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1962/145

EXPLANATORY NOTES ON THE MOUNT YOUNG 1:250,000 GEOLOGICAL SHEET, N.T.

Compiled by

K.A. Plumb & A.G.L. Paine

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INTRODUCTION

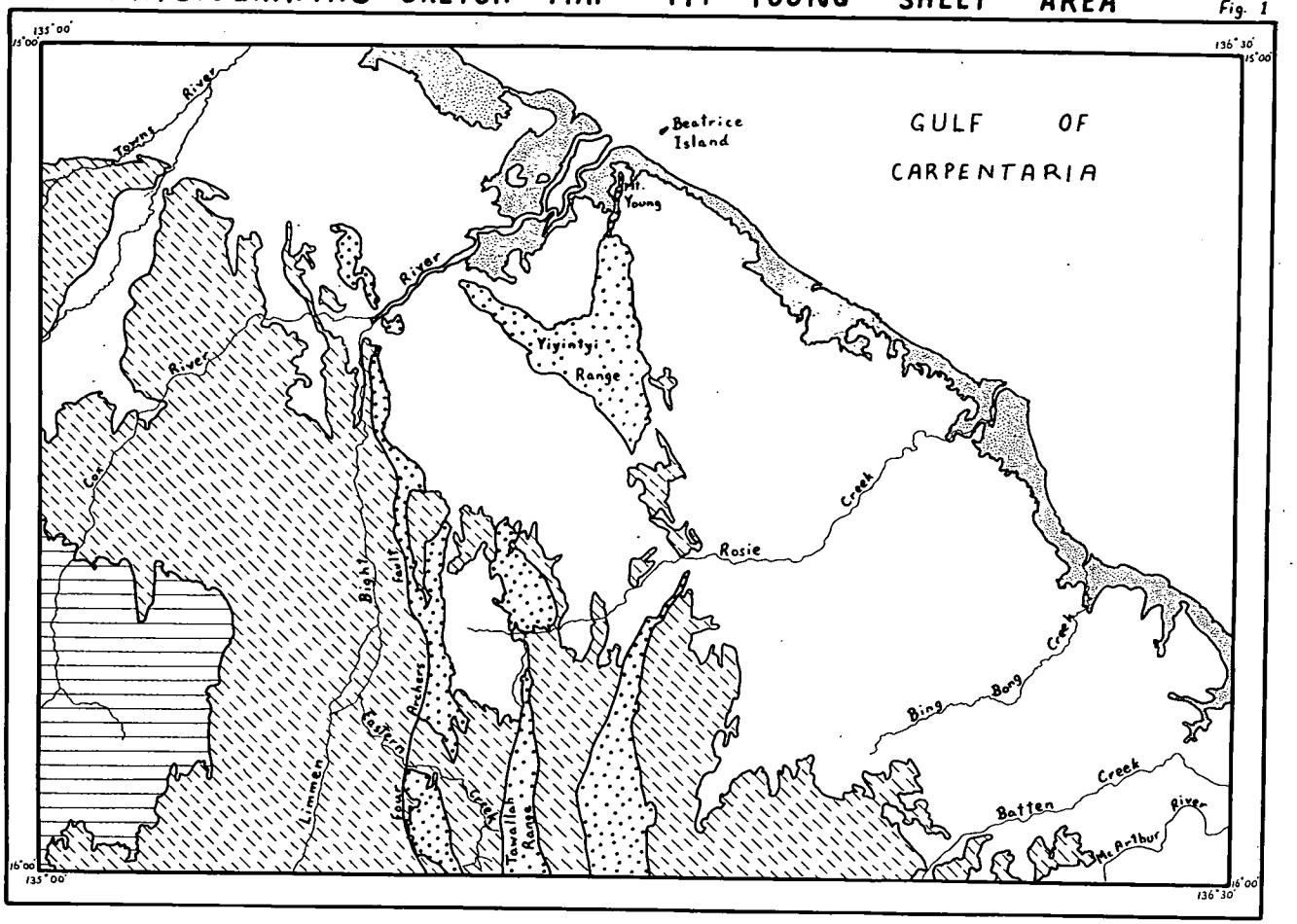
The Mount Young 1:250,000 Sheet area lies between latitudes 15°00' and 16°00'S, and longitudes 135°00' and 136°30'E in the south-west corner of the Gulf of Carpentaria, and it contains the tidal estuaries and lower drainage basins of the Towns, Cox, Limmen Bight, and McArthur Rivers.

The only permanently inhabited settlement on the Sheet area is Bing Bong Station, which has a population of three Europeans and a few aboriginals. Access to the area is by two vehicle tracks suitable for four-wheel drive vehicles during dry weather. One track links Bing Bong Station to Borroloola (5 miles south of the south-eastern Sheet boundary), and the other links Mount Young to an all-weather graded road on Bauhinia Downs Sheet area connecting Borroloola with Daly Waters. An aircraft arrives weekly at Borroloola from Mount Isa and Tennant Creek.

Available maps and air photographs of the Sheet area are: air photographs at a scale of 1:50,000 flown by the Royal Australian Air Force in 1950; an uncontrolled photomosaic at a scale of approximately 4 miles to 1 inch; a planimetric map at a scale of 1:250,000 prepared by the Division of National Mapping, Department of National Development from a controlled, photo-scale, slotted-template assembly. The geological map was compiled on a photo-scale trace of this assembly and reduced to 1:250,000 scale.

PHYSIOGRAPHIC SKETCH MAP – MT YOUNG SHEET AREA

Fig. 1



SCALE

10 0 10 20 30 Miles

REFERENCE

COASTAL PLAIN

Tidal Flats

GULF FALL

Cox River Plateau

Main Ranges

PREVIOUS INVESTIGATIONS

Leichhardt passed through the area in 1847. Parkes (1891) travelled from Borroloola to a point about five miles south of Four Archers near the Limmen Bight River (the old "Valley of Springs Homestead", whose exact location is now unknown) and noted a number of sandstone ranges.

The discovery of silver-lead mineralisation at McArthur River encouraged prospecting in the region, and in 1918 copper mineralisation was discovered at Coppermine Creek, in the south of the area.

In 1955 L. McAlister, of Mount Isa Mines Limited, made a geological reconnaissance of the Gulf Country south of the Limmen Bight River, and in 1956, in collaboration with E.J. Malone of the Bureau of Mineral Resources, he produced a photo-geological map covering the Urapunga, Mount Young, Hodgson Downs, and Bauhinia Downs 1:250,000 Sheet areas. Since then Mount Isa Mines Limited and Carpentaria Exploration Company have conducted a programme of prospecting and geological mapping of the McArthur River area, which has extended northwards onto the southern part of the Mount Young Sheet area.

During 1958 geologists from Enterprise Exploration Company Pty Limited carried out a helicopter survey of the Bulman-Urapunga area, which extended as far south as the Limmen Bight River.

These notes, and the geological map which they accompany, are based on a survey of the Carpentaria Upper Proterozoic Province carried out during 1960-61 by geologists of the Bureau of Mineral Resources.

PHYSIOGRAPHY

DRAINAGE

The western part of the Mount Young Sheet area is drained by the Limmen Bight River, and its tributaries the Cox and Nathan Rivers, which flow into the Gulf of Carpentaria. The Towns River drains the north-west corner of the Sheet area. The eastern part of the Sheet area is drained by Rosie and Bing Bong Creeks and a number of other minor streams. The south-east corner of the Sheet area is drained by the McArthur River and its tributary,

Batten Creek. The streams are largely aggrading, but a eustatic change in sea-level of about 30 feet has entrenched the streams into their own alluvial plains.

The Sheet area falls within two of the major physiographic divisions of the Carpentaria Region, the 'Gulf Fall' (Stewart, 1954) and the 'Coastal Plains' (Dunn, et al., 1962). A distinct drainage pattern has formed within each of these units. Drainage in the Coastal Plain shows a simple pattern of sub-parallel north-east flowing consequent streams. In the Gulf Fall a complicated pattern of subsequent streams, controlled by the structure of the bed-rock, has formed. The major streams flow generally north.

Figure 1 shows the major physiographic units. The Gulf Fall has been divided into the 'Cox River Plateau', the 'Main Ranges', and the 'Undifferentiated Gulf Fall'. A narrow strip bordering the shore-line, the 'Tidal Flats', can be distinguished in the Coastal Plain.

GULF FALL is the area of dissected rock outcrops, mostly Upper Proterozoic, in the south and west of the Sheet area. Elevations range from about 650 feet to 1000 feet. The topography is largely the result of differential erosion of the bed-rock.

Cox River Plateau occurs in the south-west corner of the Sheet area, where the horizontal Bukalara Sandstone and overlying Cox Formation crop out. The elevation of the Plateau is about 600 feet. A marginal scarp about 150 feet high is present near Wilarra Twin Springs; elsewhere it is poorly defined. Most of the plateau is covered by sand, but in places erosion has exposed the Bukalara Sandstone and Cox Formation and developed slight relief. The drainage is dendritic.

Main Ranges occur where resistant sandstones of the Tawallah Group, especially the Yiyintyi Sandstone and Sly Creek Sandstone, crop out in a north-trending belt through the centre of the Sheet area. These ranges are the Tawallah Range, Yiyintyi Range, and an unnamed range bordering the eastern side of the Four Archers Fault.

The crests of the ranges have a uniform elevation (about 600 to 650 feet) suggesting an old peneplain surface. The maximum relief along the edge of the ranges is about 550 feet above the surrounding plain at the southern end of the Yiyintyi Range; generally the relief is about 300 feet. The ranges are bounded by either dip slopes or very steep fault scarps.

Steep-sided valleys, up to about 250 feet deep, form on poorly outcropping units of the Wollogorong Formation and Peters Creek Volcanics. The shape and distribution of these valleys are irregular, due to the numerous faults present.

