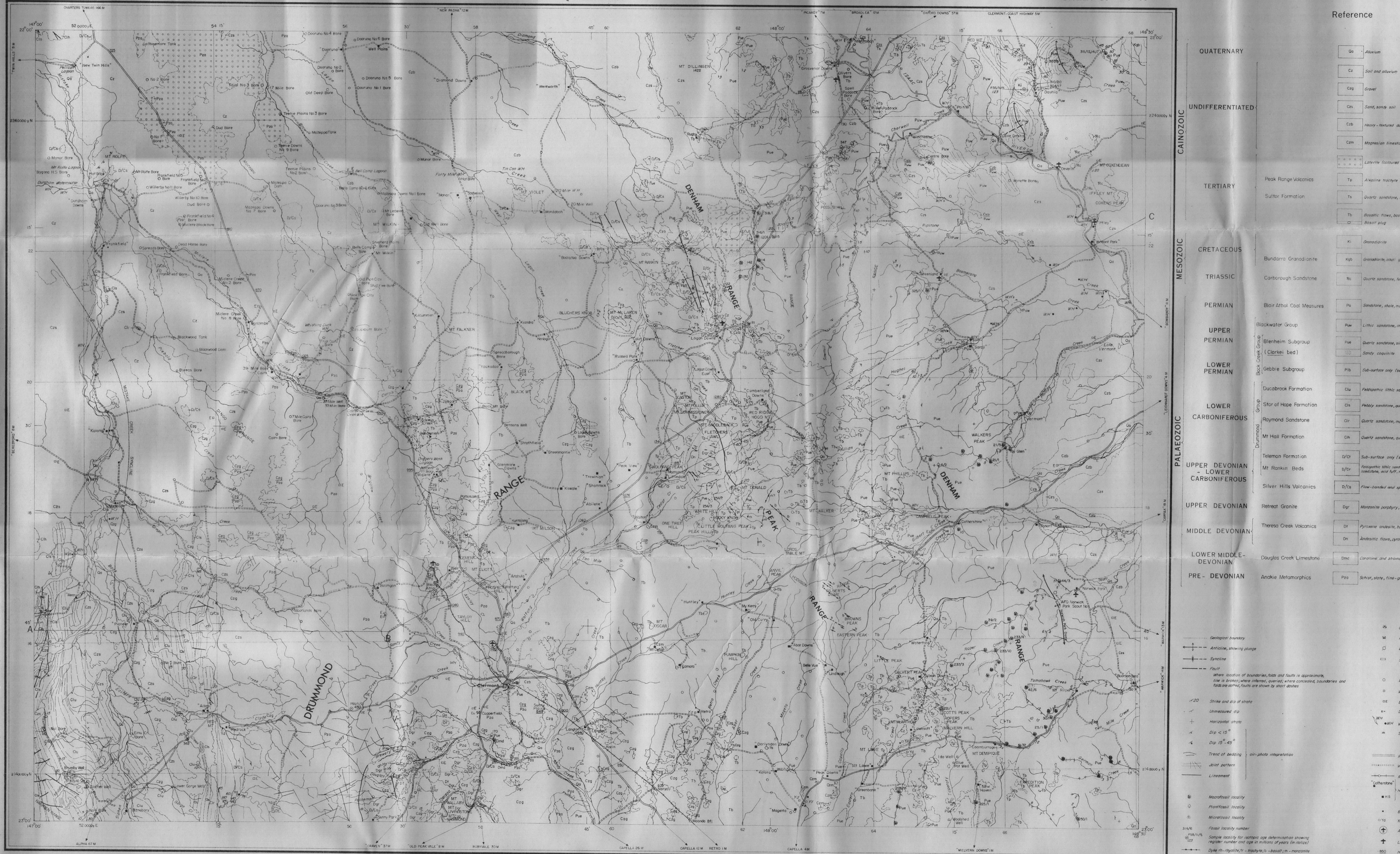
Copies of this map may be obtained from the Bureau of Mineral Resources, Geology and Geophysics, Canberra, A.C.T., or the Geological Survey of Queensland, Brisbane

