COMMONWEALTH OF AUSTRALIA.



DEPARTMENT OF NATIONAL DEVELOPMENT.

# BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1962/71



# GEOLOGY OF THE WESTERN PART OF THE MACKAY 1:250,000 SHEET AREA

by

A.R. Jensen, C.M. Gregory and V.R. Forbes

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(Progress Report on the Bowen Basin Regional Survey, 1961 Season).

CONTENTS





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FIGURES



............

## SUMMARY

The oldest unit in the area, the Lower Bowen Volcanics, consists of about ten to twenty thousand feet of andesitic volcanics, interbedded with minor sediments. The top of the unit is Lower Permian and it is possible that the basal part is Carboniferous. It is overlain, with possible disconformity, by the Middle Bowen Beds consisting of eight thousand feet of fossiliferous marine sedimentary rocks. These, in turn, are overlain conformably by ten thousand feet of Upper Bowen Coal Measures, a unit of deltaic origin, which is thought to be Upper Permian to Triassic.

The Urannah Complex, a diorite-granite-granodiorite mass with abundant acid and intermediate dykes, intrudes the Lower Bowen Volcanics. It is believed to be the core of an island arc structure, and it probably had a long history extending from Upper Palaeozoic into the Mesozoic.

Igneous intrusives in the area include the Bundarra Granodiorite, of Mesozoic age, which intrudes the Middle Bowen Beds, and the granodiorite of the Mount Travers area, which intrudes rocks of the Upper Bowen Coal Measures.

Tertiary basalt, freshwater sedimentary rocks, and acid volcanics, overlie all the Palaeozoic and Mesozoic rocks with unconformity.

The Urannah Complex separates units which, on its western side, have a regional dip to the west from those on its eastern side, which do not show any broad structural features. The units on the western side, dipping to the west at about 45°, form part of the eastern limb of the "Bowen syncline".

The area has not been an important producer of minerals. Copper, silver and gold have been mined, on a small scale, but the small deposits of coal have not been exploited.

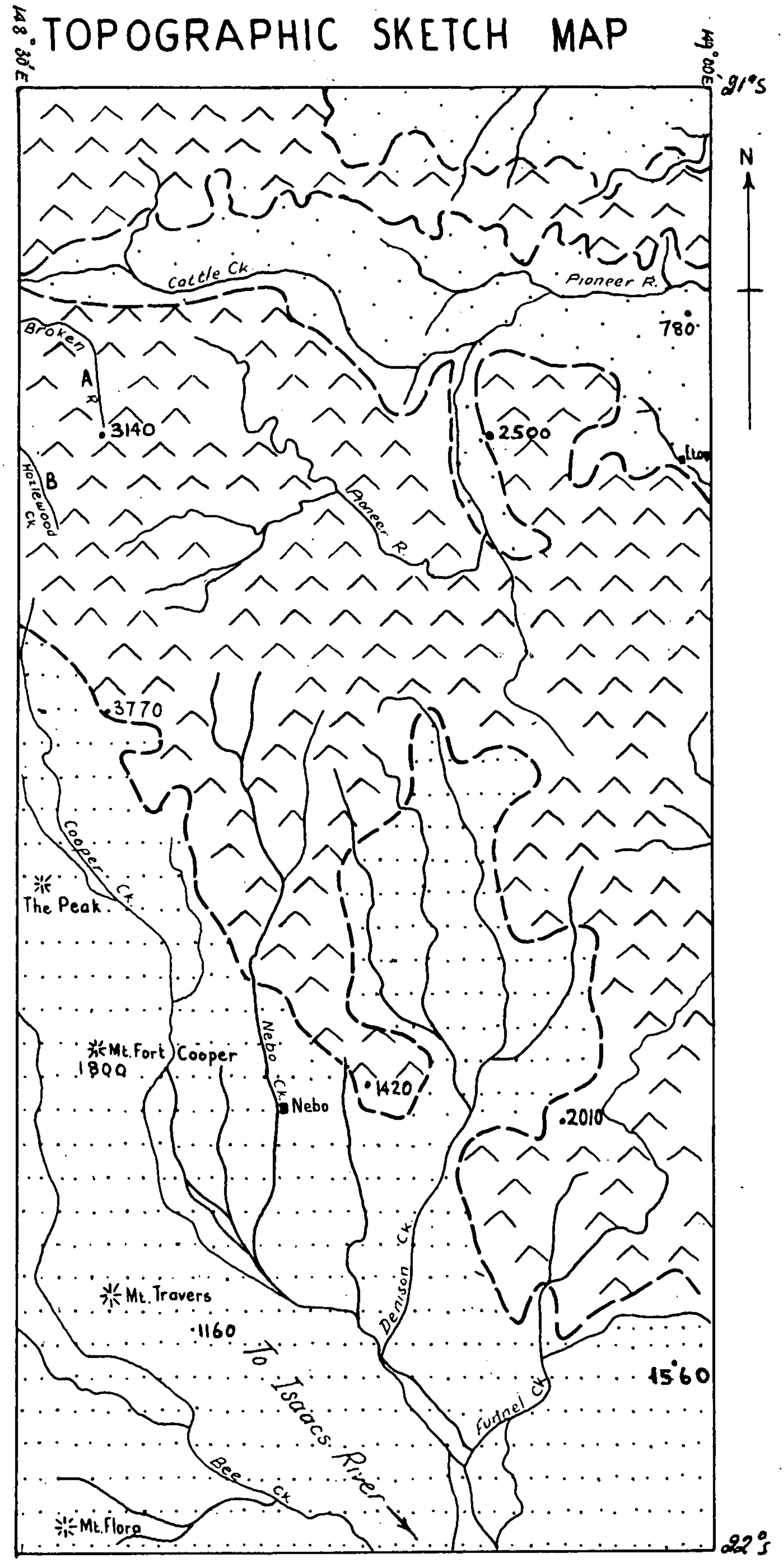
Some sub-surface water is obtained in the south-west portion of the sheet area for domestic purposes and cattle.

## INTRODUCTION

In 1960, the Bureau of Mineral Resources, in association with the Geological Survey of Queensland, commenced a programme of regional mapping in the Bowen Basin, Queensland, to assist in the search for oil. This Record is a progress report on five weeks mapping in the western part of the Mackay 1:250,000 Sheet area (referred to hereafter as the Mackay West Sheet area).

Fig. 1

# MACKAY WEST
# TOPOGRAPHIC SKETCH MAP




SCALE 1:500,000

REFERENCE

Coastal Range

Bee and Funnel Creek Area

Cattle Creek - Pioneer River Valley

▪ Town

Topographic boundary

1560 Altitude in feet

To accompany Record No 1962/71
Bureau of Mineral Resources, Geology and Geophysics. May 1962 **F55/8/1**

The Mackay West area is the western third of the Mackay 1:250,000 Sheet area. It is bounded in the west by the Mount Coolon 1:250,000 Sheet area, which was mapped in 1960, (Malone, Corbett, and Jensen 1961). It is bounded on the north side by Proserpine, on the east by Mackay, and on the south by the St. Lawrence 1:250,000 Sheet areas. All of these areas will be mapped by the Bureau of Mineral Resources in 1962 and The Queensland Geological Survey, in 1962.

The size of the area mapped is equivalent to four one-mile Sheet areas, or just over twenty thousand square miles. It was mapped in five weeks, from early September to mid-October, by A.R. Jensen, and C.M. Gregory, of the Bureau of Mineral Resources, and V.R. Forbes, of the Queensland Geological Survey. The geology was mapped at 1:85,000 scale, using aerial photos taken in 1960, by Adastra. Overlays of the geology of each photo were fitted together on a base supplied by the Division of National Mapping, to form the map contained in this record.

The three topographic units shown on the topographic sketch map (fig.1) are: the Bee and Funnel Creek area; the Coastal Range; and the Cattle Creek - Pioneer River Valley. The Bee and Funnel Creek area consists of gently undulating plains, drained by creeks of the Isaacs River system. The creeks flow south, some of them rise in the Coastal Range and others have their origin in the lowlands described in the report of the physiography of the Mount Coolon area (Malone et al.1961). The northern section of this area has small rounded hills, but in the southern section flood plains are developed. Many of the hills of the northern section are strike ridges but, isolated, steep-sided hills of volcanic origin are also present, for example "The Peak" and Mount Fort Cooper. A ring of hills composed of metamorphosed Middle Bowen Beds, surrounds the Bundarra Granodiorite; Mount Flora is one of the hills.

The Coastal Range is the watershed for three different drainage systems:

1. the Isaacs River system;
2. two rivers, marked A and B on the sketch map, which eventually flow into the Bowen-Burdekin River system;
3. some of the rivers which flow directly east to the sea, such as the Pioneer River and Cattle Creek.

The Range has rugged topography and youthful streams, with steep-sided hills and deep gorges. Relief is in the order of 1,500 feet.

The Cattle Creek - Pioneer River Valley is drained by streams flowing in an easterly direction to the coast. The Valley, in the upper reaches ofCattle Creek, is steep-sided with a total drop of about 1,500 feet and a width of about two miles. Flood plains are developed in the lower, or more easterly part of the valley, but many steep sided residual hills are present.

These three topographic units have different climates. Rainfall occurs mainly in the summer, in all areas, but the Bee and Funnel Creek area is much drier than the more easterly areas, having an annual rainfall of 10-20 inches. Both the Coastal Range and the Pioneer River Valley have an annual average rainfall of 30-50 inches, but in general the Pioneer Valley area is much more humid. All topographic units have a hot summer and a cool winter.

Access in the Mackay West area is good. The Bruce Highway, a sealed road, passes through the eastern side of the area, and there are a few sealed roads in the Eton district. Almost the whole area is served with good unsealed roads, except in the area ofthe Urannah Complex. Some of these roads are impassable during the wet season. A railway runs from Eton to the port of Mackay andthere joins the main southern line to Brisbane.

The area is fairly well populated, especially in the coastal district of Eton and Marian, where the sugarcane industry is well developed. In this coastal strip dairying and general farming also support some of the population. Timber-getting is important in the Coastal Range, and in the Bee and Funnel Creek area, beef-cattle is the main industry.

## PREVIOUS INVESTIGATIONS

Jack (1887) and Maitland (1889 a and b) were among the first to write on the geology of the area. Other early work was done by Cameron (1902), Ball (1910 a and b, 1927), and Dunstan (1901) - mainly in the Mount Flora, Mount Spencer, an ..ngella areas.

From 1925 to 1951, J.H. Reid contributed much to an understanding of the geology of the northern section of the Bowen Basin. Some of this work includes examination of the sequence in this area.

Isbell (1954 and 1955) also wrote about the area, combining the results of some field work with photo interpretation.

The French Institute of Petroleum is at present working on a photo interpretation of the Mackay 1:250,000 Sheet area.

## NOMENCLATURE

Nomenclature for all units will be the same as that used by Malone, Corbett, and Jensen (1961), except that the name "Eungella - Broken River Igneous Complex" will be replaced by "Urannah Complex". This is in conformity with the nomenclature adopted by Malone et al (1962) in the mapping of the Bowen South Sheet area.

## THE LOWER BOWEN VOLCANICS

### Summary

The oldest unit cropping out in the Mackay West Sheet area, the Lower Bowen Volcanics, is of Lower Permian age, and consists of a thick sequence of andesitic volcanics interbedded with shale, siltstone, and sandstone. Volcanics and sediments on the south-west side of the Urannah Complex form continuous outcrop with those of the type section of the Lower Bowen Volcanics, at Collinsville. Those on the north-east side are believed, on lithological similarity and fossil evidence, to belong to the same unit. Some change of lithology is noted, however, and this is thought to represent a change of depositional environment.

### Nomenclature

The name "Lower Bowen Volcanics" was first applied by Reid in 1929, in his description of volcanics cropping out in the Collinsville area. His three-fold division of the unit is not recognized in the Mackay West Sheet area, but the volcanic sequences underlying the Middle Bowen Beds in both the Mackay West area and the Collinsville area are thought to be equivalent in age and in lithology.

Distribution

The unit occurs in two blocks:

1. in a narrow belt which extends along the south-western side of the Urannah Complex (referred to as the Nebo area).

2. in a broad belt which occupies the entire north-eastern corner of the area mapped (referred to as the Eton area).

Topography

The unit in the Nebo area produces low rounded hills with little soil cover, becoming more rugged as one approaches the western side of the Urannah Complex. However, lithology is not the only control of this type of topography, since this area has quite a different climate from that found in the Eton area. There the country is much more hilly and the volcanics produce fairly rounded but steep-sided hills ; the sediments, strike ridges and cuestas.

Lithology

(i) Volcanic rocks

Volcanic rocks of both the Nebo and Eton areas show a wide variety of types, including andesite, rhyolite, dacite, andesitic tuff and agglomerate.