Undifferentiated Gulf Fall. The area west of the Four Archers Fault contains folded Roper Group sediments with some inliers of McArthur Group. Differential erosion formed strike ridges of the resistant sandstones, forming hogbacks, cuestas, and mesas, with valleys of less resistant rocks between. The elevation of the ridges are generally 100 to 200 feet above the intervening valleys and the individual sandstones form characteristic topography, which enables the sandstones to be easily recognised. Topographic relief, except for the Main Ranges, is generally less to the east of the Four Archers Fault. Near the headwaters of Eastern Creek some strike ridges of Roper Group sediments are present. Differential erosion in the McArthur Group outcrops is less marked than in the Roper Group, and low, rounded hills are formed. Minor fault blocks of Tawallah Group sandstones form prominent ridges.

Immediately to the east of the Tawallah Range fault blocks of Masterton Formation and Warramana Sandstone form prominent mesas with poorly resistant McArthur Group sediments in the intervening valleys. Farther east low rounded ridges, rising 50 to 100 feet above the plain, are present where the McArthur Group crops out. In the south-east corner of the Sheet area small mesas, about 50 feet high, have formed where horizontal Lower Cretaceous sediments cap horizontal Roper Group sediments.

COASTAL PLAIN is the wide, flat, low-lying plain bordering the coast. The average width of the plain is 20 miles, but in places it extends up to 40 miles inland. Elevations range from sea level to about 100 feet.

The bed-rock of the Plain is mainly horizontal Lower Cretaceous sediments with inliers of Upper Proterozoic. A laterite profile, which is commonly truncated by later erosion, is exposed in creek banks near the coast. The Coastal Plain is now covered by a sand blanket (of probable marine origin) with later alluvial flats developed along major streams. Beneath the sand a thin layer of cemented ferruginous detritus, derived from erosion of laterites, is common.

Ancient, north-west trending sand dunes of very low relief (shown on the geological map as 'Fixed Ancient Coastal Deposits') are exposed in many places on the Coastal Plain. These dunes have been cemented by ferruginous material to produce a lateritic rock. They are probably wind-blown dunes, transported by prevailing south-east winds, the source of the ferruginous sand being coastal sediments similar to those being formed at present.

Tidal Flats consist of a narrow zone of coastal sediments up to 5 miles wide along the coast and around the major estuaries. Many of the features present are typical of an emerging coast.

The greater part of the zone is low lying and subject to seasonal and tidal flooding. Numerous meandering tidal creeks cross this low-lying area and ferruginous silt, ferruginous fine sand, and evaporites were deposited. These low-lying areas represent emerged lagoons.

Dunes of ferruginous sand with shell remains, up to 20 feet high, are present along the beaches and represent emerged off-shore bars. Smaller dunes are also present along the inner edge of the Tidal Flats.

STRATIGRAPHY

About 30,000 feet thick of Upper Proterozoic sediments and volcanics, are exposed on the Mount Young Sheet Area and unconformably overlie volcanics of Lower Proterozoic age, the Scrutton Volcanics. The Upper Proterozoic is divided into three groups, namely, the 'Tawallah Group', consisting mostly of arenites, which are overlain by thick sequences of carbonate rocks, the 'McArthur Group', and by interbedded arenites and lutites, the 'Roper Group'.

The Upper Proterozoic is unconformably overlain by horizontal Lower Cambrian sediments, the Bukalara Sandstone and Cox Formation, and these are further overlain, unconformably, by Lower Cretaceous sediments. Finally, large areas of the Sheet area are covered by Cainozoic soil, sand, and alluvium.

PRECAMBRIAN

LOWER PROTEROZOIC

Scrutton Volcanics. The oldest rocks exposed in the Sheet area are moderately folded acid volcanics with interbedded feldspathic sandstone and small intrusions of dolerite. They are unconformably overlain by the Tawallah Group and are tentatively considered to be Lower Proterozoic in age.*

Feldspar phenocrysts in the volcanics are saussuritized and the groundmass is highly altered; fine quartz, feldspar, and chlorite can be identified.

The stratigraphy is summarized in Table 1.

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* The 1962 mapping in the Parsons and Mitchell Ranges area (Blue Mud Bay Sheet area) suggest that the Scrutton Volcanics may be correlated with acid volcanics, which appear to be near the base of the Upper Proterozoic sequence in Cyprus Creek. Also both of these volcanics resemble the Upper Proterozoic Edith River Volcanics on the Katherine 1:250,000 Sheet area.

UPPER PROTEROZOIC

The Upper Proterozoic rocks of the Mount Young Sheet area were deposited within the 'McArthur Basin' (Dunn, et al., 1962). The oldest Group, the Tawallah Group, has a wide distribution within the Basin and shows a general similarity in thickness and lithology over wide areas.

The McArthur Group is thickest in a north trending trough, the 'Batten Trough', which passes through the Mount Young Sheet area. The Group thins markedly to the east and is absent to the south-west. Facies changes in the Group are very common. On the Sheet area the McArthur Group overlies the Tawallah Group conformably, but it unconformably overlies the Tawallah Group on the Urapunga Sheet area to the north-west and the Robinson River Sheet area to the south-east.

The Roper Group unconformably overlies the McArthur Group. It is widespread within the Basin and once again shows a general lithological uniformity over wide areas. Its thickness decreases to the east of the Sheet area and increases to the west.

Age of the Units

Brown (1908) referred to sediments at Borroloola (now known as the 'Roper Group') as Permo-Carboniferous because of the presence of bituminous and carbonaceous matter. Woolnough (1912) on Bauhinia Downs Sheet area correlated his 'Bauhinia Limestones' (McArthur Group) with the Katherine River Limestone and considered them, together with the overlying sandstones (Roper Group), as Cambrian. Jensen (1914) visited the McArthur River area where he considered the dolomites (McArthur Group) to be Cambrian. The sediments at Borroloola (Roper Group) be considered to be Permo-Carboniferous on the basis of plant remains, which in fact occurred in Mesozoic cappings. Mapping later (1940) on the Redbank Copper Field on Calvert Hills Sheet area Jensen revised his earlier opinions and considered all the rocks in the region as Cambrian.

Noakes & Traves (1954) in the C.S.I.R.O. land-use survey of the Barkly Region used the term 'Carpentaria Complex' for the folded rocks extending from Mount Isa to McArthur River, and they assigned them to the Lower Proterozoic.

Hossfeld (1953) recognised the unconformity between the Cambrian limestones of the Barkly Tableland and the underlying dolomites of the McArthur River area (McArthur Group) and considered the dolomites to be Middle to Upper Proterozoic. This was supported by Noakes (1956).

The rocks are now considered to be Upper Proterozoic in age, because the Roper Group is unconformably overlain by the Lower Cambrian Bukalara Sandstone and on Calvert Hills Sheet area the Tawallah Group unconformably overlies Lower Proterozoic granites and metamorphics.

Tawallah Group

Exposures of the Tawallah Group on Mount Young Sheet area occur mostly within a north-south belt through the central portion of the Sheet area. The thickness is about 14,000 feet.

The dominant rock type of the Group is flaggy medium-grained quartz sandstone with abundant ripple-marks and cross-bedding. Minor conglomerate bands are present in places. These sediments make up the Yiyintyi Sandstone, Sly Creek Sandstone, and Masterton Formation with a total thickness of about 12,000 feet.

In the lower few hundred feet of the Yiyintyi Sandstone poorly sorted lithic sandstone, arkose, and conglomerate are present indicating relative tectonic instability during the initial sedimentation. Within the Masterton Formation deposition of iron was common producing abundant ferruginous sandstone.

The Mulholland Sandstone only crops out around the headwaters of Eastern Creek and is a stratigraphic equivalent of the upper part of the Masterton Formation. Frequently three sub-divisions can be recognised within the Masterton Formation consisting of flaggy, friable ferruginous sandstone in the middle part with more resistant quartz sandstone at the top and bottom parts.

The Peters Creek Volcanics consist entirely of basalt. The basalt is extensively altered and characterised by abundant green, white and pink amygdales, up to 3 or 4 inches in size, of chlorite, epidote, quartz, and microcline. Individual flows can be recognised, up to 40 feet thick, by a concentration of amygdales and gradual reduction in grainsize towards the top part of the flow.

In the Rosie Creek Sandstone feldspar is abundant. The quartz sandstones are frequently highly silicified and coarse glauconitic sandstones are present near the top of the unit. The Rosie Creek Sandstone is a stratigraphic equivalent of the Aquarium Formation on Calvert Hills and Robinson River Sheet areas.

The Wollogorang Formation outcrops very poorly. Well exposed sections show that grey, purple-brown and green siltstones are the dominant lithology, but in most outcrops dolomites are the only rocks exposed. A bed of dolomite containing pyrite pseudomorphs occurs about 100 feet below the top of the formation, and it is a good stratigraphic marker.

The stratigraphy of the Tawallah Group is summarized in Table 1.

McArthur Group

Scattered outcrops of McArthur Group rocks occur throughout the Sheet area. Outcrops are generally poor.

On Mount Young Sheet area three stratigraphic successions were mapped. The stratigraphic relationship of the units is shown on the Rock Relationship Diagram accompanying the Geological Map, and the stratigraphy of the Group is summarized in Table 2. Chemical analyses show that the carbonate rocks of the McArthur Group are dolomites.

On Bauhinia Downs Sheet area a north-trending hinge line affected McArthur Group sedimentation. During part of the sedimentation a reef formed on this hinge line resulting in deposition of a back-reef facies with evaporites in the west, and a fore-reef in the east. The hinge line continued onto Mount Young Sheet area and the presence of distinct fore-reef and back-reef sediments indicates that the reef was present also although now it does not crop out. The reef passed through the south-eastern part of the Tawallah Range and then trended north-west to pass just south of the Four Archers.

In the southern part of the Sheet area the thickness of the McArthur Group west of the hinge line is about 4,000 feet and east of the line it is about 6,500 feet thick. Correlations with surrounding areas however indicate that about 3,500 feet of sediments were eroded from the eastern section before the Roper Group was deposited. In the north-west of the Sheet area, around the Cox River, the sediments east of the hinge line is about 5,000 feet thick; farther

to the north-west, on Urapunga Sheet area, they are about 2,500 feet thick.