AUSTRALIA 1:250,000 GEOLOGICAL SERIES

CLERMONT
QUEENSLAND

SHEET SF 55-11

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS



Reference

Era	Period	Unit	Symbol	Description
CAINOZOIC	QUATERNARY		Qa	Alluvium
	UNDIFFERENTIATED		Cz	Soil and alluvium
			Czg	Gravel
			Czs	Sand, sandy soil
			Czb	Heavy-textured dark soil
			Czm	Magnesian limestone
				Laterite (coloured as parent rock)
	TERTIARY	Peak Range Volcanics	Tp	Alkaline trachyte and rhyolite plugs, domes and flows
		Suttor Formation	Ts	Quartz sandstone, siltstone, conglomerate
			Tb	Basaltic flows, basalt and gabbro plugs
				Basalt plug
MESOZOIC	CRETACEOUS		Ki	Granodiorite
		Bundarra Granodiorite	Kgb	Granodiorite, alkali granite, syenite
	TRIASSIC	Carborough Sandstone	Rc	Quartz sandstone, feldspathic quartz sandstone
PALAEOZOIC	PERMIAN	Blair Athol Coal Measures	Pa	Sandstone, shale, mudstone, conglomerate, coal
	UPPER PERMIAN	Blackwater Group	Puw	Lithic sandstone, in places calcareos, mudstone, carbonaceous shale, coal, aphanitic tuff
		Back Creek Group: Blenheim Subgroup	Pue	Quartz sandstone, siltstone, carbonaceous shale, minor coal
		(Clarkei bed)		Sandy coquinite
	LOWER PERMIAN	Back Creek Group: Gebbie Subgroup	Plb	Sub-surface only (see section)
	LOWER CARBONIFEROUS	Drummond Group: Ducabrook Formation	Clu	Feldspathic lithic sandstone, siltstone, shale. Minor limestone, calcareous concretions
		Drummond Group: Star of Hope Formation	Cls	Pebbly sandstone, quartz pebbly conglomerate and acid tuffs and flows
		Drummond Group: Raymond Sandstone	Clr	Quartz sandstone, mudstone, minor tuff, calcareous sandstone, limestone
		Drummond Group: Mt Hall Formation	Clh	Quartz sandstone, quartz pebble conglomerate, minor green siltstone
	UPPER DEVONIAN - LOWER CARBONIFEROUS	Telemon Formation	D/Ct	Sub-surface only (see section)
		Mt Rankin Beds	D/Cr	Feldspathic lithic sandstone and conglomerate, mudstone, fine-grained quartz sandstone, acid tuff, minor agglomerate and crystal tuff
		Silver Hills Volcanics	D/Cs	Flow-banded and spherulitic rhyolite, pyroclastics, minor arkose, lithic sandstone, siltstone
	UPPER DEVONIAN	Retreat Granite	Dgr	Monzonite porphyry, granodiorite
	MIDDLE DEVONIAN	Theresa Creek Volcanics	Dt	Pyroxene andesite, basalt, basic crystal tuff, tuff breccia
			Dn	Andesitic flows, pyroclastics with limestone lenses
	LOWER MIDDLE-DEVONIAN	Douglas Creek Limestone	Dmd	Coralline and stromatoporoid limestone, micaceous siltstone
	PRE-DEVONIAN	Anakie Metamorphics	Pza	Schist, slate, fine-grained sandstone

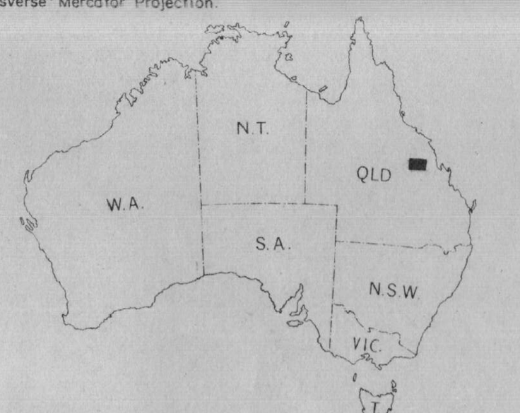
Geological boundary
Anticline, showing plunge
Syncline
Fault
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted, faults are shown by short dashes