Andesite is the most common rock type. It forms thin, fine-grained flows grading into coarse-grained massive flows. The flows are commonly porphyritic and sometimes vesicular; colour varies from blue-green to grey-green. Vugs are not common; where they do occur they are lined with quartz or chalcedony. Phenocrysts are nearly always plagioclase, but some are quartz. Plagioclase phenocrysts are typically euhedral or subhedral and range in size from 3mm. to 5mm. Andesite occurs throughout the sequence and it may have any of the other rock types associated with it.

Andesitic agglomerate is common, and it usually forms thick units containing large boulders measuring three feet in diameter. As with the andesite flows, the agglomerate is green and may contain vugs lined with quartz. Andesitic crystal tuff is normally thin bedded and fine grained.

Rhyolite is the next most common rock, both in abundance and variety. Massive pink or brown rhyolite is interbedded with coarse porphyritic varieties; it can be vesicular or flow banded. Phenocrysts in the porphyritic rhyolite are commonly quartz and rarely pyrite. Rhyolite is commonly found interbedded with andesite.

Dacite is associated with rhyolite in some places. It is generally very dark and fine-grained with quartz and feldspar phenocrysts.

(ii) Sedimentary Rocks.

Sedimentary rocks occur in the Lower Bowen Volcanics in both the Nebo and Eton area. In the Eton area they form much of the section near the Range Hotel, on the eastern margin of Urannah Complex. The rocks here are often indurated, but in places friable siltstone, sandstone and conglomerate crop out.

The siltstone is blue-grey, yellow, or purple; in places it is either micaceous, carbonaceous, or graphitic, and it often contains plant fragments, and is probably tuffaceous in parts. It ranges in grain size from fine to coarse.

The sandstone ranges in colour from blue-grey to brown, light green, buff, white, yellow, and dark green. The proportion of feldspar, quartz and lithic fragments varies considerably to give lithic sandstone, feldspathic sandstone, and quartz sandstone. It is generally well bedded with current bedding being only poorly developed. In some cases it is finely laminated and it commonly contains carbonaceous streaks. It may be tuffaceous in places.

The conglomerate ranges from boulder to pebble conglomerate. The constituents are well rounded and are igneous, metamorphic, or sedimentary.

Shale, siltstone, sandstone and conglomerate occur near Marian, in the Eton area. The shale ranges in colour from black to brown and grey. It can be carbonaceous and is generally thinly bedded. It contains very poorly preserved fossil plant fragments. The sandstone is quartz rich, thinly bedded and is usually fairly coarse-grained. It does not show cross stratification. The conglomerate contains igneous pebbles. The abundance of quartz sandstone is the most important feature of this unit.

Sedimentary rocks occurring in the Lower Bowen Volcanics in the Nebo area are interbedded with andesitic and rhyolitic volcanics. They occur as thin beds of shale, sandstone and conglomerate. The shale is thin bedded, dark grey and has a shaley cleavage; it is finely laminated and is probably tuffaceous. The sandstone is composed mainly of lithic fragments, probably of volcanic origin. The conglomerate is composed of both angular and rounded constituents and in places grades into a breccia. The sequence is tuffaceous, and is medium to thin bedded, with minor slump structures and no cross stratification.

Structure

The Volcanics of the Nebo area dip to the west, on a regional scale, underneath the Middle Bowen Beds; a disconformity, but no apparent angular unconformity separates the two units. The disconformity was reported by Malone, Corbett, and Jensen (1961).

In the northern section of the Nebo area, the Volcanics strike parallel to the regional Bowen Basin trends (north-northwest). But to the south, in the Hamilton Park area the strike ranges considerably and the unit appears to be tightly folded.

The relationship between the Lower Bowen Volcanics of the Eton area and the Urannah Complex is obscure, as the lower boundary has not been seen. The boundary is straight for considerable distances and is interpreted as being fault controlled. The sedimentary rocks near the Range Hotel are indurated and tightly folded with sudden changes in both dip and strike and some overturning of beds. The induration of the sediments may have been caused by the intrusion of the Urannah Complex, but it could also be caused by the deep burial of these very tuffaceous sediments. They are flat lying, and not indurated, further away from the contact.

In the area near Marian the rocks have a regional west strike and the dip is about 40°-50° north. Faulting and folding is common. The larger faults trend north-north-west.

## Environment of Deposition

Lower Bowen Volcanics have been produced by vulcanism associated with an island arc structure, the core of which is represented by the Urannah Complex. This structure has also given rise to the associated sedimentary rocks of the Eton area and near the Range Hotel. The environment of deposition of the sediments near Marian is unknown. The abundance of quartz sandstone suggests that the island arc did not supply all the material composing the rocks of the unit. On the other hand, there are some interbedded volcanics, both tuffs and flows, which might have had their origin in the island arc.

## Thickness

The thickness of the Lower Bowen Volcanics is unknown. It is thought to be between ten and twenty thousand feet thick. The position of the base of the unit has not been accurately located, and much of the section exposed could be due to repetition by folding.

## Age

The volcanics and sediments of the Nebo area are correlated with the Lower Bowen Volcanics, which is a Lower Permian unit, possibly extending into the Carboniferous. The rocks at the Range Hotel contain Permian plants, and by lithology we correlate them with the Lower Bowen Volcanics. The rocks of the Marian area also contain scattered, very poorly preserved fossil plant material, and so this unit is tentatively correlated with the Lower Bowen Volcanics. This correlation will be reviewed during the 1962 field season.

A list of identifications of fossil plant material is given by White (1962).

# THE MIDDLE BOWEN BEDS

## Summary

The Middle Bowen Beds, a Permian unit, crop out in a strip of country on the west side of the Urannah Complex, and in a domal structure around the Bundarra Granodiorite. The unit consists of interbedded sandstone, and siltstone, with some conglomerate bands; limestone is absent. The marine fossil fauna, contained within it, is correlated with that of the Middle Bowen Beds of the Mount Coolon and Bowen 1:250,000 Sheet areas.

## Nomenclature

"Middle Bowen Beds" is the name preferred for the unit previously described as "Middle Bowen Marine Series" (Reid 1929), and "Middle Bowen Group" (Geological Map of Queensland 1953). The term "Series" is not used because it is a time-rock unit, and the use of "Group" would imply that the unit had been divided into formations. The stratigraphic nomenclature used in this record will be revised when regional mapping of the Bowen Basin is complete.

Distribution

The Middle Bowen Beds crop out in three localities on the Mackay West Sheet area; the Homevale area - the Mount Flora area - and the Funnel Creek area. In the Homevale area, the Middle Bowen Beds crop out po rly in an elongate belt, about three miles wide, extending south-south-east from Homevale Station. The beds form gently undulating country with long strike ridges.

Metamorphosed Middle Bowen Beds encircle the Bundarra Granodiorite, in the Mount Flora area. The Beds form a semi-circular ring of hills, some of which are cuestas, around the Granodiorite.

Two small outcrops of Middle Bowen Beds occur in small gullies in the Funnel Creek flood plain.

Lithology

Sandstone and siltstone with many marine fossils, crop out in the Homevale area. The sandstone is medium to fine-grained and contains varying amounts of quartz, feldspar, calcite, mica, lithic fragments and micaceous matrix; colour ranges from white to buff and brown. Some of the sandstone is completely ferruginized; for example, a rock containing the very well preserved marine fossils, near Homevale Station; some beds are cross-stratified. The siltstone ranges in colour from buff to brown, blue and grey; it is usually micaceous and contains crinoid stems and worm tubes. Calcareous nodules in the siltstone, up to one foot in diameter, often contain abundant small gastropods. No limestone occurs in the Homevale area but some of the siltstone is calcareous.

Sandstone and siltstone crop out around the Bundarra Granodiorite. The rocks near the contact are altered to andalusite hornfels. Away from the contact the sandstone is generally hard, either indurated or silicified. One bed, about sixty feet thick, occurs near the top of the unit to give a series of cuestas known locally as the Sisters, (near Harrybrandt Station). Quartz sandstone is most common, but in places the lithic content increases to produce a quartz lithic sandstone. The siltstone ranges in colour from white to purple and black. One variety is particularly common, consisting of a purple siltstone which weathers apple green and containing sporadic crinoid stems and polyzoa. Other siltstone varieties are micaceous and range in grainsize from coarse to fine, in hand specimen.

Light blue micaceous siltstone is interbedded with calcareous sandstone in the Funnel Creek area. Fossiliferous ferruginized rubble is common.

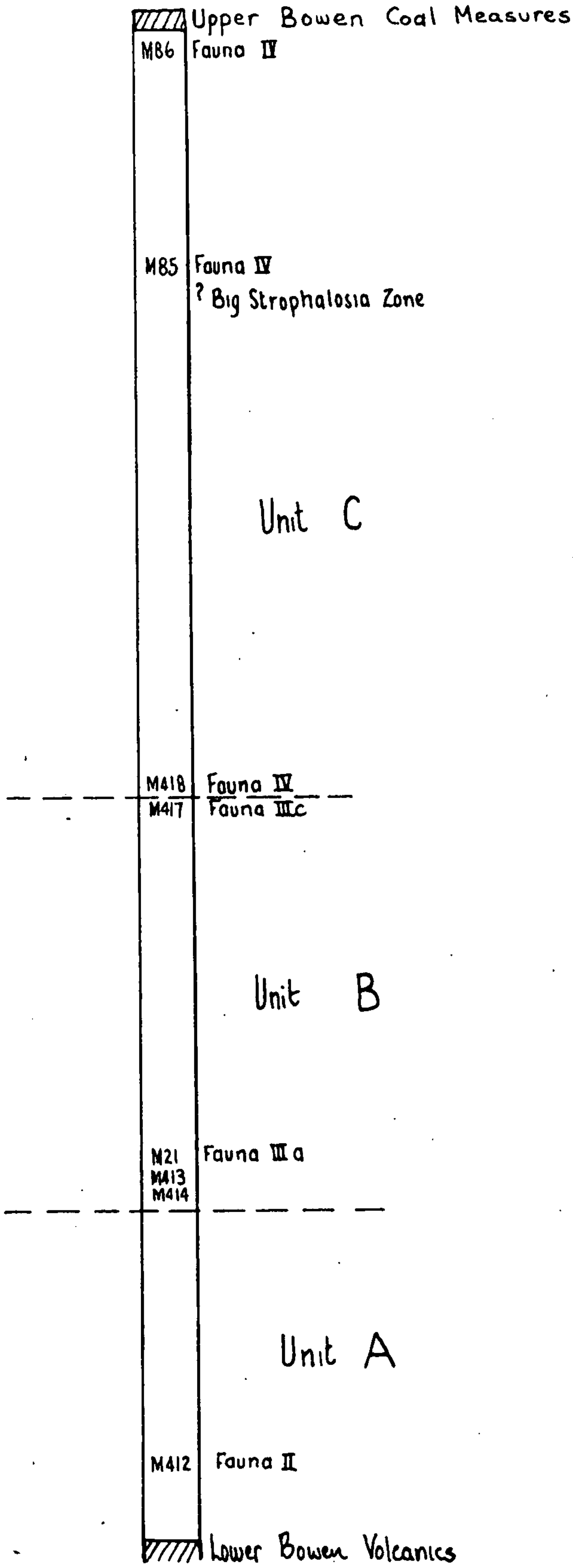
Structure

The Middle Bowen Beds have a regional shallow dip to the west, in the Homevale area; but in places the beds show quite steep dips, up to 70°, and in some cases, an easterly dip produced by small scale folding. The folds were not mapped in sufficient detail to postulate their origin, but similar folding is shown on the map in the vicinity of the Middle Bowen Beds - Upper Bowen Coal Measures boundary, near Mount Landsborough.

The Beds are domed by the Bundarra Granodiorite and near the contact dips are vertical; the dip decreases gradually until at the boundary with the Upper Bowen Coal Measures is about 45°.

Fig. 2

Relationship Between Fossil Collections at Mount Landsborough and Homevale




Scale 1 inch = 1000 feet.

To accompany Record No 1962/71
Bureau of Mineral Resources, Geology and Geophysics. May 1962 **F55/8/2**

Nothing is known of the structural relationships of the Middle Bowen Beds in the Funnel Creek area.

At Homevale and at Mount Flora the contact of the unit and the Upper Bowen Coal Measures is conformable. The boundary is quite sharp and separates two different lithologies and fossil assemblages. The boundary between the unit and the Lower Bowen Volcanics is structurally conformable; a disconformity is postulated from work on the Mount Coolon Sheet area.

## Environment of Deposition

The Middle Bowen Beds were deposited in a marine shelf environment, with a moderate depth of water, possibly sufficient to inhibit the formation of large scale current structures (as current bedding is not common). This accounts for the ill-sorted nature of the sediments and the rich fossil assemblage.