The history of deposition of the McArthur Group on Mount Young Sheet area can be summarized as seven events:-

(a) Deposition of ferruginous silt and sand with minor carbonate mud, chert, and algal biostromes on a shallow subsiding shelf (Mallapunyah Formation and lower parts of Festing Creek Formation).

(b) Decrease in supply of sediment from outside the basin resulted in deposition of widespread carbonate mud and minor silt with abundant algal biostromes on a shallow subsiding shelf (Amelia Dolomite and Basal Vizard Formation). East of the hinge line, in the south-east of the Sheet area, basalt and minor tuff was extruded and interbedded with carbonate mud and minor sand (upper parts of Festing Creek Formation).

(c) Tectonic activity accentuated the effect of the hinge line and a reef developed along it. Uplift and erosion of the source area resulted in the deposition of widespread sand (Tatoola Sandstone, Warramana Sandstone and a prominent quartz sandstone low in the Vizard Formation).

(d) Deposition in the west of a regularly alternating succession of carbonate mud, algal biostromes, silt and fine- to medium-grained sand in a back-reef environment on a subsiding shelf. (Tooganinie Formation). Halite crystals, indicating evaporitic conditions, were precipitated during deposition of the fine sand.

To the east and north of the hinge line fore-reef sediments were deposited within a trough which subsided more rapidly than the shelf to the west. Subsidence within this trough decreased to the north-west. A succession of generally thin-bedded silt, carbonates, chert, sand, and massive chert breccia was deposited (Lynott Formation and the middle of the Vizard Formation). Chert breccias were frequently slumped and the silts showed graded bedding. Greater tectonic instability at the beginning of this event is shown by the comparitive abundance of sand and chert breccia (Hammer Creek Member). The Lynott Formation was overlain by laminated silt and chert (Yalco Formation).

After deposition of the Yalco Formation the source area was uplifted and eroded, and widespread sand (Stretton Sandstone and corresponding sandstone in the upper part of the Vizard Formation was deposited in shallow water.

Return to fore-reef conditions is shown by deposition of the top of the Vizard Formation in the north-west (The Looking Glass Formation was deposited in the east, but it was eroded before the Roper Group was deposited).

(e) Tectonic movements caused a breakdown of the reef. A sandstone-conglomerate sequence with abundant chert pebbles (Mount Birch Sandstone) transgressed the hinge line from the north.

(f) Variable conditions developed on a widespread subsiding shelf. In the south-west an irregular succession of chert breccia, silt, sand, and chert (Billengarrah Formation) was deposited. This is a lateral equivalent of widespread, thick biostromes, and carbonate mud (Emmerugga Dolomite) on Bauhinia Downs Sheet area.

The Billengarrah Formation grades laterally into the Kookaburra Creek Formation to the north. This was a succession of oolitic dolomite (now silicified), carbonate mud, sand, chert breccia, and algal biostromes. On the Urapunga Sheet area basic volcanics (Yalwarra Volcanic Member) are present.

(g) Uplift and erosion of the upper part of the sequence in the south-east ended deposition of the McArthur Group.

Roper Group

On the Mount Young Sheet area the main outcrops of Roper Group occur to the west of the Four Archers Fault. No complete section can be measured, but a total thickness of more than 5,500 feet is present. In the south-east of the Sheet area only about 1,500 feet is preserved. The stratigraphy of the Group is summarized in Table 3.

The lowest and most variable unit of the Roper Group is the Limmen Sandstone. Near Batten Creek the formation is only 50 feet thick and consists largely of fine pebble conglomerate. In the north-west of the Sheet area a central flaggy, red micaceous sandstone is present between blocky coarse-grained quartz sandstone beds above and below. The total thickness is about 700 feet. In the south beds of feldspathic sandstone are common. The sandstones, which form a prominent ridge, are generally underlain by flaggy micaceous siltstones and fine sandstones, which rarely crop out.

The boundary between the poorly outcropping Mainoru Formation and the overlying Crawford Formation is gradational. The base of the Crawford Formation is a persistant, thin (15 to 20 feet) bed of massive brown quartz greywacke at the base of a prominent scarp. The Crawford Formation contains abundant glauconite.

The Abner Sandstone, which is divided into four members in the west, is dominated by clean- and well-sorted quartz sandstones. The quartz sandstone members, the Arnold Sandstone Member and Hodgson Sandstone Member, are well jointed and weathered along these joints to form a "Castle" topography. This topography and the usual good outcrop of the sandstones, makes them valuable marker beds for photo-interpretation. The Jalboi Member thins southwards and the Arnold Sandstone Member thickens. A ferruginous sandstone, the Munyi Member, caps the Hodgson Sandstone Member, but it does not always crop out.

Most of the Corcoran Formation is obscured by soil cover. Limited outcrops indicate that the Formation contains poorly outcropping shale and siltstone with better outcropping interbeds of blocky sandstone in the upper half.

The Bessie Creek Sandstone is similar to those in the Abner Sandstone. Generally, however, it shows finer bedding, a closer joint system, and is more friable than the Abner Sandstone.

In the extreme north-west of the Sheet area the Maiwok Sub-Group overlies the Bessie Creek Sandstone. In general outcrop is poor, but the Moroak Sandstone Member of the McMinn Formation forms scarps.

South of the Cox River the subdivisions of the Maiwok Sub-Group cannot be recognised. The poorly outcropping rocks overlying the Bessie Creek Sandstone have been called the Cobanbirini Formation. The top is not preserved. The maximum thickness is about 1,500 feet. On Tanumbirini Sheet area the Cobanbirini Formation is at least 4,500 feet thick.

Sedimentary Structures. Cross-bedding is well developed in all the arenites in the Roper Group. In the massive sandstone units e.g. the Hodgson Sandstone Member, the sets are commonly 2-3 feet thick, and in the Jalboi Member they are only 3-4 inches. Both oscillation and current ripple marks are present in the quartz sandstones.

INTRUSIVE ROCKS

In the north-west of the Sheet area dolerite sills intrude the Crawford Formation and Jalboi Member. They extend to the north-west and on Urapunga Sheet area are very extensive where they intrude units throughout the Roper Group and follow stratigraphic beds for up to 30 miles.

They were deformed to the same degree as the sediments they intrude, and the age of the dolerites are therefore considered to be Upper Proterozoic.

PALAEOZOIC

The stratigraphy of the rocks ranging in age from Palaeozoic to Recent is summarized in Table 4.

LOWER TO MIDDLE ?CAMBRIAN

Bukalara Sandstone. The unfossiliferous Bukalara Sandstone is a blanket sandstone of uniform lithology, which rests with strong angular unconformity on the Roper Group. Local slumping is present adjacent to a strong tectonic line. The age of the unit is regarded as Lower Cambrian from evidence on Hodgson Downs Sheet area (Dunn, 1962c).

Cox Formation. This unit conformably overlies the Bukalara Sandstone. The boundary is gradational. The formation consists of interbedded sandstone and siltstone passing up into siltstone and shale. The top of the unit is not preserved; present thickness is about 150 feet. No fossils have been found.

MESOZOIC

Lower Cretaceous Undifferentiated

Erosional remnants of Lower Cretaceous rocks rest with abutment unconformity on older rocks in the Sheet area. Lower Cretaceous rocks form the bed-rock of most of the Coastal Plain. Their maximum observed thickness is only about 80 feet, but their original thickness was probably far greater. Both terrestrial and marine deposits can be recognised. Proximity to shore-lines produced marked lateral variations in lithology.

The basal beds are generally plant-bearing quartz sandstones. These are overlain by quartz sandstones and clayey sandstones containing a marine shelly fauna; conglomerates are common. A marine transgression began in Middle Neocomian in the north and continued into Lower Aptian in the south of the

Sheet area.

Small isolated outcrops of conglomerate and sandstone occur in valleys, and in depressions on the tops of the Main Ranges. They are locally derived and contain plant remains. Massive claystones, similar in lithology to those found on the Barkly-Beetaloo Tableland, with a thick laterite profile developed on them, are present in creeks near the seaward edge of the Coastal Plain. These may overlie rocks equivalent to the fossiliferous sandstone, which outcrop farther to the south-west, because the elevation of the basal Lower Cretaceous rocks decreases to the north-east where the Cretaceous rocks are covered by the sediments of the Coastal Plain.

CAINOZOIC

TERTIARY

Kulampirri Beds. The Kulampirri Beds consists of widespread massive travertine associated with black soil, which are exposed on the Coastal Plain, between the Yiyintyi Range and the Nathan River. The travertine may have been deposited in a Tertiary lake; similar occurrences containing fossils are common elsewhere in the Carpentaria Region.