Strike and dip of strata
Unmeasured dip
Horizontal strata
Dip < 15°
Dip 15°-45°
Trend of bedding
Joint pattern
Lineament
(air-photo intepretation)

Macrofossil locality
Plantfossil locality
Microfossil locality
314/6 Fossil locality number
F55/11/5 123 Sample locality for isotopic age determination showing register number and age in millions of years (in italics)
Dyke rh-rhyolite; tr - trachyte; b - basalt; m - monzonite

Quarry c - coal
Mine, abandoned Au - gold; Cu - copper
Dry oil exploration well (abandoned)
Shaft
Bore
Well
Earth tank
Dam on stream
Waterhole
Swamp
Road
Vehicle track
Railway with siding
"Cotherstone" / H.S Homestead
Building
Yd Yard
Airport
Landing ground
850 Height in feet, instrument levelled; datum: mean sea level

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 Division of National Mapping, Department of National Development. Aerial photography by the Royal Australian Air Force at 1:50,000 scale and by Adastra Airways Pty Ltd. at 1:26,000 and 85,000 scales. Transverse Mercator Projection.



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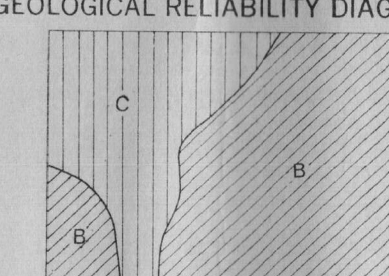
LONGREACH SF 55-13	JERICHO SF 55-14	EMERALD SF 55-15	DUARINGA SF 55-16	ROCKHAMPTON SF 56-13
BLACKALL SG 55-1	TAMBO SG 55-2	SPRINGSURE SG 55-3	BARALABA SG 55-4	MONTO SG 56-1

Scale 1:250,000

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

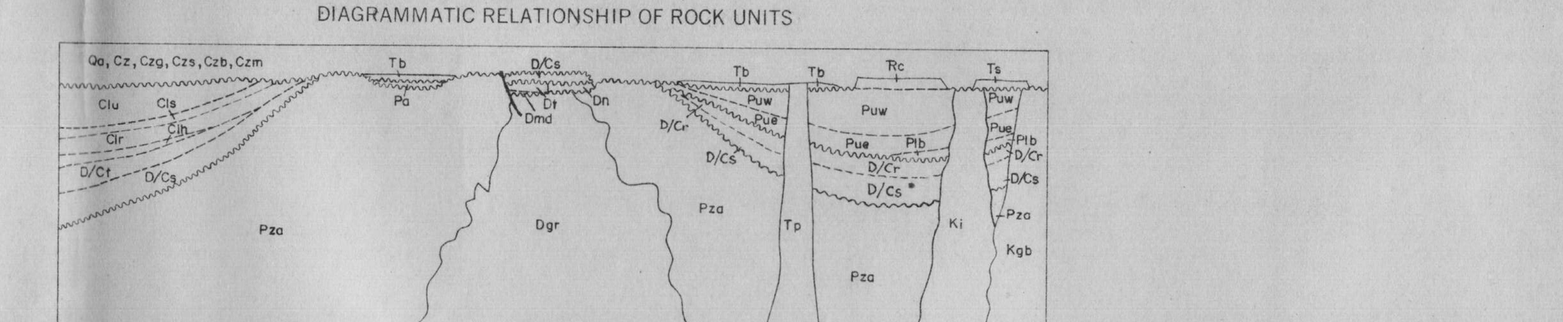
GEOLOGICAL RELIABILITY DIAGRAM



B Detailed reconnaissance: numerous traverses, air-photo interpretation
C Few traverses and air-photo interpretation