## Thickness

The unit is 8,500 feet thick in the region of Mount Landsborough. This thickness has been calculated by assuming a regional dip of 45° to the west, and measuring the distance on the ground and on the aerial photographs. The figure for the dip is derived from six dip measurements in the field.

In the same way, about 8,000 feet is estimated for the unit around the Bundarra Granodiorite. This is a very rough estimate because part of the section is missing and because the structural information is sparse.

## Faunal Content and Correlations

On the basis of the rocks cropping out in the Mount Landsborough area, the Middle Bowen Beds are divided into three units A, B, and C, already recognised on the Bowen and Mount Coolon Sheet areas. Outcrop in this area is not good and the units are recognised on faunal content alone. Fossil localities in the Homevale area are extrapolated to equivalent positions on the Mount Landsborough section (fig.2). A full description of these units is given by Malone, Jensen, Gregory, and Forbes (1962), and by Dickins, Malone and Jensen (1962).

A bed about 30 feet thick, consisting almost entirely of Strophalosia, is correlated with the Big Strophalosia Zone. However it is much higher in the section than would be expected from work done on the Mount Coolon and Bowen South Sheet areas.

The two outcrops of Middle Bowen Beds in the Funnel Creek area contain fossils belonging to unit A. A full list of the fossils found on this sheet is in Appendix A.

The age of the Middle Bowen Beds is Lower Permian.

# THE UPPER BOWEN COAL MEASURES

## Summary

The Upper Bowen Coal Measures lie conformably on the Middle Bowen Beds and are 10,000 feet thick; they contain abundant plant fossils. The unit is considered to be Upper Permian.

## Nomenclature

This unit will be called the Upper Bowen Coal Measures, Malone et al (1961), to maintain uniformity of nomenclature. It corresponds with Reid's (1929) Upper Bowen Series.

## Distribution and Topography

The unit crops out in three areas on the Mackay West Sheet area; the Homevale area, the Mount Travers area, and the Mount Flora area. In each area it forms gently undulating plains with a few rounded strike ridges.

## Lithology

The Upper Bowen Coal Measures consist of siltstone, lithic sandstone, and conglomerate. The siltstone is thin to medium bedded and contains abundant plant fossils, both wood and leaves; cone-in-cone structure is present in some of the calcareous siltstone. The sandstone contains a high proportion of lithic fragments, mostly of volcanic origin, and feldspar; current bedding is common. The conglomerate also contains a high proportion of lithic fragments. A more detailed description of the Upper Bowen Coal Measures is given in Malone et al. (1961).

## Structure

The unit has a regional dip of 30° to the west, in the Homevale area. It is folded into small local folds whose axes trend north-north-west. This type of folding is also present in the Mount Travers area. Minor faulting occurs in both areas.

The Coal Measures are domed by the Bundarra Granodiorite, and so dips in that area are away from the intrusion. For example, near HarryBrandt Station they dip to the north.

The unit is conformably above the Middle Bowen Beds. The boundary was observed in two places in the Mount Flora area, and once in the Homevale area; it is marked by a very distinct change both in lithology and fossil content.

The unit is unconformably overlain by Tertiary basalt.

## Thickness

The thickness of the unit is unknown, but work on the Mount Coolon Sheet area to the west indicates that it is about 10,000 feet.

Environment of Deposition

The abundance of plant debris, the lithology, and the large scale current bedding, indicates a deltaic environment of deposition, in brackish or fresh water.

The Urannah Complex could have supplied some of the sediment. It probably acted as a topographic high and restricted the deposition of the Coal Measures to the east.

Age

This unit is part of the Upper Bowen Coal Measures as defined on the Mount Coolon Sheet area. In that area it contains Permian to Triassic fossils. Because it underlies fossiliferous Lower Triassic rocks, overlies Lower Permian it is thought to be Upper Permian.

## TERTIARY BASALT

Summary

Tertiary basalt forms an extensive, but deeply weathered, cover over much of the south-west corner of the Mackay West Sheet area, west of Nebo - and also in the Eungella district. It varies from vesicular and amygdaloidal types to massive types, and to types which have olivine phenocrysts. It is believed to be Tertiary, and it is estimated to be less than 200 feet thick.

Distribution

Tertiary basalt flows cover large areas in the south-west of the sheet area, west of Nebo. They usually crop out only in creeks and are covered elsewhere by black-soil, with some rubble covered rises. They form flat plain country, with the exception of Mount Fort Cooper, a basaltic plug, which stands 1,000 feet above the level of the plain.

Another occurrence of basalt is in the Eungella district, where the land surface is covered by dense tropical rain-forest, and where all the rocks are deeply weathered. The basalt forms a capping on the rather rugged relief of this area.

Basalt also occurs in the flood plain of the Pioneer River, at Mirani. Outcrop is poor as the basalt is covered by red soil and alluvium.

Lithology

The basalt covering the plains west of Nebo varies in texture from coarsely vesicular and amygdaloidal, to massive or flow aligned non-porphyritic, and to porphyritic olivine basalt. The amygdaloidal basalt has amygdules up to one foot in diameter, but the average size is one to two inches.

The olivine basalt generally consists of laths and anhedral grains of olivine and titaniferous augite with labradorite as the main feldspar; black iron oxide is a common accessory mineral.

The basalt of the Eungella area, and at Mirani, are lithologically similar to the olivine basalt of the area west of Nebo. It is an olivine-titanaugite-labradorite basalt with some phenocrysts of bytownite rounded by resorption.

Thickness

The thickness of the basalt in any area is unknown, but it is believed to be less than two hundred feet. Reid (1929) estimated the thickness to be one thousand feet, on the height of Mount Fort Cooper above the level of the plain. However, this is a basaltic plug, and its height above the plain bears little relationship to the original thickness of the basalt sheets.

Age

The basalt is believed to be Tertiary by analogy with many similar basalts found in Queensland. It overlies the Upper Bowen Coal Measures with unconformity, and so is certainly post-Permian.

The amygdaloidal basalt west of Nebo seems to be overlain by a more massive type. This massive type is found extensively developed on the Mount Coolon Sheet, where its age was established as Tertiary, on fossil evidence (Malone et al., 1961).

The basalt is overlain, in the Nebo area, by acid volcanics which are believed to be Tertiary.

## TERTIARY ACID VOLCANICS

Summary

Numerous occurrences of acid and alkali intermediate volcanics cap hills in the more rugged parts of the area, and form hills on the plains. The rocks include flows and agglomerates of rhyolite, dacite, trachyte, andesite, and basalt, together with minor ignimbrite. About seven hundred feet of flows and agglomerates are exposed in the Diamond Cliffs. The age of the unit is thought to be Tertiary.

Distribution

Tertiary acid volcanics occur in a discontinuous line from Plevna to the south-eastern edge of the area mapped. There are two occurrences in the north-eastern sector of the map, at Mount Vince and at Mount Jukes.

The volcanics produce very rugged country with shear cliffs up to three hundred feet high, at the base of which are scree slopes, e.g. in the Diamond Cliffs area, east of Homevale, which form the southern margin of a dissected plateau. A small conical hill, about three hundred feet high, called "The Peak", also occurs in this area, on the Nebo - Elphinstone road; it is a volcanic plug.

North of Burrenbring, the volcanics do not form high cliffs bounding a dissected plateau as they do near Homevale, but the country is still rugged.

Less rugged hills are formed by the volcanics in the Waitara area.

(i) Lithology

Rhyolite

Rhyolite is the most common rock type of this volcanic sequence, ranging in colour from brown to pink and to white, and in texture from fine grained and massive through porphyritic to flow laminated. The porphyritic rhyolite has phenocrysts of quartz and rarely of feldspar or pyrite: pyrite phenocrysts, in the Boothill Creek area, are up to ½" in diameter. Flow laminated rhyolite is common, the laminations are thin (0.5mm to 2mm) and in many cases they are contorted, plicated, or undulose. Primary dips are, for the most part, less than 15°, but in places they reach 80°.

(ii) Agglomerate and Volcanic Breccia

Rhyolitic breccia and agglomerate are both commonly found interbedded with flow rocks. They occur over most of the area, but are most extensive in The Marling Spikes, Mount Britton, and Mount Landsborough areas.

Jack (1887) reported that a near horizontal deposit of volcanic ash, containing rare large fragments, capped hills to the east of **Homevale Station.** Maitland (1889 b) examined a cliff about a mile to the south of the town, and considered that it was made up of lava and flows containing subangular fragments of itself, broken up by movement of successive flows over the rapidly cooling mass.

Probably both of these views are correct, as both tuffaceous rocks and autobrecciated lavas are present. Near Diamond Cliffs, rhyolitic agglomerate, brecciated rhyolite, and poorly bedded rhyolitic tuff occur. The rugged Diamond Cliffs proved inaccessible for close study, but from a distance large fragments up to two feet in diameter could be seen. Boulders, presumably from the cliff, were of rhyolitic agglomerate and they contained fragments of fluidal rhyolite and glassy black pitchstone, which ranged from very small to two feet in diameter. Rare outcrops of vesicular basalt were noted in this area, but their relationship to the agglomerates and flows could not be determined because of heavy vegetation. However, all the rugged peaks and plateaux in The Marling Spikes - Mount Britton area were capped by rhyolitic flows, breccia, or agglomerate.

The Marling Spikes are a series of spectacular peaks which have generally been regarded as volcanic plugs. However, it is now thought that they are remnants of a once extensive flat-lying sheet of pyroclasts and flows. The plug like shape of the peaks is probably the result of the dissection and erosion of a plateau. One of the smaller peaks was examined and it consisted of fine-grained, flow banded rhyolite or trachyte. The rocks exhibited large scale flow banding which was nearly horizontal, suggesting that they are a flow remnant rather than a plug. No slickensiding or obvious disturbance of the underlying rocks near the peaks was seen.

Mount Britton, east of Carrinyah homestead and south of the Marling Spikes, is capped by rhyolite or trachyte and is probably a remnant of the same sheet which covered the Marling Spikes area.

At Mount Landsborough, further to the south, a thick sheet of brecciated rhyolite, overlying vesicular basalt, is capped by a thin bed of siltstone.

(iii) The ignimbrite of Pine Mountain

Pine Mountain, eleven miles east-south-east of Nebo, is about nine hundred feet above the level of the plain. Dense scrub surrounds the hill, making approach difficult, and although few cliffs are developed, very steep slopes are common, especially towards the top.

The mountain is a pile of basaltic and andesite rocks, capped by about seven hundred feet of ignimbrite. The ignimbrite is composed of large flattened lapilli of pumice, minor andesite rock fragments and corroded phenocrysts of quartz and feldspar, in a welded mass of glass shards, volcanic ash and glass. Much of the glass has devitrified, and pumice fragments have altered to a mass of spherulites.

The symbol "Tb" on Pine Mountain, in the Mackay West map, should be replaced by "Tv".

(iv) Dacite

The grey and brown dacite occurring in this sequence is generally more massive and coarser-grained than the rhyolite. Porphyritic dacite is not common; pyrite is the most common mineral forming phenocrysts. The dacite is often interbedded with trachyte, rhyolite, and andesite.

(v) Intermediate Volcanics.

Trachyte is next in abundance to rhyolite. It is pale green to cream with small phenocrysts of potash feldspar and chlorite, with accessory iron oxide, and mafic minerals. The iron oxide is often titaniferous and is altered to leucoxene. The mafic minerals have altered to chlorite (penninite). Quartz is generally absent but can form up to 2% of the rock.

Andesite is not common. It is generally green, and contains a few phenocrysts, notably pyrite.

Mount Vince, in the northern part of the sheet area, has the topographic form of a volcano, and is believed to be Tertiary. One specimen from it is a porphyritic, biotite-rich, microdiorite. Phenocrysts of biotite, now almost entirely chloritized, and of plagioclase, make up half the rock. The plagioclase phenocrysts are euhedral and up to 4mm. long. The groundmass consists of plagioclase, secondary calcite, chlorite, and clay material, with accessory quartz, zircon, apatite, and iron oxide. The plagioclase is extensively altered to calcite and clay material.

Relationship With Other Units

The acid volcanics overlie the Tertiary basalt, and it is not known if there is any marked time break between their extrusion. They are overlain, at Mount Landsborough, by a thin bed of quartz siltstone of unknown age.

The unit is thought to be Tertiary by analogy with similar acid volcanics occuring in Queensland.

## TERTIARY SEDIMENTS

Summary

Tertiary sediments are not very extensive in the Mackay West Sheet area, and where they do occur they are usually thin and discontinuous. Sediments of Tertiary age crop out in four areas; Plevna, Boothill Creek, Mount Landsborough, and Lake Epsom. These probably represent three different ages of sedimentation.

Plevna

Tertiary sediments have been known at Plevna since Ball (1927) reported the occurrence of oil shales in the area. The outcrop is very small (approximately 60 acres, according to Reid, 1942) and thus they are not shown on the map, but are included within the Tertiary Volcanics.