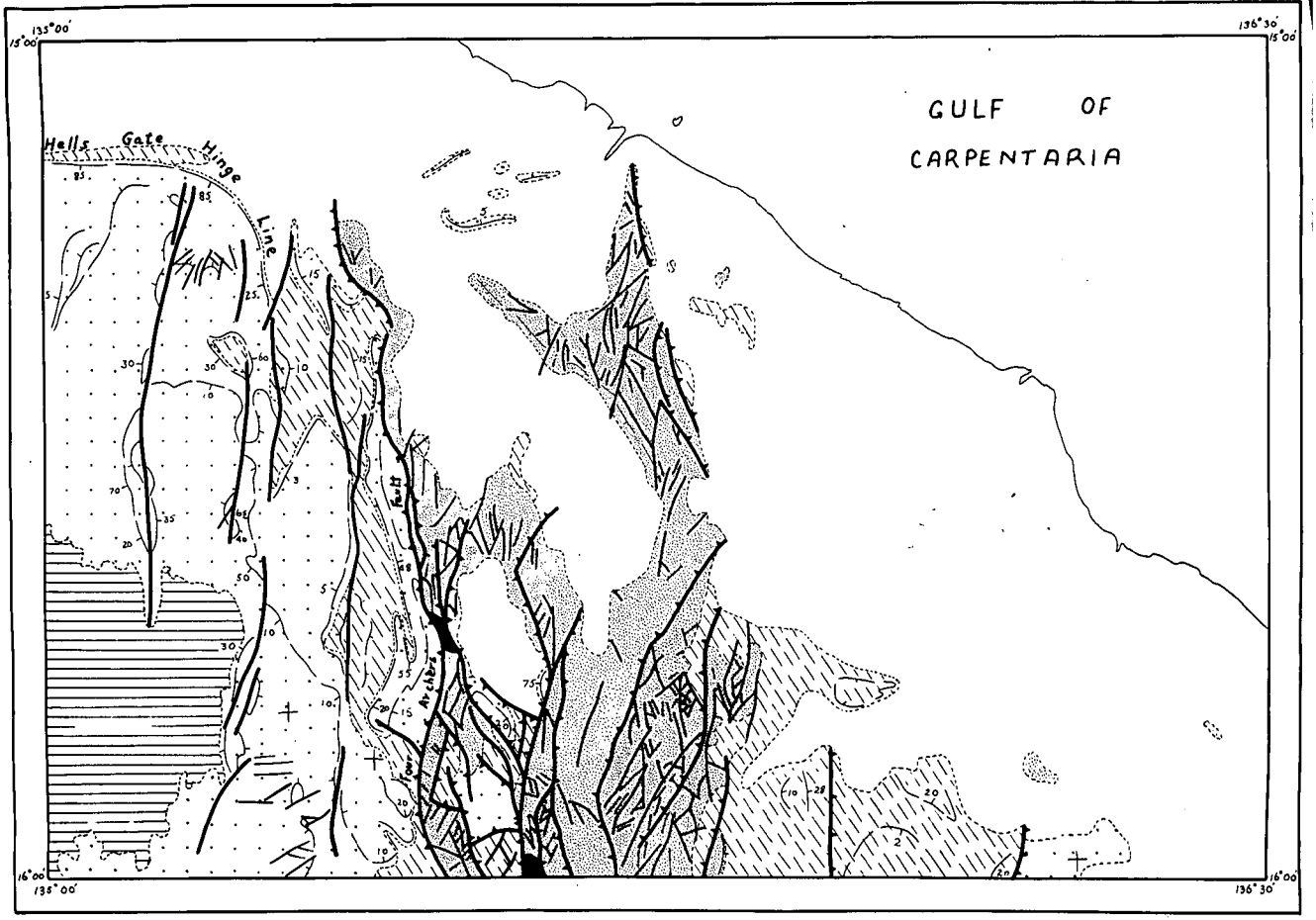
Laterite. A laterite profile, up to about 30 feet thick, is present beneath the sand blanket of the Coastal Plain. The profile is truncated in places by later erosion. It is probably part of the Tertiary Lateritic Plain, which covered most of the Northern Territory. Laterite may have developed locally since the Tertiary.

QUATERNARY

Beatrice Island Limestone. Beatrice Island is composed of a horizontal buff oolitic limestone, 30 feet thick, which unconformably overlies the Tawallah Group rocks. Microfossils include gastropods and lamellibranchs indicating a Sub-Recent age. The limestone is correlated with the Vanderlin Limestone in the Sir Edward Pellew Group (Smith, 1962) and represents a shallow marine deposit exposed by recent eustatic changes in sea level.

TECTONIC SKETCH MAP — MT YOUNG SHEET AREA

Fig. 2



SCALE

10 0 10 20 30 Miles

REFERENCE

- Soil cover
- Cambrian
- Roper Group
- McArthur Group
- Tawallah Group
- Scrutton Volcanics

- Geological Boundary
- 10 Trend line with dip of bedding
- Horizontal dip
- Major fault with direction of downthrow
- Major fault along faulted dome
- Subsidiary fault

Soils. Large areas are covered by alluvium, residual soil, cemented ferruginous detritus, and sand. The relationships are discussed in the physiography of the Coastal Plain and in Table 4.

STRUCTURE

The Upper Proterozoic rocks of the Sheet area were faulted and folded in response to movements in the basement; no shearing is present. Since the Upper Proterozoic no deformation has occurred in the Mt. Young area except for some minor movements on pre-existing faults, but in other parts of the Carpentaria Province Mesozoic sediments are faulted.

Figure 2 illustrates the general structure of the Sheet area.

The overall structure of the Mount Young Sheet area is a broad north-trending anticlinorium, modified by faulting and folding, with the axis in the central part of the Sheet area. This structure can be divided into three zones:-

(i) A zone of associated folds and faults west of the Four Archers Fault.

(ii) A highly faulted zone in the central part of the Sheet area.

(iii) A stable block east of the Tawallah Range.

(i) Fold-Fault Zone west of the Four Archers Fault. Rocks outcropping in this zone belong to the Roper Group with minor inliers of McArthur Group. Deformation has produced a series of faulted domes similar to those described by Read & Hollister (1936) from the Newport-Inglewood belt in Southern California. This structural zone extends to the west onto Hodgson Downs Sheet area.

The faults trend and dip steeply. Small asymmetrical domes, the axes of which trend north-west, are arranged in an en echelon pattern along the faults. The limbs of these folds dip up to 70°, with local dips up to vertical against faults.

The main fault movement appears to be horizontal wrenching, but some normal faulting can be recognised. The domes are best developed along the wrench faults.

Minor subsidiary fault fans are associated with the major faults and make angles of 45° to 60° with them. Some north-west faults are present in the eastern part of the zone and these are probably subsidiary faults related to the Four Archers Fault, which forms the western boundary of the Central Fault Zone.

The areas between the lines of faulted domes are not folded and dips are generally less than 10°.

The sandstones of the Roper Group show a pattern of intersecting joints in which the angle of intersection of the joints is about 60° to 70°. The lines bisecting the acute angles of intersection of these joints generally trend east.

The northern edge of the zone is bounded by the east-trending Hells Gate Hinge Line. Dips are very steep to the south (80° to 85°) and in places overturned 80° to the north. This overturning may indicate compression from the north.

(ii) Central Fault Zone. Outcrops in the Central Fault Zone are mostly Tawallah Group sediments with some McArthur Group and Roper Group, and in places uplift has exposed the basal rocks (Scrutton Volcanics). The structure is dominated by block faulting and tilting of the fault blocks, which is the result of basement uplift and east-west crustal tension.

The Yiyintyi Range is a large, faulted, south-east plunging anticlinorium, but the anticlinal structure of the Tawallah Range area is obscured by the intense faulting.

The major faults vary in strike between north-west and north-north-east; north-north-east is the most common. The fault planes dip steeply and movements are mainly vertical with apparent throws of up to 20,000 feet (Four Archers Fault). The faults, when visible on the ground, are marked by zones of brecciation and silicification about 30 or 40 feet thick.

A closely-spaced set of subsidiary faults is developed, which generally make angles of about 30° with the major faults. The most common trends are north-east, north and north-west. The sandstones of the Tawallah Group have a well developed pattern of joints which parallels these subsidiary faults.

Very little folding has occurred in the Central Fault Zone. Minor warping, with north-west axes, is present in outliers of McArthur and Roper Groups. Within the outcrops of Tawallah Group fault blocks have been tilted to dips of 20° to 50° with local steeper dips due to fault drag.

A problematical structure is present immediately to the west of Mount Young. The Limmen Sandstone strikes west (i.e. at right angles to the regional structure) and dips about 5° to the north. The structure is probably related to the Hells Gate Hinge Line.

(iii) Eastern Stable Block. Deformation decreases to the east of the Central Fault Zone, so that the area east of the Tawallah Range is comparatively stable and is here referred to as the 'Eastern Stable Block'. West of Batten Creek McArthur Group rocks are warped into gentle north-west trending folds. Dips are generally about 5° with a maximum of about 20°. Some small north striking faults are present. East of Batten Creek Roper Group sediments are sub-horizontal.

TECTONIC HISTORY

The Tectonic History of the Sheet Area is summarized in Table 5.

ECONOMIC GEOLOGY

COPPER

Two occurrences of copper, on Coppermine Creek and Sly Creek, are known from the Sheet area. Copper has been reported from near Rosie Creek, but this could not be located during the 1960-61 survey. Copper mineralisation was reported from the Limmen River Watershed in 1918, and it is assumed that this referred to the prospect at Coppermine Creek.

The known occurrences are both in a coarse-grained grey dolomite within the Amelia Dolomite. They are associated with east-west faults with thick zones (up to 200 feet thick at Coppermine Creek) of silicification and brecciation. Malachite is the main mineral at the surface and is secondary after bornite and chalcopyrite, which is present in minor amounts. Malachite is present as disseminated grains and pods and as coatings on joint planes. No subsurface information is available.

Coppermine Creek Locality. This occurrence is on the western side of the Mount Young track about five miles north of the southern boundary of the Sheet area. A shaft, of unknown depth, has been sunk on an iron blow containing abundant malachite staining. Prospecting pits indicate scattered copper over a length of 2,500 feet. The main mineralisation however is confined to a length of 500 feet between the shaft and a small north-east trending cross-fault to the west. This zone corresponds to the intersection of the east-west fault with the massive grey dolomite. The best mineralisation is present within 50 feet of the fault zone, but some copper occurs up to 100 feet away. Some mineralisation is exposed in jaspers and breccias within the fault zone and occasional specks of galena are present.

Spasmodic production has occurred since 1918. Total production to 1957 was 44½ tons of ore and 0.162 tons of metal. Some surface gauging, with hand picking of high-grade ore, was carried out during 1960. The ore, amounting to a few tons, has not been carted away.

Sly Creek Locality. This prospect occurs on the northern side of the track leading to "Hammer's Hut" on Eastern Creek, and is about ¼ mile east of Sly Creek. Copper is present in two small prospecting pits about 100 yards apart. Outcrop between the pits is very poor and the total extent of the copper is not known. No production has been recorded.