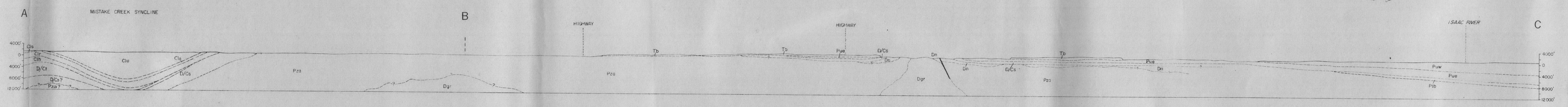
Geology, 1961, by: J.J. Veevers, M.A. Randal, R.G. Mollan (B.M.R.); R.J. Paten, (Q.G.S.).
Revised, 1966, by: F. Olgers, H.F. Doutch, (B.M.R.); J. Eftekharnezhad (Geological Survey of Iran)
Drawn by:

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS



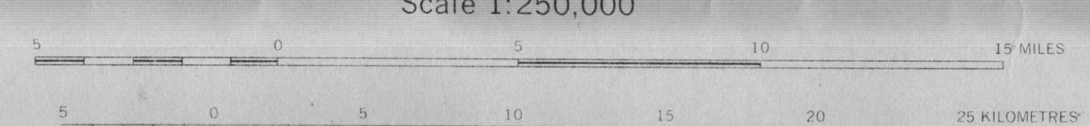
Unconformity

Section
(Quaternary and Undifferentiated Cainozoic omitted)
Scale V/H = 1



CLERMONT
SHEET SF 55-11

Copies of this map may be obtained from the Bureau of Mineral Resources, Geology and Geophysics, Canberra, A.C.T., or the Geological Survey of Queensland, Brisbane



AUSTRALIA 1:250.000 GEOLOGICAL SERIES

GALILEE
QUEENSLAND

SHEET SF 55-10

PRELIMINARY EDITION, 1967

SUBJECT TO AMENDMENT

Compiled and issued by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Division of National Mapping and the Bureau of Mineral Resources, Geology and Geophysics Department of National Development. Aerial photography by the Royal Australian Air Force. Complete vertical coverage at 1:48,000 scale.

Transverse Mercator Projection.

Reference

CAINOZOIC	QUATERNARY		Qa — Alluvium
			Qs — Sand, gravel, rubble, soil
	UNDIFFERENTIATED		Cz — Soil and alluvium
			Czd — Duricrust
	TERTIARY ?		T — Argillaceous sandstone, sandy mudstone, clay, sometimes silicified
MESOZOIC	LOWER CRETACEOUS	Wallumbilla Formation Doncaster Member	Kld — Mudstone, glauconitic mudstone, siltstone, limestone
	JURASSIC – LOWER CRETACEOUS	Ronlo Beds	J-Kr — Quartz and labile sandstone, mudstone, coal
	MIDDLE – UPPER TRIASSIC	Mooleyember Formation	Rm — Mudstone, labile and quartz sandstone, siltstone, shale, clay
	LOWER-MIDDLE TRIASSIC	Clematis Sandstone	Re — Quartz sandstone, conglomerate minor siltstone and mudstone
	LOWER TRIASSIC	Dunda Beds	Rld — Labile and quartz sandstone, siltstone, mudstone
		Rewan Formation	Rlr — Mudstone, labile sandstone, siltstone
PALAEOZOIC	LOWER ? – UPPER PERMIAN		Pu — Mudstone, coal, carbonaceous shale, labile and quartz sandstone, siltstone (Section only)
	PERMIAN	Undifferentiated	P — Labile sandstone, mudstone, siltstone, conglomerate
	CARBONIFEROUS–LOWER PERMIAN		C–P — Mudstone, siltstone, labile and quartz sandstone, minor coal, calcareous siltstone, greywacke. Section only.
	LOWER CARBONIFEROUS	Drummond Group: Ducabrook Formation	Clu — Interbedded feldspathic sandstone and green and brown mudstone; minor limestone and tuff
		Drummond Group: Star of Hope Formation	Cls — Pebbly feldspathic sandstone; acid pyroclastics and minor lithic sandstone
		Drummond Group: Raymond Sandstone	Clr — Feldspathic quartz sandstone; green mudstone and minor limestone
		Drummond Group: Mount Hall Formation	Clh — Quartz pebble conglomerate, quartz sandstone, minor green mudstone
	UPPER DEVONIAN – LOWER CARBONIFEROUS	Telemon Formation	D/C1 — Quartz sandstone, green and brown mudstone; acid tuff
	UPPER DEVONIAN		Du — Quartz and labile sandstone, mudstone, shale, siltstone, minor calcareous siltstone. Section only.