Because the oil shale may have possible economic importance, a number of bores and shafts have been put down in the sediments. The sequence consisted essentially of shale at the base, overlain by a thin section (under forty feet) of clays and tuff. Lithologies logged (Reid, 1942) include carbonaceous shale, tuffaceous shale, oil shale, siltstone, mudstone, fine sandstone and tuff.

The sediments are younger than the Late Palaeozoic or Mesozoic orogeny which folded the Bowen Basin succession. They are overlain by basalt which is believed to be Tertiary from the mapping done on the Mount Coolon Sheet area (Malone et al. 1961). They could probably be correlated with the Exevale Formation, which is of Tertiary age.

The unit is about 250 feet thick calculated from the bores.

Boothill Creek and Mount Landsborough

There are some outcrops of poorly bedded, semi-friable, coarse, quartz sandstone, in the Boothill Creek area, which are interbedded with the Tertiary acid volcanics. They are both thin and discontinuous.

On top of the acid flows and agglomerate at Mount Landsborough, there is a thin bed of siltstone, whose outcrop is too small to show on the map.

Lake Epsom

Isbell (1955) mentions "coarse unbedded sandstones and gravels that are sometimes partially lateritised", which crop out along the Eton-Nebo road, near Lake Epsom. These sediments are semi-friable and generally contain abundant quartz and mica. It is possible that Lake Epsom is a shallow remnant of the once much larger Tertiary or Recent lake, in which the sediments were deposited.

Although they are discontinuous over a moderately large area, these beds are very thin and igneous basement of Urannah Complex is exposed in many places, even close to Lake Epsom.

## THE URANNAH COMPLEX

Summary

The Urannah Complex is a diorite-granite-granodiorite mass with minor basic and intermediate rocks, which include abundant acid and intermediate dykes. It occupies a strip of country about twenty miles wide, extending from the north-west corner of the Sheet area to the eastern edge of the area; it also extends on to the Mount Coolon, Bowen and Proserpine Sheet areas. It is believed to be the core of an Upper Palaeozoic island arc structure.

Nomenclature

The name "Urannah Complex" is a new one, introduced by Malone et al (1962) in the geology of the Bowen South Sheet area.

Although it occupies a large part of the area mapped, it was not examined in detail. It may include the products of several major intrusive episodes.

Area of Outcrop and Topography

The main area of outcrop is a strip of country averaging twenty miles wide, and extending from the north-west corner of the sheet area to the eastern side of the area. A few small stocks occupy part of the north-east corner of the area, and these are regarded as part of the Complex.

The unit forms either high, very rugged hills, or plain country; gently undulating country only forms a small part of the unit. The two main areas of plain development are the Denison Creek Valley, and the Cattle Creek Valley (known locally as the Pioneer Valley).

Most of the area of outcrop is inaccessible except for a good forestry road from Pinnacle Homestead, as well as a few roads radiating from Eungella and the Nebo-Eton, and Nebo-Sarina roads.

## Lithology

The rocks of the Urannah Complex, on the Mackay West Sheet area, were not studied in great detail. Comparison with the rocks of the Complex, as developed on the Bowen South Sheet area, showed them to be almost identical. A more complete report of the lithology of the Complex is included in the geology of the Bowen South Sheet area, (Malone et al. 1962); a summary of this is included in this Record.

Within the Complex there are at least twenty-eight different rock types which have been divided into nine groups.

### (i) Basalt and Dolorite.

Basalt and dolorite dyke rocks occur throughout the Complex and appear to be of at least two different ages. They are partially altered, with the production of secondary calcite, chlorite, and hydrated iron oxides; some are extensively epidotized. Some of the rocks are porphyritic and some show flow alignment of the phenocrysts. The width of the dykes ranges from about one inch to more than twenty feet; bifurcations are common.

### (ii) Gabbro and hornblendite

Gabbro and hornblendite occur as sub-round intrusions into the Complex, and they occupy areas of negative relief, up to a square mile in surface area. These rocks are all hornblende rich and apparently free of inclusions.

### (iii) Diorite.

Diorite is the most abundant rock type in the Complex. It ranges in grainsize from fine to very coarse, and can be massive, or foliated. The mineral assemblage is normal, with plagioclase, hornblende, minor quartz, and accessory iron oxide. Xenoliths are common in places, while epidotization is common in others.

Xenoliths of melanocratic diorite in more massive diorite, and dykes of porphyritic leucocratic diorite intruding the massive diorite, have been noted.

### (iv) Andesite, micro-diorite, and porphyritic micro-diorite.

Micro-diorite and andesite form the majority of dyke rocks in the Complex. In outcrop they are dark to light green depending on the degree of epidotization and chloritization. The dykes range greatly in width as do the basaltic dykes, and in texture they range from fine-grained to medium-grained and porphyritic. Chilled margins against the diorites and granites are usual.

There are at least two ages of intrusion of the micro-diorite. The most frequent direction of intrusion is north-west; other directions are random.

Micro-diorite has also developed as sub-round masses, up to 300 yards in diameter in the Complex, and these are probably related to the dykes.

(v) Granite, pegmatite, and aplite.

The granite of the Complex varies widely in type from massive to foliated, and there are leucocratic and porphyritic varieties. Granite is not abundant in the Complex.

Pegmatitie and aplite, both abundant, contain the normal mineral assemblages, and exist as narrow, often wispy, dykes, up to two feet wide.

(vi) Granodiorite.

Granodiorite varies from m ive types to those which are foliated and even gneissic. It is second in abundance only to diorite and thus it forms one of the major rock types of the Complex. It contains abundant xenoliths of melanocratic hornblende granodiorite, and also of diorite and amphibolite. Pegmatite and granite dykes are found in association with the granodiorite.

(vii) Amphibolite.

Amphibolite generally occurs as xenoliths in diorite and granodiorite, but one occurence was also noted as a separate mass or roof pendant, near a coarse-grained basic intrusion of hornblendite. As xenoliths, the amphibolite consists of a medium-grained, equigranular mass of green hornblende, plagioclase, and quartz. The xenoliths range from an inch up to twenty yards in length. They are generally elongate and narrow, and show a random distribution with concentration in certain areas.

(viii) Porphyries.

Porphyries occur as dykes intruding granite, diorite and granodiorite, and are in turn intruded by younger andesitic and basaltic dykes. They consist of feldspar porphyries, with a groundmass of dacitic material, and quartz-feldspar porphyries, with a groundmass of micro-granite or dacite. All the dykes are deeply weathered.

There is no apparent preferred orientation of these dykes, nor do they bifurcate as do the andesitic and basaltic dykes. They are up to two feet wide.

Secondary minerals, especially epidote, have formed where joints cut the dykes.

(ix) Dacite.

Dacite and porphyritic dacite occurs as dyke rocks throughout the Complex, intruding all the acid and intermediate plutonic rocks. It is frequently deeply weathered. Mineralogically it is normal.

Relationship with other Units

It is thought that the Urannah Complex intrudes the Lower Bowen Volcanics, because both sediments and volcanics are indurated at their contact. In many cases however, especially on the eastern side of the Complex, the boundary between the two units is faulted.

It is unconformably overlain by rocks of Tertiary age.

THE BUNDARRA GRANODIORITE

The Bundarra Granodiorite occupies the south-west corner of the Mackay West Sheet area. It intrudes and domes the Middle Bowen Beds, producing at the contact a metamorphic aureole. It crops out poorly and it forms an area of negative relief. The only outcrops found within the boundary of the mass consist of small patches of andalusite hornfels. Near the base of Mount Flora a grey, gneissic granodiorite crops out, but as this is close to the edge of the intrusion the lithology may not be truly representative.

From previous work, (Malone et al. 1961), it is believed that the Granodiorite ranges from a leucocratic granodiorite to an alkali granite. Biotite is the main ferromagnesian, but in places hornblende is abundant, and the rock approaches a syenite.

Intensive prospecting and some small scale mining for copper and gold has been concentrated in this unit. Most of the mineralization occurs within the metamorphosed sediments but a few veins continue into the igneous rock. A description of the geology and mineralization is given by Ball (1910 b).

The intrusion domes the Middle Bowen Beds in such a way that the strike of the beds on the northern flank appear quite regular. However, the dip does not show a regular decrease away from the contact and it is possible that the beds were gently folded before the intrusion of the Granodiorite.

The intrusion post dates the deposition of the Middle Bowen Beds, and was probably intruded during the folding of Bowen Basin sediments. It is thus thought to be Mesozoic.

## THE GRANODIORITE OF THE MOUNT TRAVERS AREA

The granodiorite of the Mount Travers area, described on the map as a leuco-microdiorite (Md), has been examined petrographically and found to be a microgranodiorite.

It forms an elongate ridge three miles long, and 150 feet above the plain which crops out about seven miles north of Mount Flora.

The rock is fine-grained and has more than 10% quartz. It is a microgranodiorite with altered sodic plagioclase, accessory muscovite, and secondary calcite.

The intrusion is concordant into the folded rocks of the Upper Bowen Coal Measures. The beds are folded into a series of small folds, the axes of which trend north-north-west.

The intrusion certainly post dates the deposition of the Coal Measures, and probably took place either during or sometime after the folding of the sediments.

## STRUCTURAL GEOLOGY

The Urannah Complex separates those units that have a regional dip to the west, from the rocks of the north-east corner that do not exhibit any broad regional, structural features.

Both folding and faulting occur in the Lower Bowen Volcanics. Folding of the Lower Bowen Volcanics on the western side of the Complex is part of the general folding of the "Bowen syncline", and as this forms part of the eastern limb of the syncline, the dip is to the west. Faulting is not common. The structure of the Lower Bowen Volcanics on the eastern side of the Urannah Complex is obscure. Faulting here is common, and it is thought that the folding is associated with the faulting. This is particularly true of the rocks near the Range Hotel. North of Mirani there does appear to be a general dip to the north, but this is not persistent. Many of the faults trend in a north-north-west direction.

The Middle Bowen Beds dip 45° to the west, on a regional scale, but smaller, tighter folding is present at Homevale. The Beds form a dome around the Bundarra Granodiorite. The Upper Bowen Coal Measures also exhibit a regional dip to the west, and tighter folding on a local scale. The axes of the smaller folds are oriented north-south. The intrusion of the granodiorite at Mount Travers has not domed the beds, the strike remaining north-north-west.

Tertiary sediments and volcanics are, for the most part, flat lying.

## ECONOMIC GEOLOGY

### Summary

The Mackay West area has not been an important producer of minerals, but small amounts of copper, silver, and gold has come from numerous small workings in three main fields; Mount Flora, Mount Britton, and Mount Spencer (Pinevale).

Deposits of coal and oil shale have been tested, but have not been exploited. Clay for brickmaking has been mined.

Sub-surface water is not as important as it is further to the west, because of the relative abundance of surface water.

### Metalliferous Deposits

Most of the metalliferous deposits in the area occur close to the contact between the various intrusives and the bedded rocks. They occur both in the intrusives and in the bedded rocks, and in places persist across the contact. Joints, faults and shear zones have been important factors in determining ore location. Some deposits (Tally Ho) occur far from any contact, and within the main mass of the intrusive, but even here ores are found in the faulted and brecciated zones.

Copper ores are the most common and they have been mined at several localities. The most important areas of copper mineralization are at Mount Flora, Mount Orange, Pinevale and Tally Ho.

At Mount Flora and Mount Orange the ore occurs close to the contact of the Bundarra Granodiorite with the Middle Bowen Beds. Prospecting has been intense and copper matte was produced spasmodically until 1915. During 1957 the old workings at Mount Orange were reopened and 8.3 tons of ore were won yielding:

1.6 tons copper
54 oz. silver
5.6 oz. fine gold.

Recent production has been spasmodic, but it is reported that 9.6 tons of ore were produced in 1959, and 15 tons in 1960. There is no production at the present time.

Mines in the vicinity of Pine-vale have produced a small quantity of copper and there has been little or no recent production. Pine-vale mine was first opened in 1902 but the only appreciable production was from 1956 to 1957 when 565 tons of copper ore were produced. Since then there has been no mining. Bong Bong mine, two miles north-east of Pine-vale, was worked early in the century, but production was never large. A little prospecting and development work has been done in recent years, and at present a shaft and a drive are being constructed in the hope of producing copper ore. The mineralization associated with these mines occurs close to the contact of the Urannah Complex with the Lower Bowen Volcanics.

At the Tally Ho mine, where the ore is lead-zinc with a little copper, the mineralization occurs well within the Urannah Complex, in a brecciated granite. Total production is only in the order of 15 tons, mostly hand picked, and there has been little work done since 1915.