IRON

The Sherwin Ironstone Member, which forms ore-bodies on Hodgson Downs and Urapunga Sheet areas, outcrops in the north-west corner of the Sheet area. The rock here is of low grade and not of immediate economic interest.

Small hematite bodies are sometimes present at the intersection of faults and ferruginous sandstones. A hand-picked specimen from one body (75 x 15 yards) near the Sly Creek copper deposit assayed 56.1 percent Fe. The body contained up to 30 percent quartz in places.

An isolated outcrop of Masterton Formation 15 miles south-south-east of Bing Bong Homestead, extending over an area of 1 mile x ¼ mile, is altered to quartz-veined hematite. Hand-picked specimens contained only 21.9 and 31.2 percent Fe.

The Munyi Member of the Abner Sandstone contains up to 25 percent Fe and ferruginous beds within the Masterton Formation contain about 9 percent Fe.

BARYTES

A small deposit of barytes, with minor amounts of galena, is present within dolomitic siltstone and silicified dolomite from the Kookaburra Creek Formation in the bed of Eastern Creek about 10½ miles west of the Mount Young track. The barytes occurs as irregular lenticular bodies up to six or seven feet in length over a distance of about 100 yards. Farther east, within the Tooganinie Formation, small veinlets and vughs are exposed along an east-west line for a farther 200 yards. No sign of faulting is present.

Minor occurrences of barytes were reported by Mount Isa Mines Limited geologists from near Coppermine Creek.

WATER

No bores have been sunk in the Sheet area. There are no permanently flowing streams, but surface water, in the form of permanent water holes, is sufficient to support any pastoral activity since the carrying capacity of the country is limited by poor soils and vegetation. Numerous springs and seepages occur around the edges of sandstone ranges of Tawallah Group and Roper Group rocks.

SALT

Salt deposits occur on the Tidal Flats and would be sufficient to support local pastoral requirements.

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APPENDIX 1

Lower Cretaceous Fossils Collected on Mount Young Sheet Area, (after S.K. Skwarko, 1962)

Locality Number: T.T. 35

Locality: 1½ miles south-east of Rosie Creek Homestead.

Fauna:

Pelecypoda:

- Grammatodon sp. nov.
- Modiolus (?) sp. nov.
- Pseudavicula sp. nov. aff. P. papyracea Eth. Jnr., 1892
- Maccoyella corbiensis (Moore), 1870
- Syncyclonema sp. nov.
- Camptonectes sp. nov. a
- Camptonectes sp. nov. b
- Camptonectes (?) sp. nov. c
- Ostrea sp. ind.
- Exogyra sp. nov.
- Trigonia sp. nov.
- Pterotrigonia (Rinetrigonia) sp. nov.
- Nototrigonia sp. nov. a
- Nototrigonia sp. nov. b
- Trigonia sp. indet.
- Astarte (?) sp. nov.
- Lucina sp. aff. Lucina sp. H. Woods, 1907
- Cyprina (?) sp. nov. a
- Cyprina (Venilicardia) sp. nov. b
- Cyprina (Venilicardia) sp. nov. c
- Dosiniopsis (?) sp. nov.
- Gen. nov. ? sp. nov. a
- Panope sp. nov. a
- Panope sp. nov. b

Gen. et. sp. nov. b

Pelecypod fragments indet.

Gastropoda: Cinulia (?) sp.

Pleurotomaria (?) sp. a

Pleurotomaria (?) sp. b

Gen. et. sp. indet.

Cephalopoda: Ammonite frag. indet.

Age: Upper Neocomian

Locality Number: T.T. 55

Locality: Western edge of Yiyintyi Range; 20 miles north-north-east of Rosie Creek.

Fauna:

Pelecypoda: Maccoyella sp. nov.

Syncyclonema sp. nov.

Camptonectes sp. nov. a

Camptonectes sp. nov. d

Camptonectes cf. sp. nov. d

Lima sp. nov. b

Iotrigonia subgen. nov. sp. nov.

Trigonian gen. nov. sp. nov.

Pterotrigonia (Rinetrigonia) sp. nov.

Trigonia sp. ind.

Panope sp. nov. c

Gastropoda: Cellana (?) sp. nov.

Diodora (?) sp. nov.

Brachiopoda: not identified

Cephalopoda: new species of Dinistobelidae

Plants: Indeterminate

Age: Upper Neocomian

Locality Number: T.T. 56

Locality: 16 miles south-south-west of Rosie Creek.

Fauna:

Pelecypoda: Maccoyella sp. nov. aff. M. barklyi (Moore, 1870

(?) Trigonia sp.

Astarte (?) sp. ind.

Brachiopoda: Indeterminate

Age: Neocomian - Aptian trans.

Locality Number: T.T. 57

Locality: 11 miles south of Rosie Creek

Fauna:

Pelecypoda: Maccoyella sp. nov. aff. M. barklyi (Moore), 1870

Exogyra sp. nov.

Pterotrigonia (Rinetrigonia) sp. nov.

Panope sp. cf. P. sulcata (Etheridge Snn), 1872

Panope sp. cf. P. maccoyi (Moore), 1870

Pelecypod frags. indet.

Age: Neocomian - Aptian trans.

TABLE 1

STRATIGRAPHIC TABLE - MOUNT YOUNG SHEET AREA - SCRUTTON VOLCANICS AND TAWALLAH GROUP

SYSTEM	AGE		ROCK UNIT	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
PRECAMBRIAN	UPPER PROTEROZOIC	TAWALLAH GROUP	Mulholland Sandstone (Btm)	Up to 600	Flaggy, pink to white, fine quartz sandstone. Mud cracks and clay pellet impressions present.	Moderately resistant unit forming small, parallel strike ridges.	Southern part of Sheet area between Four Archers Fault and Tawallah Range.	Not recognised in east. Upper part of the Masterton Formation is a stratigraphic equivalent of the Mulholland Sandstone.
			Masterton Formation (Btn)	2200 ǂ	Flaggy to blocky, white, pink and purple, medium quartz sandstone, ferruginous sandstone and feldspathic sandstone. Flaggy purple ferruginous siltstone. Some basalt. Ripple marks, cross-bedding and clay pellet impressions common.	Resistant unit forming strike ridges and mesas.	Throughout area east of the Four Archers Fault.	East of the Tawallah Range a central unit of flaggy, friable ferruginous sandstone and siltstone can be separated from blocky sandstones above and below. Small lens of basalt present south of Eastern Creek.
			Wollogorang Formation (Bto)	650 ǂ	Flaggy pink, red and grey dolomite and silty dolomite, laminated grey dolomitic siltstone and shale; sandy dolomite and dolomitic sandstone; chert; ferruginous sandstone. Algal structures.	Non-resistant unit forming valleys between resistant sandstones.		Persistant bed containing pyrite pseudomorphs about 100' below top of formation. Siltstone and shale are the dominant lithologies, but crop out very poorly.
			Rosie Creek Sandstone (Btr)	830ǂ	Flaggy and massive, reddish-brown to white, poorly sorted feldspathic sandstone and quartz sandstone. Sometimes micaceous. Locally glauconitic. Some siltstone. Poor cross-bedding and ripple-marks.	Moderately resistant. Forms small strike ridges on back slopes of prominent ranges of Sly Creek Sandstone.		Rocks poorly sorted and rich in feldspar in comparison with rest of Tawallah Group.
			Sly Creek Sandstone (Btl)	1600 ǂ Up to about 3000 maximum	Flaggy to blocky, white to pink, medium quartz sandstone. Some feldspar. Scattered pebble bands. Strongly ripple-marked and cross-bedded.	Very resistant unit forming prominent ridges and ranges.	Throughout central north-south belt of Sheet area.	
			Peters Creek Volcanics (Btp)	740 ǂ	Massive amygdaloidal basalt. Amygdales contain quartz, microcline, chlorite, and epidote.	Non-resistant unit forming valleys between resistant sandstones.		Widespread alteration of the basalts. Separate flows, up to 70 feet thick, can be recognised.
			Yivintyi Sandstone (Bty)	8500	Flaggy to blocky, white to pink, medium quartz sandstone. Strongly ripple-marked and cross-bedded. Minor conglomerate, arkose and lithic sandstone.	Very resistant unit. Forms core of the Yivintyi and Tawallah Ranges.		Conglomerates, arkose and lithic sandstones (containing volcanic fragments) present at base where rocks rest unconformably on Lower Proterozoic. Thin quartz veins common near base.
	LOWER PROTEROZOIC(?)		Scrutton Volcanics (Bls)	Base not exposed.	Porphyritic dacite and quartz porphyry with interbedded medium feldspathic sandstone. Minor dolerite intrusions.	Rounded hills with moderate relief.	Southern border of Sheet area on western side of Tawallah Range. Against Four Archers Fault due west of Rosie Creek.	Unconformably overlain by Tawallah Group. Tentatively regarded as Lower Proterozoic in age.

ǂ Denotes thickness measured on ground. Other thicknesses estimated from maps.