- Geological boundary
- Anticline, showing plunge
- Syncline, showing plunge
- Fault — Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried, where concealed, boundaries and folds are dotted, faults are shown by short dashes
- 25 — Strike and dip of strata
- Horizontal strata
- Dip < 15° (dir.-photo interpretation)
- Dip 15 -45° (dir.-photo interpretation)
- Dip > 45° (dir.-photo interpretation)
- Trend lines
- Plant fossil locality with reference number
- Macro fossil locality
- Measured section
- X 36 — Section reference number
- Abandoned oil exploration well with show of oil
- Abandoned scout hole
- Abandoned bore or well
- Sub-artesian bore or well
- Earth tank
- Dam
- Waterhole
- Road
- Vehicle track
- Fence
- "Dunrobin" — Homestead
- Landing ground
- 982' — Height in feet, datum mean sea level
- Astronomical station
- P.O. — Position doubtful

Geology and compilation, 1964, by: R.R.Vine (B.M.R.)/D.J. Casey (G.S.Q.)
1966, by: H.F. Doutch (B.M.R)

Drawn by: I. Chertok , J.G.A. Den Hertog

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MARATHON SF 54-16	LONGREACH SF 55-13	JERICHO SF 55-14	EMERALD SF 55-15	ROCKHAMPTON SF 55-16
LONDON SE 54-4	BLACKALL SE 55-1	TAMBO SE 55-2	SPRINGSURE SE 55-3	MARLBARA SE 55-4

ANNUAL CHANGE 2'E

Scale 1:250,000

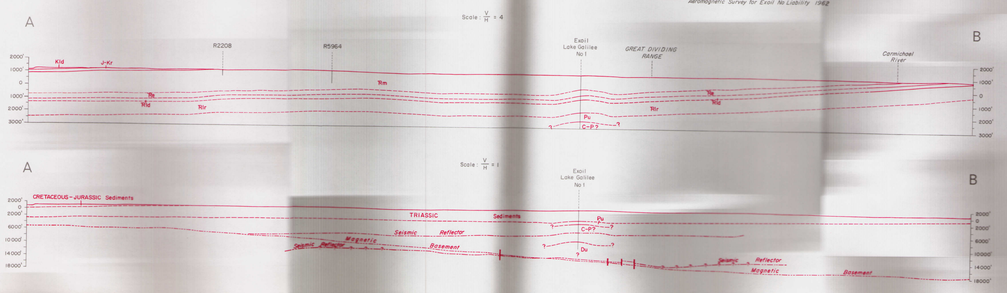
5 0 5 10 15 MILES

5 0 5 10 15 20 25 KILOMETRES

Sections

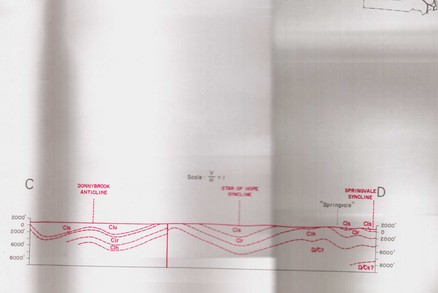
Cainozoic sediments omitted from sections