A few small gold prospects are reported in the area but the only occurrence of any importance is at Mount Britton, about four miles north of Homevale homestead. The latest production figures are :

1956 - - - 17 tons ore yielding 17oz. fine gold

1960 - - - 50 tons ore yielding 11 oz. " "

Alluvial mining, 1959 - - - yielding 48 oz. " "

The gold occurs in quartz veins and lenses, in generally andesitic country rock of the Lower Bowen Volcanics, not far from its contact with the rocks of the Urannah Complex.

Non-Metalliferous Deposits

Non-metalliferous deposits which occur in this area include coal, oil shale and clay. Coal has been reported in Blackwaterhole Creek, near the R Hotel, but no seam greater than three feet has been found and the coal has not been mined (Dunstan, 1901). This occurrence is interbedded with the Lower Bowen Volcanics. Minor coal seams have also been reported at several localities within the Upper Bowen Coal Measures, (Cameron, 1905). However, none of the seams has been exploited.

Oil shale from the Plevna district were first reported by Ball (1927). Work in the area has been confined to exploration and determination of reserves. Seven bores were put down during 1939-40, and three bores in 1958. One of the bores bottomed at 265 feet in what are thought to be Tertiary sediments. The shales are uniformly fissile, and greenish-grey in colour. They are of a low grade type, with a crude oil yield of slightly over 20 gallons per ton. They have not been mined.

Note: the word "torbanite" on the legend of the map should be replaced by "oil shale".

The only clay deposit known in the area is at Mirani. It has been worked for clay for the Mirani Brickworks but production is spasmodic, and the last production was in 1953.

Water

There has not been a large number of bores drilled for water in the Mackay West area. Most are less than 100 feet deep, and few exceed 200 feet. The supply from bores in use seems to vary from 500 to 1300 galls/hour. However, records are largely incomplete, and it is hard to obtain a useful picture of the occurrence of underground water from them.

Rainfall in the area varies from 30 to 50 inches annually in the more easterly part and from 10 to 20 inches in the south-west corner. The creeks in the south and west are non-perennial, but generally have large permanent waterholes, and water can usually be obtained from spears in the sandy beds of many of the larger streams. In the Pioneer Valley however, streams are perennial, and bores are few. Numerous windmills pump from shallow wells on the wide flood plains.

Most of the bores are in the thick alluvium and flood plain deposits that cover much of the area south and west of Nebo. One bore, four miles south of Nebo, passed through 115 feet of alluvium. Permanent water is usually obtained at shallow depth in the alluvium close to the creeks.

In general, the Lower Bowen Volcanics have little potential as underground water producers. Both the Middle Bowen Beds and the Upper Bowen Coal Measures contain aquifers for sub-artesian water.

Bores into intrusive igneous rocks are rare. Water is sometimes obtained where the bore intersects a major joint, but otherwise chances of obtaining good supplies are poor. Quality too, is unpredictable, varying from good to acidic and corrosive.

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# APPENDIX A

## PERMIAN MARINE MACROFOSSILS FROM THE BOWEN AND MACKAY SHEET AREAS

by

J.M. Dickins

## SUMMARY

More than 120 species, mainly pelecypods, gastropods and brachiopods are identified and referred to Faunas I, II, III and IV, which characterize successive stratigraphic subdivisions. Fauna III is further subdivided stratigraphically into III a, b, and c.

Faunas I and II, from the top part of the Lower Bowen Volcanics and the lower part of the Middle Bowen Beds, are similar and are characterized by the pelecypods Deltopecten and Eurydesma. Fauna II has in addition the brachiopods Anidanthus, Taeniothaerus and Neospirifer (Grantonia). Fauna III differs distinctly and lacks the five genera or subgenera characterizing Fauna II. The pelecypod Glyptoleda and the gastropod Platyteichum and many new species appear. The changes seem to indicate a hiatus or a marked change in environment. Fauna IIIb is found in the Glendoo Sandstone Member of the Collinsville Coal Measures in the northern part of the basin. To the south, where the coal measure environment is poorly developed or absent and marine conditions predominate, Fauna IIIb is an important marker.

Fauna IV is characterized mainly by the incoming of new species and may reflect a relatively rapid deepening of the basin without a distinct hiatus in most places.

The marine faunas range in age from Lower Permian (lower Artinskian or possibly Upper Sakmarian) to lower Upper Permian.

Table I

# SPECIES DISTRIBUTION CHART

## BOWEN MT COOLON AND MACKAY SHEET AREAS

| SPECIES | Fauna IV. (Above Big Strophalosia Zone) | Fauna IV. (Big Strophalosia Zone) | Fauna IV. (Below Big Strophalosia Zone) | Fauna III C. | Fauna III B. (Glendoo equivalent, Gebbie Crk. and Exmoor | Fauna III B. (Glendoo Member) | Fauna III A. | Fauna II. | Fauna I. |
|---|---|---|---|---|---|---|---|---|---|
| Pachymyonia cf. etheridgei | | | | | | | | | ● |
| Aviculopecten sp. | | | | | | | | | ● |
| Notospirifer sp. A. | | | | | | | | | ● |
| Eurydesma hobartense | | | | | | | | ● | ● |
| Deltopecten limaeformis | | | | | | | | ● | ● |
| Chaenomya sp. nov. A. | | | | | | | | ● | ● |
| Myonia cf. davidis | | | | | | | | ● | ● |
| Ingelarella profunda | | | | | | | | ● | ● |
| Notospirifer hillae plicata | | | | | | | | ● | ● |
| Astartila cf. gryphoides | | | | ? | ● | ● | ● | ● | ● |
| Merismopteria sp. | ● | | ● | | ● | ● | | ● | ● |
| Warthia sp. | ● | | | ● | ● | ● | ● | ● | ● |
| Aviculopecten cf. leniusculus | | | | | | | | ● | |
| Aviculopecten cf. comptus | | | | | | | | ● | |
| Astartella sp. nov. | | | | | | | | ● | |
| M. (Mourlonia) sp. nov. | | | | | | | | ● | |
| Bembexia sp. nov. A. | | | | | | | | ● | |
| Terrakea pollex | | | | | | | | ● | |
| Anidanthus springsurensis | | | | | | | | ● | |
| Strophalosia preovalis | | | | | | | | ● | |
| Taeniothaerus sp. | | | | | | | | ● | |
| Lissochonetes sp. | | | | | | | | ● | |
| Ingelarella ovata | | | | | | | | ● | |
| Notospirifer hillae | | | | | | | | ● | |
| Schizodus nov. sp. A. | | | | | | | | ● | |
| Pseudomyalina cf. mingenewensis | | | | | | | | ● | |
| Deltopecten sp. | | | | | | | | ● | |
| Streblopteria cf. englehardti | | | | | | | | ● | |
| Stutchburia cf. randsi | | | | | | | | ● | |
| Cypricardinia sp. cf. C. gregarius | | | | | | | | ● | |
| Paralleledon sp. nov. B. | | | | | | | | ● | |
| Cancrinella farleyensis | | | | | | | | ● | |
| Trigonotreta sp. A. | | | | | | | | ● | |
| Gilledia cf. cymbaeformis | | | | | | | | ● | |
| Gilledia sp. nov. | | | | | | | | ● | |
| Deltopecten squamuliferus | | | | | | | | ● | |
| Aviculopecten tenuicollis | | | | | | | | ● | |
| Strophalosia brittoni | | | | | | | | ● | |
| Neospirifer (Grantonia) cf. hobartense | | | | | | | | ● | |
| Modiolus sp. | | | | | | | | ● | |
| Aviculopecten sp. nov. | | | | | | | | ● | |
| Aviculopecten cf. fittoni | | | | | | | | ● | |
| Streblochondria? sp. | | | | | | | | ● | |
| Palaeosolen? sp. nov. | | | | | | | | ● | |
| Pseudosyrinx sp. nov. | | | | | | | | ● | |
| Megadesmus? cf. nobilissimus | | | | | | | | ● | |
| Terrakea sp. | | | ● | | | | ● | ● | |
| Streblopteria sp. | | | | ● | | | | ● | |
| Dielasmatids | | ● | ● | ● | | ● | | ● | |
| Cancrinella sp. | | ● | | | | | ● | ● | |
| Neospirifer sp. | ● | ● | ● | | | ● | | ● | |
| Glyptoleda sp. nov. | | | | | | | ● | | |
| Chaenomya sp. nov. B. | | | | | | | ● | | |
| Schizodus sp. | | | | | | | ● | | |
| Ingelarella sp. | | | | | | | ● | | |
| Megadesmus sp. nov. | | | | | | | ● | | |
| Pachymyonia sp. nov. | | | | | | | ● | | |
| Atomodesma cf. mytiloides | | | | | | | ● | | |
| Wilkingia? sp. nov. | | | | | | | ● | | |
| Pseudomonotis? sp. nov. | | | | | | | ● | | |
| Mourlonia (Platyteichum) cf. costatum | | | | ● | | | ● | | |
| Gyptoleda cf. reidi | ● | | | | | | ● | | |
| Ingelarella cf. ingelarensis | | ● | ● | ● | | | ● | | |
| Stutchburia cf. costata | ● | ● | ● | ● | | ● | ● | | |
| Notospirifer extensus | | | | | | ● | | | |
| Walnichollsia? sp. nov. | | | | | | ● | | | |
| Paralleledon or Cypricardinia? sp. | | | | | | ● | | | |
| Volsellina? sp.? | | | | | ● | ● | | | |
| Pelecypoda gen. et sp. nov. | | | | ? | ● | ● | | | |
| Bembexia sp. nov. B | | | | | ● | ● | | | |
| Cypricardinia? sp. | | | | ● | ● | ● | | | |
| Aviculopecten cf. subquinquelineatus | | | | ● | | ● | | | |
| Schizodus sp. nov. B. | | | | ? | | ● | | | |
| Notomya or Pyramus sp. | | ● | ● | | ● | ● | | | |
| Nuculana sp. | ● | | ● | | | ● | | | |
| Notospirifer sp. B. | | | | ● | | ? | | | |
| Notomya? sp. nov. | | | | ● | | | | | |
| Streblopteria sp. | | | | ● | | | | | |
| Astartidae gen. et sp. nov. A. | | | | ● | | | | | |
| Megadesmus? sp. | | | ● | ● | ? | | | | |
| Ingelarella undulosa | | | | ● | | | | | |
| M. (Mourlonia) cf. strzeleckiana | ● | | ● | ● | | | | | |
| Peruvispira sp. nov. | ● | | ● | ● | | | | | |
| Stutchburia cuneata | ● | | | ● | | | | | |
| Stutchburia cf. compressa | ● | | | ● | | | | | |
| Aviculopecten sp. A | | | ● | | | | | | |
| Ingelarella magna | | | ● | | | | | | |
| I. cf. magna or mantuanensus | | | ● | | | | | | |
| Strophalosia sp. | | | ● | | | | | | |
| Notospirifer cf. minutus | | ● | ● | | | | | | |
| Megadesmus grandis | | ● | ● | | | | | | |
| Strophalosia cf. typica | | ● | ● | | | | | | |
| S. clarkei | ? | ● | ● | | | | | | |
| Terrakea solida | ? | ● | ● | | | | | | |
| Myonia cf. carinata | ● | ● | ● | | | | | | |
| Pseudosyrinx sp. | ● | ● | ● | | | | | | |
| Strophalosia cf. brittoni var. gattoni | ● | ● | ● | | | | | | |
| Astartidae gen. et sp. nov. E. | ● | | ● | | | | | | |
| Schizodus sp. nov. C. | ● | ● | ● | | | | | | |
| "Solemya" edelfelti | ● | ● | | | | | | | |
| Trigonotreta sp. B. | | ● | | | | | | | |
| Cancellospirifer sp. | | ● | | | | | | | |
| Conocardium sp. | | ● | | | | | | | |
| Strophalosia ovalis | ● | ● | | | | | | | |
| Myonia cf. corrugata | ● | ● | | | | | | | |
| Chaenomya sp. | ● | ● | | | | | | | |
| Ingelarella ingelarensis | ● | ● | | | | | | | |
| Streptorhynchus pelicanensis | ● | ? | | | | | | | |
| Ingelarella angulata | ● | | | | | | | | |
| Astartila cf. cytheria | ● | | | | | | | | |
| Ingelarella havilensis | ● | | | | | | | | |
| Notospirifer minutus | ● | | | | | | | | |
| Cleiothyridina sp. | ● | | | | | | | | |
| Plekonella? sp. | ● | | | | | | | | |
| Walnichollsia subcancellata | ● | | | | | | | | |
| Mourlonia (Platyteichum) coniforme | ● | | | | | | | | |
| Nuculopsis (Nuculopsis) sp. nov. | ● | | | | | | | | |
| N. (Nuculanella) sp. | ● | | | | | | | | |
| Paralleledon sp. nov. B | ● | | | | | | | | |

## INTRODUCTION

The study of the Permian macrofossils from the Bowen Basin and their use for the stratigraphy initiated in 1961 (Dickins, 1961c; 1961d.) is continued in the present report. Fossils from some parts of the sequence from which none were previously collected are now available and a comprehensive account is possible for the northern part of the basin.