TABLE 2

STRATIGRAPHIC TABLE - MOUNT YOUNG SHEET AREA - McARTHUR GROUP

SYSTEM	AGE		ROCK UNIT	THICKNESS IN FEET	LITHOLOGY	DISTRIBUTION	STRATIGRAPHIC EQUIVALENTS	REMARKS
PRECAMBRIAN	PROTEROZOIC	UPPER	Billengarrah Formation (Bmb)	Up to 1000	Massive chert breccia, flaggy siltstone, quartz sandstone, chert. Slump structures common.	South-western part of Sheet area around Eastern Creek and Blackfellow Creek.	Kookaburra Creek to north. Emmerugga Dolomite and Stott Formation on Bauhinia Downs.	Silicification common. Unconformably overlain by Roper Group.
		McARTHUR GROUP — BAUHINIA DOWNS SUB-GROUP	Tooganinie Formation (Bmt)	1000 minimum. Thickens southwards.	Rhythmically alternating sequence of flaggy purple dolomite, algal dolomite, purple dolomitic siltstone, fine red sandstone with halite pseudomorphs, flaggy ripple marked quartz sandstone.	South-western part of Sheet area around Eastern Creek and northwards along Limmen Bight River.	Part of Vizard Formation in north. Lynott Formation, Yalco Formation and Stretton Sandstone in east, plus Looking Glass Formation on Bauhinia Downs.	Rhythmic alternations are very regular. Back-reef facies.
			Tatoola Sandstone (Bmd)	350 ±	Flaggy white, reddish-brown and yellow-brown dolomitic quartz sandstone. Ferruginous in places. Medium quartz sandstone. Shallow water sedimentary structures common.		Warramana Sandstone in east. Prominent quartz sandstone within Vizard Formation to north.	Dolomite frequently leached in outcrop giving porous ferruginous sandstone and quartz sandstone. Blanket sandstone present throughout back-reef area.
			Amelia Dolomite (Bma)	470 ±	Flaggy fine grained dolomite and dolomitic siltstone with chert bands; massive blue-grey dolomite; algal dolomite; fissile green siltstone.		Upper part of Festing Creek Formation in east. Basal Vizard Formation to north.	Dolomites frequently show silicified cappings on tops of hills.
			Mallapunyah Formation (Bml)	800 ±	Flaggy purple siltstone; ferruginous sandstone with cross-bedding and ripple marks; yellow-brown dolomite. Minor chert, oolitic chert, algal chert, white siltstone.	Central southern part of Sheet area.	Basal Festing Creek. Formation in east.	Silicification of some dolomite beds very common.
		McARTHUR GROUP — BATTEN SUB-GROUP	Stretton Sandstone (Bmr)	About 500	Flaggy pink medium quartz sandstone with abundant shallow water sedimentary structures. Minor fissile green siltstone.	South-east part of Sheet area.	Sandstone of similar type in Vizard Formation to north-west Leila Sandstone Member in back-reef area on Bauhinia Downs.	Blanket sand of uniform thickness over wide area of fore-reef area.
			Yalco Formation (Bmj)	About 500	Rhythmically alternating laminated white siltstone, claystone and chert. Slump structures. Graded bedding visible in thin sections.	South-east part of Sheet area.	Part of Tooganinie Formation in west. No equivalent present in Vizard Formation to north.	Forms good marker bed due to good outcrop. Fore-reef facies.
			Lynott Formation (Bmm)	About 2000	Flaggy grey to white dolomitic siltstone and cherty siltstone. Minor sandstone, chert and chert breccia. Some slump structures. Graded bedding.	South-east part of Sheet area.	Part of Tooganinie Formation in west. Part of Vizard Formation in north.	Dolomite frequently leached in outcrop producing white porous siltstone. Fore-reef facies.
			Hammer Creek Member (Bmg)	About 1700	Flaggy chert and cherty siltstone, silicified dolomitic siltstone, massive chert breccia, quartz sandstone, oolitic chert.	Eastern part of Sheet area.	Basal Lynott Formation in south. Basal Tooganinie Formation in west. Part of Vizard Formation to north.	Distinguished from the Lynott Formation as a whole by greater abundance of chert, chert breccia and sandstone. Fore-reef facies.

± Denotes thickness measured on ground. Other thicknesses estimated from maps.

TABLE 2 - (Contd.)

SYSTEM	AGE	ROCK UNIT	THICKNESS IN FEET	LITHOLOGY	DISTRIBUTION	STRATIGRAPHIC EQUIVALENTS	REMARKS
		Warramana Sandstone (Bmx)	About 100	Flaggy white to reddish-brown medium quartz sandstone. Strongly cross-bedded.	Eastern part of Sheet area.	Dies out to south. Tatoola Sandstone in west. Prominent quartz sandstone in Vizard Formation to north.	Good marker bed in east. Crops out well.
PRECAMBRIAN	UPPER PROTEROZOIC	Festing Creek Formation (Bmz)	About 1100 maximum	Massive basalt, amygdaloidal basalt. Minor trachyte and tuffs. Flaggy dolutite and dolomitic siltstone, blocky dolomite with gypsum(?) crystals. Minor oolitic chert, sandstone and arkose.	Eastern part of Sheet area.	Amelia Dolomite and Mallapunyah Formation to south and west. Basal Vizard Formation in north.	
		Kookaburra Creek Formation (Bmu)	Greater than 500	Cross-bedded oolitic chert, banded chert, dolomitic siltstone, chert breccia, massive algal dolomite, quartz sandstone.	West of the Four Archers Fault and north of Eastern Creek.	Billengarrah Formation to south. Stott Formation and Emmerugga Dolomite on Bauhinia Downs.	Silicification common. Lateral change in Billengarrah Formation sudden.
	Mc ARTHUR GROUP	Mount Birch Sandstone (Bmh)	About 300	Medium quartz sandstone with chert fragments, chert conglomerate. Strong cross-bedding.		Smythe Sandstone to the south-east on Bauhinia Downs.	Lenses out south of Eastern Creek. Good marker bed.
		Vizard Formation (Bmv)	About 4000	Flaggy dolomitic siltstone; cherty siltstone; chert; blocky medium to coarse quartz sandstone and feldspathic sandstone; massive chert breccia.	Crops out in area near junction of Cox and Limmen Bight Rivers.	In west equivalent to Tooganinie Formation, Tatoola Sandstone, Amelia Dolomite and Mallapunyah Formation. In east equivalent to Stretton Sandstone, Yalco Formation, Lynott Formation, Warramana Sandstone and Festing Creek Formation.	Originally defined on Urapunga Sheet Area where it was not practical to map subdivisions. Basal section not exposed on Mount Young Sheet area. Algal dolomites present at base on Urapunga.

TABLE 3

STRATIGRAPHIC TABLE - MOUNT YOUNG SHEET AREA - ROPER GROUP AND IGENOUS INTRUSIONS

SYSTEM	AGE		ROCK UNIT	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
PRECAMERIAN	UPPER PROTEROZOIC	ROPER GROUP — MAIWOK SUB-GROUP	McMinn Formation Kyalla Member (Bry)	300 preserved	Flaggy fine micaceous sandstone, siltstone and shale.	Low rounded hills and rises with poor outcrop.	Confined to north-west corner of Sheet area.	
			Sherwin Ironst Ironstone Member (Brz)	30	Medium-grained ferruginous quartz sandstone. Colitic hematite.	Locally caps dip-slopes of Moroak Sandstone Member.		Interfingers with Kyalla Member and Moroak Sandstone Member.
			Moroak Sandstone Member (Brk)	200	Blocky, red and white, medium quartz sandstone.	Crops out well. Forms hog-backs and cuestas.		
			Velkerri Formation (Brv)	1,000	Laminated siltstone and shale.	Featureless plains with very poor outcrop.		Crops out only where preserved beneath scarp of Moroak Sandstone Member.
			Cobanbirini Formation (Brb)	1,500+	Shale, flaggy fine micaceous sandstone and siltstone.	Featureless plains with very poor outcrop.	West of the Four Archers Fault. (Only crops out near Wilarra Twin Springs where preserved beneath scarp of Bukalara Sandstone).	Stratigraphic equivalent of the Maiwok Sub-Group.
			Bessie Creek Sandstone (Bre)	West 400 ± / East 415 ±	Massive, white and red, medium to fine quartz sandstone. Ripple-marked and cross-bedded.	Good outcrop. Forms cuestas, hog-backs, rare mesas and sand covered plateaux.	West of the Four Archers Fault.	Weathering along joints produces "Castle" topography. Sandstone is friable except where silicified.
			Corcoran Formation (Bro)	420 ± / 520 ±	Shale and siltstone. Blocky medium to fine quartz sandstone towards top.	Poor outcrop. Forms valleys between resistant sandstone ridges		
			Abner Sandstone Undifferentiated (Bra)	80	Massive, white, medium to coarse quartz sandstone.	Forms capping on low plateaux.	South-east corner of Sheet area.	Thin markedly to south-east where individual members cannot be recognised.
			Munyi Member (Brm)	95± / 25 ±	Massive and blocky coarse ferruginous quartz sandstone.	Locally forms veneer on dip-slope of Hodgson Sandstone Member.		Thickens to 200 feet on Hodgson Downs Sheet area.
			Hodgson Sandstone Member (Brh)	325 ± / 390 ±	Massive and blocky, white and red, medium to coarse quartz sandstone. Ripple marked and cross-bedded.	Resistant units. Form prominent hog-backs and cuestas.	Western part of Sheet area.	Weathering along joints produces "Castle" topography. Friable when not silicified.
			Jalboi Member (Brj)	420 ± / 200 ±	Alternating massive quartz sandstone and blocky ferruginous quartz sandstone with rare glauconite.			Thins southwards. Probably contains considerable fine micaceous interbeds which do not crop out.
			Arnold Sandstone Member (Brx)	160 ± / 175 ±	Massive to blocky, white to pink, coarse to medium quartz sandstone. Some pebble conglomerate. Ripple-marked and cross-bedded.			Thickens towards south.

TABLE 3 (Contd.)

SYSTEM	AGE	ROCK UNIT	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
PRECAMBRIAN	UPPER PROTEROZOIC	Crawford Formation (Brr)	West 530 ✱ East 280 ✱	Flaggy, pink and red, fine, micaceous sandstone and feldspathic sandstone with glauconite. Blocky quartz sandstone interbeds near top. Micaceous quartz greywacke at base.	Forms scarp beneath capping of Abner Sandstone.	Western and southern parts of Sheet area.	Elongate, rounded granules of glauconite are widespread and characteristic.
		Mainoru Formation (Bru)	1780 ✱ Thins eastwards	Flaggy, brown and grey, micaceous siltstone and fine sandstone. Minor dolomite lenses 50 feet from base.	Poor outcrop. Forms valleys between sandstone ridges.	Western part of Sheet area.	
		Limmen Sandstone (Bri)	435 ✱ Up to 700 maximum.	Blocky and massive, purple and white, fine to coarse quartz sandstone and feldspathic sandstone; flaggy micaceous siltstone and sandstone; pebble conglomerate.	Good outcrop. Forms prominent cuestas, hog-backs and mesas.	Western and southern parts of Sheet area.	Unconformably overlies the McArthur Group. Thickens west of the Limmen Bight River. Flaggy micaceous siltstone and sandstone at base rarely crop out.
		Intrusions (Bdl)	Up to 200	Massive dolerite	Poor outcrop. Forms valleys between sandstone ridges.	North-west corner of Sheet area.	Sills intrude Crawford Formation and Jalboi Formation.