- Seismic reflectors interpreted from Lake Galilee Seismic Survey for Exoil No Liability 1962.
- Magnetic basement interpreted from Aromac–Mt Coxon Aeromagnetic Survey for Exoil No Liability 1962



GEOLOGICAL RELIABILITY DIAGRAM

B — Reconnaissance – traverses and air-photo interpretation



GALILEE
SHEET SF 55-10
Complimentary

PRELIMINARY EDITION, 1967

SUBJECT TO AMENDMENT

AUSTRALIA 1:250,000 GEOLOGICAL SERIES

JERICHO

QUEENSLAND

SHEET SF 55-14

Reference

Era	Period	Formation	Symbol	Lithology
CAINOZOIC	QUATERNARY		Qa	Alluvium
			Qs	Sand, gravel, rubble, soil
	UNDIFFERENTIATED		Czd	Duricrust
	TERTIARY?		T	Argillaceous sandstone, sandy mudstone, limestone; sometimes lateritized
			Tb	Basalt
MESOZOIC	LOWER CRETACEOUS	Wallumbilla Formation	Klu	Mudstone, siltstone, limestone, calcareous shale
		Doncaster Member	Kld	Mudstone, glauconitic mudstone and siltstone, limestone
	JURASSIC – LOWER CRETACEOUS	Ronlo Beds	J-Kr	Quartz and lithic sandstone, mudstone, minor coal
	MIDDLE JURASSIC	Injune Creek Beds	Jmi	Lithic sandstone, mudstone
	LOWER JURASSIC	Hutton Sandstone	Jlh	Quartz sandstone
	MIDDLE – UPPER TRIASSIC	Moolayember Formation	Rm	Mudstone, sandstone, siltstone, shale, clay
	LOWER – MIDDLE TRIASSIC	Clematis Sandstone	Re	Quartz sandstone, minor siltstone and mudstone
	LOWER TRIASSIC	Dunda Beds	Rld	Lithic sandstone, siltstone, mudstone
		Rewan Formation	Rlr	Mudstone, siltstone, lithic sandstone
PALAEOZOIC	LOWER ?– UPPER PERMIAN	Undifferentiated	P	Lithic and quartz sandstone, siltstone, mudstone, carbonaceous shale, coal, conglomerate
		Colinlea Sandstone	Plo	Lithic and quartz sandstone, minor siltstone and coal
	CARBONIFEROUS – LOWER PERMIAN	Joe Joe Formation	C-Pj	Mudstone, lithic sandstone, siltstone, shale
	LOWER CARBONIFEROUS	Drummond Group: Ducabrook Formation	Clu	Interbedded feldspathic sandstone and green and brown mudstone; minor limestone and tuff
		Drummond Group: Star of Hope Formation	Cls	Quartz sandstone, minor pebbly sandstone, conglomerate, lithic sandstone, oolitic limestone
		Drummond Group: Raymond Sandstone	Clr	Quartz sandstone, minor siltstone
	UPPER DEVONIAN – LOWER CARBONIFEROUS	Drummond Group: Telemon Formation	D/Ct	Tuff, agglomerate, basalt, conglomerate, algal limestone, feldspathic sandstone, mudstone
		Silver Hills Volcanics	D/Cs	Flow banded and spherulitic rhyolite

Geological boundary

Anticline, showing plunge

Fault

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

Strike and dip of strata

Horizontal strata

Dip < 15° }
Lineament }
Trend lines } *air-photo interpretation*
Joint pattern }

Plant fossil locality

G 1745 *Locality reference number*

Spores

SP C 59 *Locality reference number of bottom-hole samples of seismic shot-holes*

Measured section

X39 *Section reference number*

Quarry

Gr *Gravel*

Bs *Building stone*

Abandoned dry oil exploration well

Abandoned scout hole

Abandoned bore or well

Artesian bore ceased flowing

Sub-artesian bore or well

R 1179 Refers to bore registered number of Queensland Irrigation and Water Supply Commissions record.