As well as the pelecypods and gastropods the brachiopods are identified where practicable, at the specific level. In making these identifications the latest publications have been used, but in the absence of detailed descriptive work for so many of the species, these must be regarded at least partly, as tentative. A special effort, however, has been made by comparing actual specimens, to ensure that the identifications are internally consistent.

I am grateful to Dr.K.S.W. Campbell of the Department of Geology at the Australian National University, for discussion on these faunas and for checking some of my identifications. I am, however, fully responsible for the identifications given. I would also like to thank Professor Dorothy Hill, of the Department of Geology of the University of Queensland for making the collections of the University available for examination. These collections arranged in stratigraphical sequence have proved a firm basis for further work. I am grateful also, to Mr.A.K.Denmead, Chief Government Geologist, and Mr.J.T.Wood, Superintending Palaeontologist, for making the collections of the Geological Survey of Queensland available to me.

The ranges of the species of pelecypods, gastropods and brachiopods according to the faunal subdivisions are shown in Table 1. In constructing this table, information has been used from Dickins (1961c) and from the identifications given later in this report.

The Middle Bowen Beds range in age from lower Artinskian or possibly uppermost Sakmarian, (see Dickins 1961c.), to Kungurian (late Lower Permian) and probably lower Upper Permian (Campbell, 1959; Dickins 1961a).

## FAUNAL SUBDIVISIONS AND CORRELATIONS

The divisions I, II, III and IV, proposed in Dickins (1961c), are retained and further extended. Collections have now been made in the interval of 1,500 feet which previously separated Fauna IV from Fauna III and Fauna III has been subdivided into III a, b, and c, which occur at three different stratigraphical levels. This method of naming has been used to indicate that although the subdivisions of III differ from each other, they have species in common which distinguish them from Fauna II below and Fauna IV above.

Faunas I, II, III a, b and c, and IV are found in successive, stratigraphical units - the Lower Bowen Volcanics and Units A, B1, B2, B3, and C, of the Middle Bowen Beds. These units and the positions of the faunas are shown in Dickins, Malone and Jensen (1962, Plate 1), and the nature of the stratigraphical units and the relationship of the faunas to them is discussed.

Fauna I.

During 1962 no additional localities of Fauna I were found so that this fauna is represented by a single collection from the Lower Bowen Volcanics. As shown in Table I, it differs from Fauna II in having possibly three species which are not known from Fauna II and in lacking many species from the beds above.

Recent examination of the faunas of the Permian of the Hunter Valley, New South Wales, has added further evidence that this fauna is younger than that of the Allandale of the Dalwood Group (Lower Marine Beds). The differences between Faunas I and II are similar to those between III a, b, and c, but for consistency with previous work, the designations I and II are retained in preference to I a and b.

Fauna II.

Forty-nine species are positively identified, most of which do not range into Fauna III above. Genera or subgenera which do not occur above are *Deltopecten*, *Eurydesma*, *Anidanthus*, *Taeniothaerus*, and *Neospirifer* (*Grantonia*). The fauna contains characteristic species of many other genera.

Campbell (1961 p.168) has recently discussed the correlation of the Cattle Creek Shale of the Springsure area and considers it slightly younger than the beds at Homevale, which are at the base of the unit with Fauna II. The fauna of the

Cattle Creek Shale can be referred to Fauna II. It contains Eurydesma, Anidanthus and Taeniothaerus as well as Terrakea pollex Hill 1950, Strophalosia preovalis Maxwell 1954 and Notospirifer hillae Campbell 1961. On the other hand, forms characteristic of Fauna III are absent.

In New South Wales this fauna appears to be closest to that of the lower part of the Branxton Beds of the Maitland Group (Upper Marine Beds) between the Great Coal Measures and the Fenestella Zone. In part however, it may be equivalent in age to the Farley Beds, underlying the Greta Coal Measures.

The relationship of the fauna of the Dilly Beds and the Stanleigh Shale to Fauna II is not clear.

Fauna III.

Fauna III lacks most of the species found in Fauna II. Altogether forty-two species are identified, of these eight occur in Fauna II and sixteen in Fauna IV. On the whole brachiopods are poorly represented compared with Faunas II and IV, whereas the pelecypods and gastropods are relatively plentiful. This together with the sandy character of the rocks suggests that in the northern part of the Bowen Basin this fauna accumulated in a relatively shallow-water environment. (see Dickins, in press.). In the Collinsville area the Collinsville Coal Measures belong to the unit containing Fauna III.

New genera which appear in Fauna III are Glyptoleda and Platyteichum. Ingelarellas of the I. ingelarensis type first appear, and characteristic species of Schizodus, Megadesmus, Pachymyonia and Walnichollsia.

The differences between Faunas II and III are striking and represent the most marked faunal change in the Middle Bowen Beds. Two explanations of this change seem possible - a hiatus or a rapid change in environment or a combination of these. The absence of Eurydesma and Deltopecten from Fauna III, genera which are known to be associated with cool-water conditions may indicate the change was in fact caused by climate. The basin certainly became shallower.

Fauna III a contains seventeen species, of which four are found in Fauna II and nine in the overlying beds. Fauna III b also contains seventeen species, of which three are found in IIIa and eight in the overlying beds. Fauna III c has eighteen species identified definitely, of which four are found in III b and nine in Fauna IV.

In the Table the faunas from the Glendoo Member itself and the Glendoo Member equivalent (B2) in Gebbie Creek and near Exmoor Homestead, south along the eastern flank of the syncline, are considered separately. The Glendoo Member equivalent has a lesser number of species, but with one possible exception, all the species are found in the Glendoo Member. It lacks species found in IIIa or IIIb. Both are characterized by abundant representatives of a new species which appears to represent a new genus of pelecypod. This pelecypod externally resembles Eurydesma or Atomodesma, the right valve however, is considerably flatter than the left which precludes reference of the shell to the biconvex Eurydesma. The main shell structure in microscopic cross-section appears to be complex and not prismatic as in Atomodesma (or Aphanaia). A well preserved hinge is not available but in the examples on hand it could resemble that either of Eurydesma or Atomodesma.

In New South Wales the boundary between Faunas II and III appears to be close to the Fenestella zone which separates the lower and upper parts of the Branxton. The boundary between Faunas III and IV seems close to the Muree.

Correlation of Faunas III with the sequence in the Springsure area is not clear. It is younger than the Cattle Creek Formation and older than the Mantuan Productus Bed which has species characteristic of Fauna IV.

Fauna IV.

Fifty species are identified in this fauna, sixteen of which carry over from the beds below. It is especially marked by the incoming of many new species both of brachiopods and molluscs. This change may have been caused by a relatively rapid deepening of the basin, probably with uplift in the hinterland which brought in a different environment, rather than by a hiatus of any length. The fauna is not distinguished by entry of new genera, but many of the genera found in underlying beds are represented by different species.

No distinct faunal changes are apparent at any particular horizon. Within Fauna IV. The gradual change is shown for example by the Big Strophslodia Zone, most of the species of which occur below and above. The Big Strophalosia Zone appears to be a member of a larger unit and lacks sharp upper and lower limits.

In New South Wales, Fauna IV resembles closely that from the Mulbring Shale, the marine beds at Rylestone and Bundanoon, and the Gerringong Volcanics. The close relationship suggests a direct sea connection between the Bowen and Sydney Basins at the time. In both basins this appears to have been the time of most widespread western marine transgression during the Permian.

Correlation of Fauna IV with the Springsure sequence is not altogether clear. The fossils below the Big Strophalosia Zone are not older than the Ingelara Shale. The occurrence of Terrakea solida, Strophalosia brittoni var. gattoni, Notospirifer cf. minutus, Ingelarella magna and species of pelecypods such as Megadesmus grandis, and Schizodus sp. nov. C. in Fauna IV may indicate it is entirely younger. Unfortunately molluscs except Glyptoleda and Platyteichum are poorly represented in collections from the Ingelara Shale. Forms similar to Glyptoleda reidi, Ingelarella ingelarensis and I. angulata appear to be too long-ranged to establish the exact position of the Ingelara Shale. In Fauna IV, however, Platyteichum coniforme may replace P. costatum of Fauna III[1].

1 Recently Dickins (1961b, p.132) concluded that P.coniforme (Etheridge Jnr.) 1872 appeared to be a synonym of P.costatum Campbell 1953, although it had a slightly lower spire. I have since examined specimens collected by Isbell from the "Streptorhynchus Bed" which are referable to P.coniforme. These are younger than any known specimens of P.costatum, as probably are those from the type locality of P.coniforme in the Flat Top Formation of the Banana Area (south-east Bowen Basin). Therefore, P.coniforme may be a distinct morphological group at a stratigraphical level different to that of P.costatum.

On the other hand, the base of Fauna IV is unlikely to be younger than the base of the Mantuan Productus Bed which contains Strophalosia ovalis Maxwell 1954, as well as Terrakea solida, Trigonotreta sp.B, Parallelodon sp.nov.B, Myonia cf. carinata, M.cf. corrugata, and Chaenomya sp. S.ovalis has not so far been found below the Big Strophalosia Zone in the north-eastern part of the Bowen Basin and the last six species are characteristic of Fauna IV as a whole.

No faunal evidence seems to preclude the equivalence of the Big Strophalosia Zone and the Mantuan Productus Bed which resemble each other closely in lithological appearance and in their association of fossils.

## IDENTIFICATIONS

Locality numbers from the Bowen 1:250,000 sheet have the prefix B, and those from the Mackay sheet the prefix M.

Fauna II

B 686 - Lat. ~~21°11'~~ 20°55' 45" S., Long. 148°08'30" E.

Pelecypods

Astartila cf. gryphoides (de Koninck) 1877

Chaenomya sp. nov. A (same species as in MC 479 - Dickins, 1961c)

Palaeosolen? sp. nov.

Modiolus sp. (has a rather distinct umbonal ridge and is rather convex)

Deltopecten limaeformis (Morris) 1845 (some of ribbing is more complicated than in type specimen and some approaches that of D. squamuliferus)

Aviculopecten sp. nov.

Aviculopecten cf. leniusculus (Dana) 1847

Aviculopecten cf. comptus (Dana) 1847 (has rather broad main ribs)

Astartella sp. nov.

Gastropods

Warthia sp.

Mourlonia (Mourlonia) sp. nov.? (may be higher spired than M. strzeleckiana)

Bembexia sp. nov. A

Brachiopods

Terrakea cf. pollex Hill 1950 (rather larger than Hill's specimens)

Cancrinella sp. (rather flat pedicle valve and concentric ornament poorly developed)

Anidanthus springsurensis (Booker) 1932

Strophalosia preovalis Maxwell 1954

Taeniothaerus sp.

Lissochonetes sp.

Neospirifer sp.

Ingelarella ovata Campbell 1961

Ingelarella profunda Campbell 1961

Dielasmatids

Crinoids

Part of a cup

Ossicles

M 411 - Lat. 21°29'15" S., Long. 148°32'00" E.

Pelecypods

Merismopteria sp.

Brachiopods

Ingelarella profunda Campbell 1961

Dielasmatid

M 412a - Lat. 21°29'30" S., Long. 148°32'45"E.

Pelecypods

Astartila cf. gryphoides (de Koninck) 1877

Deltopecten limaeformis (Morris) 1845

Aviculopecten cf. fittoni (Morris) 1845 (Outline of shell wavy)

Schizodus sp. nov. A.

Brachiopods

Terrakea pollex Hill 1950

Cancrinella sp. (rather flat pedicle valve and ornament not well developed)

Cancrinella farleyensis (Etheridge & Dun) 1909

Anidanthus springsurensis (Booker) 1932

Strophalosia preovalis Maxwell 1954

Taeniothaerus sp.

Lissochonetes sp.

Neospirifer sp. ind.

Trigonotreta sp. A (close to T. stokesii of Brown, 1953)

*Ingelarella ovata* Campbell 1961

*Ingelarella profunda* Campbell 1961

*Notospirifer* sp. ind.

*Pseudosyrinx* sp. nov.

*Gilledia* cf. *cymbaeformis* (Morris) 1845

*Gilledia* sp. nov.

M 412b - Latitude and Longitude as for M 412a.

Pelecypods

*Astartila* cf. *gryphoides*

*Pachymyonia* sp. ind. (one specimen similar to but may not be identical with *P.* cf. *etheridgei* Dun from MC 479 of Dickins, 1961c)

*Modiolus* sp.

*Deltopecten squamuliferus* (Morris) 1845

*Aviculopecten tenuicollis* (Dana) 1847

*Streblopteria* sp.

*Cypricardinia* ? sp. ind.