✱ Denotes thickness measured on ground. Other thicknesses estimated from maps.

TABLE 4

STRATIGRAPHIC TABLE - MOUNT YOUNG SHEET AREA - PALAEOZOIC TO RECENT

SYSTEM	AGE	ROCK UNIT	THICKNESS IN FEET	LITHOLOGY	TOPOGRAPHY	DISTRIBUTION	REMARKS
CAINOZOIC	QUATERNARY	(Qa)	Usually 20 to 30. Greater than 50 in places.	Alluvial black soil, sand, silt, gravel.	River flats.	Flood plains of major streams. Best developed around Limmen Bight River and its tributaries.	Eustatic change in sea level has entrenched the rivers into their own flood plains.
		(Qa)	-	Coastal deposits. Fine sand, silt, evaporites.	Tidal Flats.	Narrow strip up to 5 miles wide bordering the coast and major estuaries.	
	CAINOZOIC Mostly Quaternary	(Czs)	-	Residual soils, blanket sand, cemented ferruginous detritus.	Coastal plains, valleys, plateau cappings.	Universal.	Widespread sand blanket of probable marine origin covers coastal plain. Sand dunes bordering the coast.
	CAINOZOIC Probably Quaternary	(Czs)	-	Cemented ferruginous sand dunes.	Low rises on Coastal Plain.	Coastal Plain	Ancient sand dunes preserved by cementing of ferruginous material.
				UNCONFORMITY			
	QUATERNARY	Beatrice Island Limestone (Qze)	30	Massive, buff, oolitic limestone.	Raised platform 30 feet above present sea level.	Beatrice Island.	Small gastropods and lamellibranchs indicate Sub-Recent age.
				UNCONFORMITY			
	TERTIARY(?)	Kulampirri Beds (Tk)	-	Massive travertine.	Poor outcrop within black soil plain on Coastal Plain.	Between Nathan River and Yiyintyi Range.	Fresh water lake deposit.
		(Czl)	-	Laterite and lateritic soil.	Outcrops in creek banks within Coastal Plain.	Coastal Plain.	Remnant of Tertiary Lateritic Plain. Best developed on Lower Cretaceous claystone.
				UNCONFORMITY			
MESOZOIC	LOWER CRETACEOUS	Undifferentiated (Kl)	Maximum observed section 80	Buff, white and red, clayey sandstone; white to red quartz sandstone; conglomerate; claystone and sandy claystone. Local silicification.	Small mesa cappings, low outcrops within coastal plain, valley infillings.	Small discontinuous outcrops throughout the Sheet area.	Both marine and freshwater facies present. Marine overlies freshwater when present together.
				UNCONFORMITY			
PALAEOZOIC	LOWER To MIDDLE ?CAMBRIAN	Cox Formation (Elc)	150 preserved	Purple micaceous siltstone and fine sandstone; green shale; medium quartz sandstone.	Undulating surface on top of plateau.	Confined to Cox River Plateau in south-west corner of Sheet area.	Contact with underlying Bukalara Sandstone gradational.
		Bukalara Sandstone (Elb)	Up to 100	Massive, buff, cross-bedded, fine to coarse, slightly feldspathic quartz sandstone.	Forms Cox River Plateau.	Confined to Cox River Plateau in south-west corner of Sheet area.	Characteristic west-north-west striking joint system visible on air-photographs.
				UNCONFORMITY			

TABLE 5

TECTONIC HISTORY - MOUNT YOUNG SHEET AREA

SYSTEM	AGE	EVENT	REMARKS
CAINOZOIC	Tertiary to Recent	Slight epeirogenic uplift and downwarping with erosion and sedimentation.	Continuous erosion of topographically high areas. Eustatic changes in sea level - alternating erosion and sedimentation on Coastal Plains. Alluvial flats developed around streams.
	Tertiary	Deposition of fresh water lake deposits	Peneplain conditions on area corresponding to present Coastal Plain. Main Ranges present as topographic highs.
		Lateritization.	
MESOZOIC		Epeirogenic uplift and marine transgression. Slight erosion.	Peneplain developed on Lower Cretaceous sediments.
	Lower Cretaceous	Marine transgression and deposition of fresh-water and marine sediments on Stable Shelf.	Slow transgression of sea from north to south. Topographically high areas remained as islands with fresh-water sedimentation in depressions.
		Epeirogenic uplift and erosion.	Area dissected to produce a topography similar to present day.
PALAEOZOIC	Lower Cambrian	Deposition of Bukalara Sandstone and Cox Formation on Stable Shelf.	
PRECAMBRIAN	Upper Proterozoic	Orogenic uplift and erosion.	Basement uplift and faulting produced faulting and folding of the Upper Proterozoic rocks.
		Deposition of Roper Group (5,500 feet of micaceous siltstones and arenites) on shelf with variable rate of subsidence.	Centre of sedimentation moved westward. Marked thinning in east. Variable rate of subsidence shown by quartz sandstone alternating with micaceous siltstone and quartz greywacke.
		Local uplift and erosion of the McArthur Group.	Up to 3,500 feet of section eroded in the east.
		Formation of the Batten Trough and deposition of the McArthur Group (10,000 feet of carbonates). 3 stages of Tectonic Development (1) Subsiding Shelf (2) Rapidly subsiding trough in east with subsiding shelf in west bounded by hinge-line. (3) Subsiding Shelf.	Marked thinning of sediments to east of Sheet area; no sediments to west. Area generally a subsiding shelf. Hinge line formed during middle stage with increased subsidence in the east. Total thickness in west 4,000 feet; total in east 10,000 feet. Some volcanics near beginning of McArthur Group. (See Stratigraphy of McArthur Group for detail).
		Deposition of Tawallah Group (14,000 feet of arenites with some carbonates and volcanics) on a widespread subsiding shelf.	Sedimentation uniform over wide area. Sedimentation kept pace with subsidence giving rise to thick sequences of quartz sandstone.
	(?)Lower Proterozoic	Orogenic uplift and folding.	Lower Proterozoic sediments and volcanics folded.
		Acid vulcanism - Scrutton Volcanics.	Oldest rocks exposed.