□E *Earth tank*

Dam

W.H *Waterhole*

Spring

Road

Vehicle track

Railway with station

Fence

"Merida" *Homestead*

Airfield

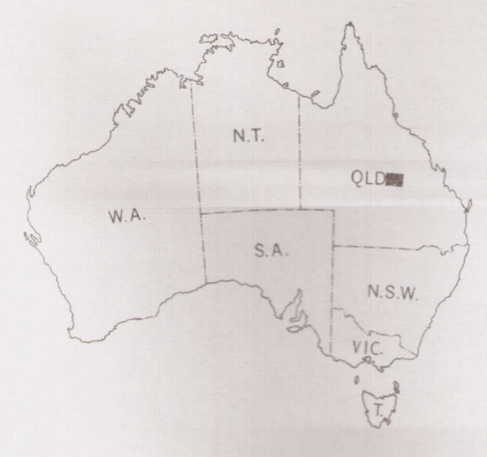
Landing ground

Astronomical station

1129 *Height in feet; datum mean sea level*

P.D *Position doubtful*

Compiled and issued by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Division of National Mapping and the Bureau of Mineral Resources, Geology and Geophysics Department of National Development. Aerial photography by the Royal Australian Air Force; Complete vertical coverage at 1:48,000 scale. Transverse Mercator Projection



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WINDORAH SG 54-8	ADAVALE SG 55-5	AUGATHELLA SG 55-6	EDDYSTONE SG 55-7	TAROOM SG 55-8

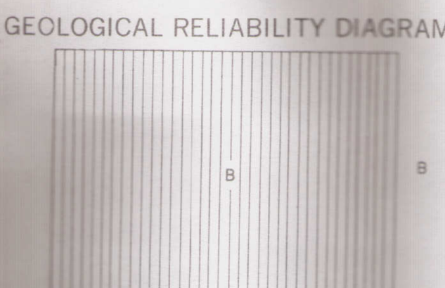
ANNUAL CHANGE 2'E

Scale 1:250,000

5 0 5 10 15 20 25 Statute Miles

5 0 5 10 15 20 25 Kilometres

GEOLOGICAL RELIABILITY DIAGRAM



B Reconnaissance - traverses and air-photo interpretation

Geology and compilation, 1964, by: R.R.Vine, W. Jauncey, M.C. Galloway (B.M.R.); D.J.Casey (GSQ)
1966, by: F.Olgers, H.F.Doutch (B.M.R.); J. Eftekharnezhad (Geological Survey of Iran)
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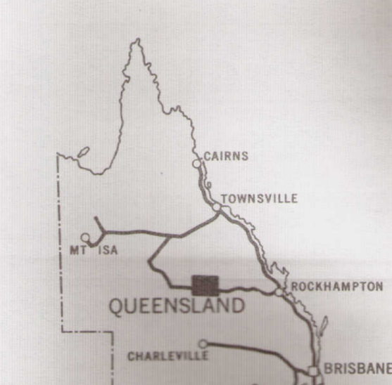
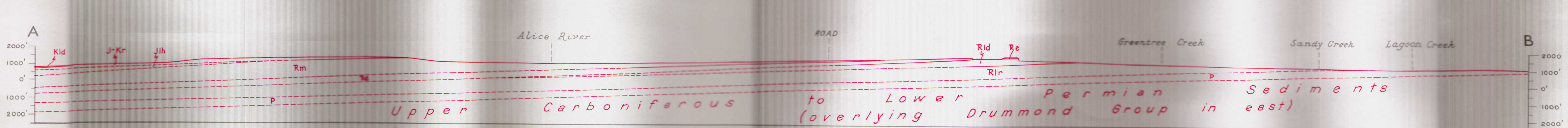


Section

Cainozoic sediments omitted from section

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



JERICHO

SHEET SF 55-14

Complimentary