Brachiopods

*Cancrinella farleyensis* (Etheridge & Dun) 1909

*Anidanthus springsurensis* (Booker) 1932

*Strophalosia preovalis* Maxwell 1954

*Strophalosia brittoni* Maxwell 1954

*Taeniothaerus* sp.

*Neospirifer* (*Grantonia*) cf. *hobartense* (Brown) 1953

*Trigonotreta* sp. A.

*Ingelarella ovata* Campbell 1961

*Ingelarella profunda* Campbell 1961

*Notospirifer hillae* Campbell 1961

Fauna II ?

M 414 - Lat. 21°28'15" S., Long. 148°31'30" E. (lies stratigraphically between definite Fauna II and Fauna III)

Brachiopods

Terrakea sp. (a large form but seems wider at the umbo than T. solida and apparently lacks well developed umbonal thickening)

Fauna III a

B 261 - Lat. 20°44'30" S., Long. 147°57'00"E.

Pelecypods

Glyptoleda cf. reidi Fletcher 1945

Gastropods

Warthia sp.

Ammonites

To be identified by Dr. B.F. Glenister.

Brachiopods

Cancrinella sp. (as at MC 420, see Dickins 1961c, but may be long ranging).

M 413 - Lat. 21°28'15" S., Long. 148°31'15" E.

Pelecypods

Glyptoleda cf. reidi Fletcher 1945

Glyptoleda sp. nov. ? (squat form upturned at the back, also found in MC 420, Dickins 1961c)

Astartila cf. gryphoides (de Koninck) 1877

Chaenomya sp. nov. B?

Stutchburia cf. costata (Morris) 1845

Schizodus sp. (possibly similar to that from Glendoo Member)

Gastropods

<u>Mourlonia (Platyteichum)</u> cf. <u>costatum</u> Campbell 1953

<u>Glossopteris</u> leaf.

M 415 - Lat. 21°28'00" S., Long. 148°31'15" E.

Pelecypods

<u>Glyptoleda</u> sp.?

<u>Megadesmus</u> sp. nov.?

<u>Astartila</u> cf. <u>gryphoides</u> (de Koninck) 1877

<u>Pachymyonia</u> sp. nov.

<u>Chaenomya</u> sp. nov. B

<u>Wilkingia</u> ? sp. nov.

Gastropods

<u>Warthia</u> sp.

<u>Mourlonia (Platyteichum)</u> cf. <u>costatum</u> Campbell 1953

Brachiopods

<u>Ingelarella</u> cf. <u>ingelarensis</u> Campbell 1960

Wood.

<u>Probable Fauna IIIa</u>

M 21 - Lat. 21°31'00" S., Long. 148°33'30" E.

Pelecypods

<u>Wilkingia</u>? sp. nov.?

<u>Atomodesma</u> cf. <u>mytiloides</u> Beyrich 1864

<u>Pseudomonotis</u>? sp. nov. (gryphoid spiny shell)

Gastropods

<u>Mourlonia (Platyteichum)</u> cf. <u>costatum</u> Campbell 1953

Brachiopods

<u>Cancrinella</u> sp.

<u>Ingelarella</u> cf. <u>ingelarensis</u> Campbell 1960

Crinoids

Separate plates.

Fauna IIIb

Glendoo Member

B 634 - Lat. 20°56'30" S., Long. 147°41'15" E.

Pelecypods

*Volsellina* ? sp.?

*Cypricardinia* ? sp. (as at B 1633 - relationship to form in Fauna II not clear)

Brachiopods

*Notospirifer* cf. *extensus* Campbell 1961

Large dielasmatid

Bryozoans

Branching stenoporids

B 629 - Lat. 20°55'30" S., Long. 147°41'15" E.

Pelecypods

Gen. et sp. nov. (very plentiful)

Gastropods

*Bembexia* sp. nov. B

B 1569 - Lat. 20°48'15" S., Long. 147°41'15" E.

Pelecypods

Gen. et sp. nov. (very plentiful)

Gastropods

Indet.

B 1633 - Lat. 20°49'00" S., Long. 147°41'00" E.

Pelecypods

*Nuculana* sp. (two species may be present - an elongated and a short one)

*Astartila* cf. *gryphoides* (de Koninck) 1877

*Merismopteria* sp.

*Notomya* or *Pyramus* sp. (could be species in Glendoo Member north of Bowen River and probably species at B 261d)

Gen. et sp. nov.

*Aviculopecten* cf. *subquinquelineatus* (McCoy) 1847 (simple ribbed type)

*Stutchburia* cf. *costata* (Morris) 1845

*Cypricardinia* ? sp. (seems similar to species in Fauna II)

*Parallelodon* or *Cypricardinia* ? sp. (with radiating ornament at rear)

*Schizodus* sp. nov. B (as in Glendoo Member north of Bowen River)

Gastropods

*Warthia* sp.

*Mourlonia* (*Mourlonia*) sp. ind.

*Bembexia* sp. nov. B (one specimen similar to *B.* sp. nov. A. from Fauna II but most specimens are higher spired).

*Walnichollsia*? sp. nov. (distinct keel on upper whorl surface)

Capulid gastropod with radiating ornament.

Brachiopods

*Neospirifer* sp.

*Notospirifer* cf. *extensus* Campbell 1961 (in *N. minutus* Campbell the posterior sweeps back more quickly and dental plates are closer and more parallel, has some resemblance to *N. darwini* (Morris) 1845).

Dielasmatid (flat species as in Glendoo Member to north of Bowen River)

Bryozoans

Stenoporids or batostomellids

Fenestellids

Crinoids

Plates

Bones

Glendoo Member (Gebbie Creek and Exmoor Sections)

B261d - Lat. 20°44'30" S., Long. 147°57'00" E.

Pelecypods

Megadesmus? sp.? (like a small M. grandis but perhaps more like M. nobilissimus, not clear whether same as species in Collinsville 3).

Astartila cf. gryphoides (de Koninck) 1877

Notomya or Pyramus sp. (apparently not the same species as at CL. 122, CL 12/1 or Collinsville 5)

Merismopteria sp.

Volsellina ? sp.?

Gen. et. sp. nov. (very plentiful)

Aviculopecten sp. ind.

Gastropods

Warthia sp.

Bembexia sp. nov. B

Worm Burrows

B 711 - Lat. 20°56'30" S., Long. 148°08'15" E.

Pelecypods

Merismopteria sp.

Gen. et sp. nov.

Fauna III c

M 416 - Lat. 21°27'45" S., Long. 148°30'00" E.

Pelecypods

Megadesmus? sp. (appears to be same as at Collinsville 3 - Dickins 1961d)

Astartila? cf. gryphoides (de Koninck) 1877? (one incomplete specimen)

Notomya? sp. nov. (may be same as species of CL 122 - Dickins 1961d)

Gen. et sp. nov.?

Streblopteria sp.

Stutchburia cf. compressa (Morris) 1845

Schizodus ? sp. nov. B?

Gastropods

Warthia sp.

Mourlonia (Mourlonia) cf. strzeleckiana (Morris) 1845

Mourlonia (Platyteichum) cf. costatum Campbell 1953

Peruvispira sp. nov. (as at B 270b and CL 122 - Dickins 1961d)

Brachiopods

Notospirifer sp. B (like a large N. cf. extensus. Appears less cut back from umbo than N. minutus Campbell. However, has a fold in sulcus and therefore differs from N. cf. extensus)

M 417 - Lat. 21°27'00" S., Long. 148°30'45" E.

Pelecypods

Aviculopecten cf. subquinquelineatus (McCoy) 1847

Stutchburia cf. costata (Morris) 1845

Stutchburia cf. compressa (Morris) 1845

Stutchburia cuneata (Dana) 1847

Cypricardinia? sp.

Astartidae gen. et nov. A (seems more transversely elongated than species in Fauna IV)

Brachiopods

Ingelarella cf. ingelarensis Campbell 1960

Ingelarella undulosa Campbell 1961

Notospirifer sp.? (may be N. minutus or N. cf. extensus)

Flattish dielasmatid

Wood.

Fauna IV

Below Big Strophalosia Zone

B 261e - Lat. 20°44'30" S., Long. 147°57'00" E.

Pelecypods

Megadesmus grandis (Dana) 1847

Merismopteria sp. (very large specimens)

Aviculopecten sp. A (species with large irregular ribs more or less of one order - same as A. sp. B in Clermont shaft and CL 225/1 - see Dickins 1961d)

Schizodus sp. nov. C.

Gastropods

Mourlonia (Mourlonia) cf. strzeleckiana (Morris) 1845

Brachiopods

Terrakea solida (Etheridge and Dun) 1909

Strophalosia cf. typica (Booker) 1929 (same as in Collinsville 4. Poorly developed ventral sulcus, which may distinguish it from S. typica)

Ingelarella cf. magna or mantuanensis Campbell 1960

Bryozoans

Branching stenoporids

B 683 - Lat. 20°56'45" S., Long. 148°08'00" E.

Pelecypods

Myonia cf. carinata (Morris) 1845

Aviculopecten sp. A.

Stutchburia cf. costata (Morris) 1845

Schizodus sp. nov. C.

Astartidae gen. et sp. nov. B.

Brachiopods

Terrakea sp. (may be small T. solida)

Neospirifer sp.

Ingelarella cf. ingelarensis Campbell 1960

Ingelarella magna Campbell 1960

Notospirifer cf. minutus Campbell 1960

Pseudosyrinx sp.

Biplicate dielasmatids (same species as at B 1510)

Blastoid or crinoid plates

B 1634 - Lat. 20°50'00" S., Long. 147°42'00" E.

Brachiopods

Strophalosia sp.

Ingelarella cf. ingelarensis Campbell 1960

Crinoid Cup.

M 418 - Lat. 21°27'00" S., Long. 148°30'30" E.

Pelecypods

Megadesmus grandis (Dana) 1847
Megadesmus? sp. (similar to species in Collinsville 3)
Stutchburia sp. ind.

Schizodus sp. nov. C.

Big Strophalosia Zone

B 1570 (undifferentiated) - Lat. 20°50'00" S., Long. 147°42'30" E.

Brachiopods

Terrakea solida (Etheridge & Dun) 1909

Strophalosia brittoni var. gattoni Maxwell 1954

Strophalosia clarkei (Etheridge Snr.) 1872

Strophalosia ovalis Maxwell 1954

Neospirifer sp.

Ingelarella ingelarensis Campbell 1960

Biplicate dielasmatid

Branching and Encrushing Bryozoans

Single Coral

B 1570c - as for B 1570, 0 to 16 feet above base; fine to medium-grained calcareous sandstone with some siltstone.

Pelecypods

*Myonia* cf. *carinata* (Morris) 1845

*Aviculopecten* sp. ind.

Brachiopods

*Terrakea solida* (Etheridge & Dun) 1909

*Strophalosia* cf. *brittoni* var. *gattoni* Maxwell 1954

*Strophalosia clarkei* (Etheridge Snr.) 1872

*Neospirifer* sp.

*Trigonotreta* sp. B.

*Pseudosyrinx* sp.

Encrusting Bryozoans

(including incrustations on pebbles up to 1 inch across)

B 1570b - as for B 1570, 32 to 43 feet above base; mainly fine to medium-grained calcareous sand.

Brachiopods

*Terrakea solida*

*Cancrinella* sp. (simple type)

*Strophalosia clarkei*

*Strophalosia ovalis*

*Neospirifer* sp.

*Ingelarella* cf. *ingelarensis*

Encrusting Bryozoans

Single coral

B 1570a - as for B 1570, 101 to 117 feet above the base; calcareous siltstone or limestone with some fine-grained sandstone.

Pelecypods

*Myonia* cf. *corrugata* Fletcher 1932

"*Solemya*" *edelfeldti* (Etheridge Snr.) Jnr.

Brachiopods

<u>Terrakea</u> <u>solida</u>

<u>Strophalosia</u> cf. <u>typica</u>

<u>S.</u> cf. <u>brittoni</u> var. <u>gattoni</u>

<u>S.</u> <u>clarkei</u>

<u>Neospirifer</u> sp.

<u>Trigonotreta</u> sp. B.

<u>Ingelarella</u> cf. <u>ingelarensis</u>

<u>Cancellospirifer</u> sp.

Encrusting Bryozoans

Single Corals

B 712 - Lat. 20°56'30" S., Long. 148°08'00" E., top 20 feet of zone.

Brachiopods

<u>Strophalosia</u> cf. <u>brittoni</u> var. <u>gattoni</u>

<u>S. clarkei</u>

<u>S. ovalis</u>

<u>Neospirifer</u> sp.

<u>Trigonotreta</u> sp. B.

<u>Ingelarella</u> <u>ingelarensis</u>

Encrusting Bryozoans

Big <u>Strophalosia</u> Zone or Close to Zone

B 594 - Lat. 20°49'15" S., Long. 147°59'30" E.

Pelecypods

<u>Chaenomya</u> sp. (species in Fauna IV)

Brachiopods

<u>Terrakea</u> or <u>Cancrinella</u> sp.

<u>Strophalosia</u> cf. <u>clarkei</u>

<u>Notospirifer</u> cf. <u>minutus</u>

B 628 - Lat. 20°49'15" S., Long. 147°43'00"E.

Pelecypods

<u>Conocardium</u> sp.

Brachiopods

*Terrakea solida*

*Strophalosia ovalis*

Bryozoa

Encrusting and fenestellid forms.

Single Coral

B 635 - Lat. 20°56'30" S., Long. 147°42'00" E.

Brachiopods

*Terrakea solida*

*Strophalosia* cf. *clarkei*

B 667 - Lat. 20°26'00" S., Long. 147°45'15" E.

Brachiopods

*Terrakea solida*

*Neospirifer* sp.

M 85 - Lat. 21°34'45" S., Long. 148°34'00" E.

Pelecypods

*Myonia* cf. *carinata* (Morris) 1845

*Myonia* cf. *corrugata* Fletcher 1932

"*Solemya*" *edelfeldti* (Etheridge Jnr.) 1892

"*Modiolus*" cf. *mytiliformis* (Etheridge Jnr.) 1892

*Stutchburia* cf. *costata* (Morris) 1845

Astartidae gen., sp. ind.

Brachiopods

*Strophalosia* cf. *clarkei* (very numerous as in Big *Strophalosia* Zone)

*Strophalosia* cf. *ovalis*

*Ingelarella* cf. *ingelarensis*

*Notospirifer* cf. *minutus*

*Streptorynchus* cf. *pelicanensis* Fletcher 1952

Bryozoans

Probably above Big *Strophalosia* Zone

M 86 - Lat. 21°34'45" S., Long. 148°33'15" E.

Pelecypods

"*Modiolus*" cf. *mytiliformis* (Etheridge Jnr.) 1892

Astartidae gen., sp. ind.

Brachiopods

*Cancrinella* or *Terrakea* sp.

*Strophalosia* cf. *ovalis*

*Neospirifer* sp.

Fenestellid bryozoans

Corals

*Cladochonus* sp.

Single corals.

Crinoid step ossicles

Above Big *Strophalosia* Zone

B 270a - Lat. 20°57'00" S., Long. 148°08'00" E., close to "*Streptorynchus*-bed"

Pelecypods

*Nuculana* sp.

*Astartila* cf. *cytheria* Dana 1847

*Chaenomya* sp.

*Aviculopecten* sp. ind.

*Stutchburia* cf. *costata* (Morris) 1845

*Stutchburia cuneata* (Dana) 1847

*Schizodus* sp. nov. C

*Astartidae* gen. et. sp. nov. B

Gastropods

*Warthia* sp.

*Mourlonia* (*Mourlonia*) cf. *strzeleckiana* (Morris) 1845

Brachiopods

*Strophalosia ovalis* Maxwell 1954

*Notospirifer minutus* Campbell 1960

Wood

B 270b - as for B 270a, slightly higher stratigraphically.

Pelecypods

<u>Merismopteria</u> sp. (very large specimens)

<u>Aviculopecten</u> sp.? (a large specimen with distinct concentric rugae)

Gastropods

<u>Peruvispira</u> sp. nov. (same species as at CL 122 and M 416 and similar to <u>P. trifilata</u> (Dana))

B 1572 - Lat. 20°47'15" S., Long. 147°44'45" E., "<u>Martiniopsis</u>-bed"

Brachiopods

<u>Ingelarella</u> <u>havilensis</u> Campbell 1960.

## REFERENCES

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CAMPBELL, K.S.W., 1961 - New species of the Permian spiriferoids <u>Ingelarella</u> and <u>Notospirifer</u> from Queensland and their stratigraphic implications. <u>Palaeontographica</u>, 117(A), 159-192.

DICKINS, J.M., 1961a - Permian pelecypods newly recorded from Eastern Australia. <u>Palaeontology</u>, 4(1), 119-130.

DICKINS, J.M., 1961b - The gastropod <u>Platyteichum</u> in the Permian of Western Australia. <u>Ibid</u>., 131-137.

DICKINS, J.M., 1961c - Appendix <u>in</u> Malone, E.J., Corbett, D.W.P., and Jensen, A.R., Geology of the Mount Coolon 4-mile area. <u>Bur. Min. Resour. Aust. Rec</u>. 1961/69 (unpubl.).

DICKINS, J.M., 1961d - Appendix <u>in</u> Veevers, J.J., Randal, M.A., Mollan, R.G., and Paten, R.J., The geology of the Clermont 4-mile Sheet area, Queensland. <u>Bur. Min. Resour. Aust. Rec</u>., 1961/75 (unpubl.).

DICKINS, J.M., in press - Permian pelecypods and gastropods from Western Australia. <u>Bur. Min. Resour. Aust. Bull</u>. 63.

DICKINS, J.M., MALONE, E.J., and JENSEN, A.R., 1962 - Subdivision and correlation of the Middle Bowen Beds. <u>Bur. Min. Resour. Aust. Rec</u>., 1962/87 (unpubl.).

Mackay West Sheet Area.

ERRATA

Reference

1. Delete "porphyritic rhyolite" from Tb
2. Md should be changed to Mg and lithology to microgranodiorite.
3. Ol - Torbanite should be changed to Ol - Oil Shale.

On face of map

1. At Mirani, symbol Cl should be changed to Cy
2. Pine Mountain should be changed from Tb to Tv.

.......

PRELIMINARY EDITION, 1962

SUBJECT TO AMENDMENT



# MACKAY WEST

## QUEENSLAND

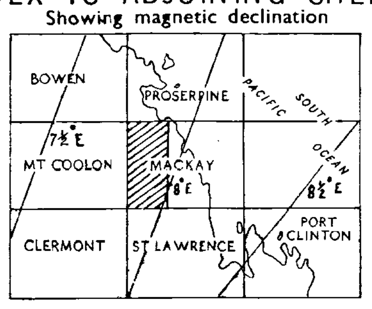
Scale
1 : 250.000

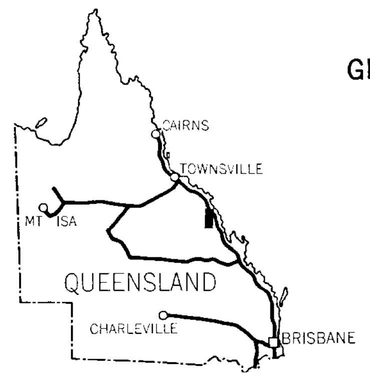
5 0 5 10 15 MILES

Geology by: A.R. Jensen, C.M. Gregory, V.R. Forbes.
Drawn by: G. Matveev.

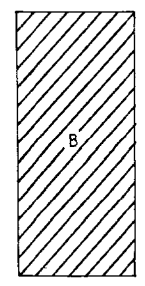
INDEX TO ADJOINING SHEETS

Showing magnetic declination




GEOLOGICAL RELIABILITY DIAGRAM

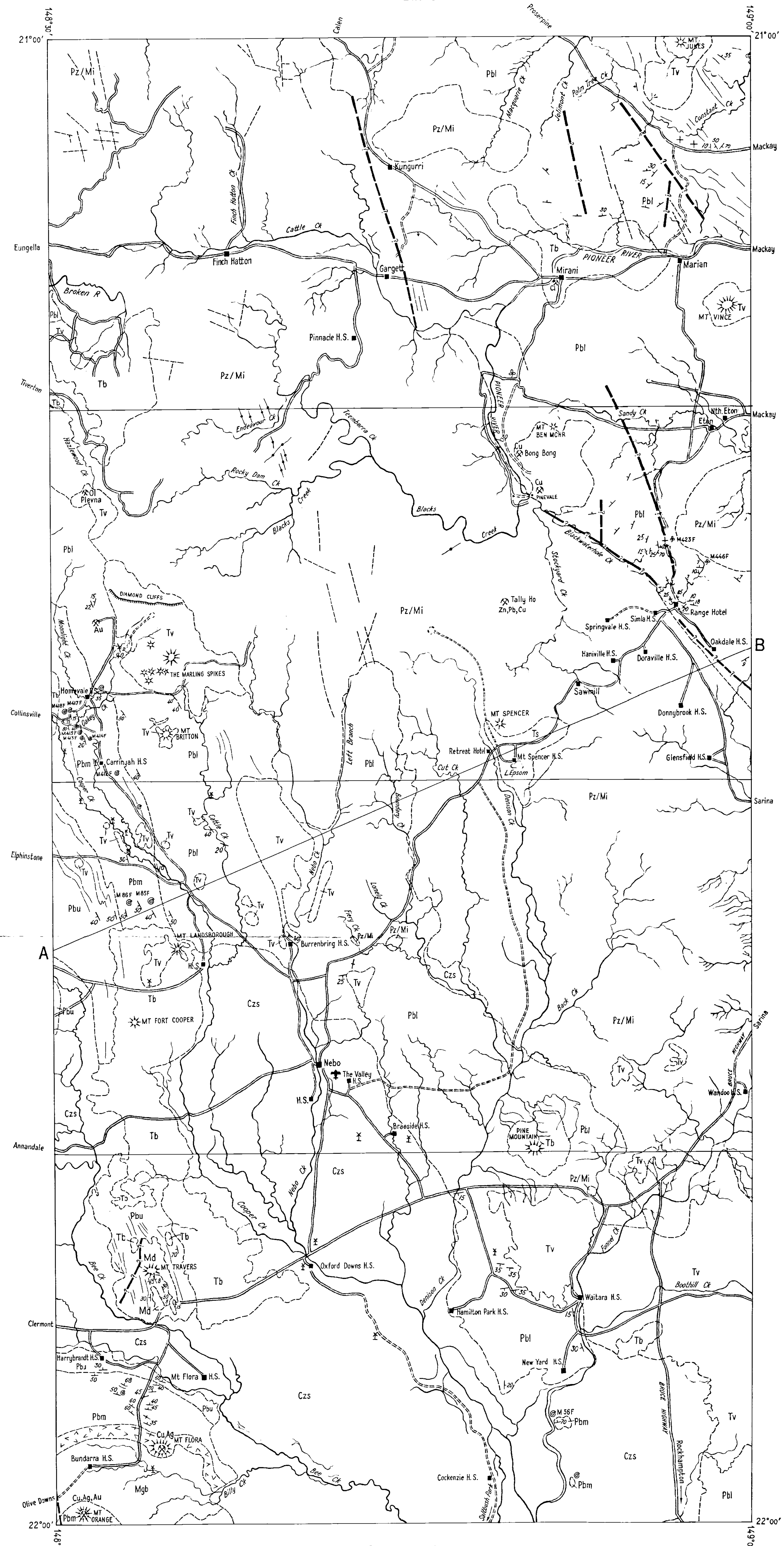



B - Detailed Reconnaisance - Numerous Traverses

## Reference

| | | | | |
|---|---|---|---|---|
| CAINOZOIC | | | Czs | Soil, sand, alluvium, flood plain deposits. |
| | Tertiary | | Ts | Coarse semi-friable sandstone, partially lateritized. |
| | | | Tv | Rhyolite, trachyte, andesite, rhyolitic agglomerate and breccia, minor basalt. |
| | | | Tb | Mainly basalt flows, some porphyritic rhyolite. |
| MESOZOIC | | Bundarra Granodiorite | Mgb | Leuco-granodiorite. |
| | | | Md | Leuco-microdiorite. |
| | | Urannah Complex | Pz/Mi | Diorite-granodiorite-granite mass with abundant acid, intermediate and basic dykes. |
| PALAEOZOIC | Permian | Upper Bowen Coal Measures | Pbu | Cross bedded, well sorted, lithic sandstone, calcareous lithic sandstone, siltstone, carbonaceous shale; some coal; conglomerate bands. |
| | | Middle Bowen Beds | Pbm | Quartz sandstone, blue micaceous fossiliferous siltstone, calcareous lithic quartz sandstone. |
| | | Lower Bowen Volcanics | Pbl | Andesitic flows, agglomerates and tuffs; minor rhyolite and dacite; shale, siltstone and sandstone. |

- Geological boundary, position approximate
- Inferred fault
- Strike and dip of strata
- Prevailing dip
- Vertical strata
- Horizontal strata
- Overturned strata
- Dip slope
- Trend of bedding
- Macrofossil locality
- Plant fossil locality
- Ag Silver
- Au Gold
- Cy Clay
- Cu Copper
- Ol Torbanite
- Pb Lead
- Zn Zinc
- Mine, glory hole, or large open cut
- Windmill
- ■ Nebo Township
- ■ H.S. Homestead
- Airfield
- Formed road
- Vehicle track
- Joints
- Igneous dyke
- Metamorphic aureole




## Section A-B

Horizontal scale 1 : 250.000

Vertical scale 1inch = 5000 feet