PRELIMINARY EDITION, 1962

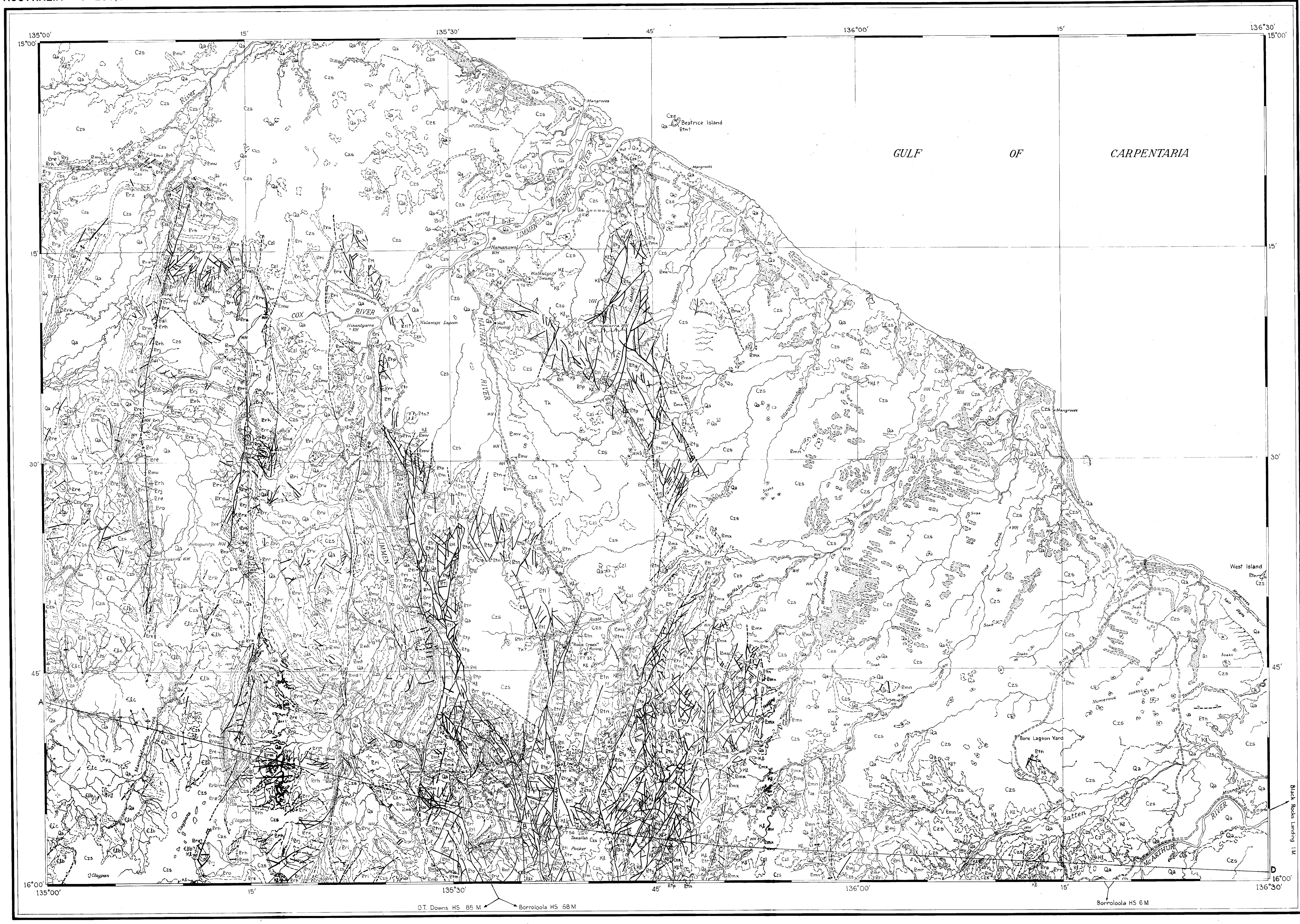
SUBJECT TO AMENDMENT

AUSTRALIA 1:250,000

MT YOUNG

NORTHERN TERRITORY

1:250,000 GEOLOGICAL SERIES SHEET SD 53-15



Reference

Symbol	Explanation
	Geological boundary
	Synclinal axis, showing plunge
	Anticlinal axis, showing plunge
	Fault
	Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted. Faults are shown by short dashes
65	Strike and dip of strata
+	Horizontal strata
	Trend of bedding showing direction of dip (Air-photo interpretation)
	Horizontal strata (Air-photo interpretation)
	Joint pattern (Air-photo interpretation)
	Macrofossil locality
TT 35	Text reference to fossil locality
	Mine or prospect
Ba	Barium
Cu	Copper
Fe	Iron
Pb	Lead
	Circle around mineral symbol indicates unexploited deposit
====	Vehicle track
HS	Homestead
Yd	Yard
WH	Waterhole
	Soak
S	Spring
	Astro station
	Escarpment
	Reef

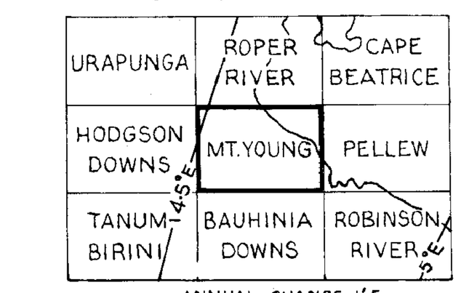
Reference

Era	Period	Group	Unit	Symbol	Description
CAINOZOIC	QUATERNARY			Qa	Alluvium
				Qa	Coastal silt, sand and evaporite deposits
	UNDIFFERENTIATED			Czs	Soil, sand, ferruginous cemented detritus
				Czs	Fixed ancient coastal deposits
				Czl	Laterite, lateritic soil
			Beatrice Island Limestone	Cze	Massive oolitic limestone
	TERTIARY		Kulampirri Beds	Tk	Travertine
MESOZOIC	LOWER CRETACEOUS Neocomian?		Undifferentiated	Kl	Friable, yellow, clayey sandstone. Massive white quartz sandstone and conglomerate
PALAEOZOIC	LOWER TO MIDDLE? CAMBRIAN		Cox Formation	€lc	Flaggy micaceous siltstone; green shale; blocky to massive white sandstone
			Bukalara Sandstone	€lb	Massive, medium to coarse-grained quartz sandstone
PRECAMBRIAN	UPPER PROTEROZOIC			Ꝑdl	Dolerite sills
		Roper Group; Maiwok Sub-Group	McMinn Formation		
			Kyalla Member	Ꝑry	Flaggy fine micaceous sandstone. Siltstone and shale
			Sherwin Ironstone Member	Ꝑrz	Oolitic hematite, ferruginous medium-grained sandstone
			Moroak Sandstone Member	Ꝑrk	Blocky, red and white, medium-grained quartz sandstone
			Velkerri Formation	Ꝑrv	Laminated siltstone and shale
		Roper Group	Cobanbirini Formation	Ꝑrb	Flaggy, grey, fine micaceous sandstone. White shale
			Bessie Creek Sandstone	Ꝑre	Massive, white to red, medium to coarse quartz sandstone
			Corcoran Formation	Ꝑro	Black and white shale; flaggy and blocky, grey and white, medium to fine quartz sandstone
			Abner Sandstone	Ꝑra	Massive, white, medium to coarse quartz sandstone
			Munyi Member	Ꝑrm	Massive and blocky, purple, coarse ferruginous quartz sandstone
			Hodgson Sandstone Member	Ꝑrh	Massive, white to red, medium to coarse, quartz sandstone
			Jalboi Member	Ꝑrj	Massive, medium to coarse quartz sandstone, with blocky and flaggy micaceous fine quartz sandstone interbeds
			Arnold Sandstone Member	Ꝑrx	Massive, white to red, coarse to medium-grained quartz sandstone
			Crawford Formation	Ꝑrr	Flaggy and blocky, red-brown, fine micaceous glauconitic quartz sandstone, minor massive quartz sandstone interbeds
			Mainoru Formation	Ꝑru	Flaggy, brown and grey, micaceous siltstone and fine-grained sandstone, local thin carbonate lenses
			Limmen Sandstone	Ꝑri	Blocky, purple and white, fine quartz sandstone; massive, purple micaceous sandstone; flaggy red fine micaceous sandstone
		McArthur Group	Billengarrah Formation	Ꝑmb	Massive chert breccia; flaggy siltstone, quartz sandstone; chert
		McArthur Group; Bauhinia Downs Sub-Group	Tooganinie Formation	Ꝑmt	Alternating flaggy dolomite, algal dolomite, dolomitic siltstone, sandstone with halite pseudomorphs; quartz sandstone
			Tatoola Sandstone	Ꝑmd	Flaggy, white and red-brown, fine-grained dolomitic sandstone, and medium-grained quartz sandstone
		McArthur Group	Amelia Dolomite	Ꝑma	Laminated, fine-grained dolomite and dolomitic sandstone; massive dolomite; algal dolomite; fissile green siltstone
			Mallapunyah Formation	Ꝑml	Purple siltstone, ferruginous quartz sandstone, dolomite; chert, oolitic chert, algal chert; flaggy white siltstone
		McArthur Group; Batten Sub-Group	Stretton Sandstone	Ꝑmr	Thinly flaggy, fine to medium-grained pink to white quartz sandstone
			Yalco Formation	Ꝑmj	Laminated white siltstone, claystone and chert
			Lynott Formation	Ꝑmn	Flaggy cherty siltstone and dolomitic siltstone, sandstone, chert, chert breccia
			Hammer Creek Member	Ꝑmg	Flaggy white chert and cherty siltstone; massive chert breccia
		McArthur Group	Warramana Sandstone	Ꝑmx	Blocky, white to pink, medium-grained quartz sandstone
			Festing Creek Formation	Ꝑmz	Pink dolomite, chert, porphyritic basic volcanics, laminated purple and green tuff
			Kookaburra Creek Formation	Ꝑmu	Oolitic chert, banded chert, flaggy dolomitic siltstone, chert breccia, algal dolomite, quartz sandstone
			Mount Birch Sandstone	Ꝑmh	Blocky, medium-grained quartz sandstone, with chert pebbles, oligomictic conglomerate
			Vizard Formation	Ꝑmv	Dolomitic siltstone, cherty siltstone, quartz sandstone, feldspathic sandstone, dolomitic sandstone, chert and chert breccia
		Tawallah Group	Mulholland Sandstone	Ꝑtm	Flaggy, white to grey, fine to medium-grained quartz sandstone
			Masterton Formation	Ꝑtn	Blocky, purple and white, medium-grained quartz sandstone, minor feldspathic sandstone
			Wollogorang Formation	Ꝑto	Dolomitic siltstone, flaggy grey and pink finely crystalline dolomite, dolarenite, dolomitic sandstone, chert
			Rosie Creek Sandstone	Ꝑtr	Flaggy, purple and white, very coarse to fine quartz sandstone; ferruginous and feldspathic glauconitic siltstone
			Sly Creek Sandstone	Ꝑtl	Blocky, white to pink, medium-grained quartz sandstone
			Peters Creek Volcanics	Ꝑtp	Amygdaloidal basalt
			Yiyintyi Sandstone	Ꝑty	Blocky, white, medium to coarse quartz sandstone, minor arkose and pebble to boulder conglomerate
	LOWER PROTEROZOIC		Scrutton Volcanics	Ꝑls	Porphyritic dacite, feldspathic sandstone, tuff. Minor dolerite dykes

Compiled and published by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Division of National Mapping, Department of National Development. Aerial photography by the Royal Australian Air Force; complete vertical coverage at 1:50,000 scale. Transverse Mercator Projection.

INDEX TO ADJOINING SHEETS

Showing Magnetic Declination



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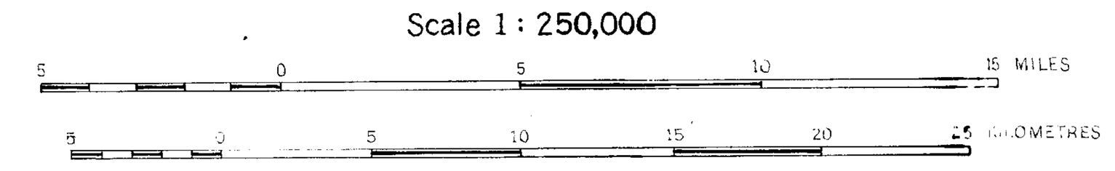
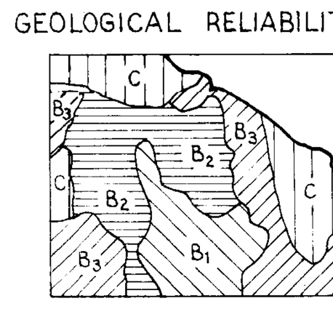


GEOLOGICAL RELIABILITY DIAGRAM



B_1 Detailed reconnaissance - numerous ground traverses, and air-photo interpretation

B_2 Reconnaissance - ground traverses, and air-photo interpretation.

B_3 Reconnaissance - helicopter traverses, and air-photo interpretation

C Air-photo interpretation

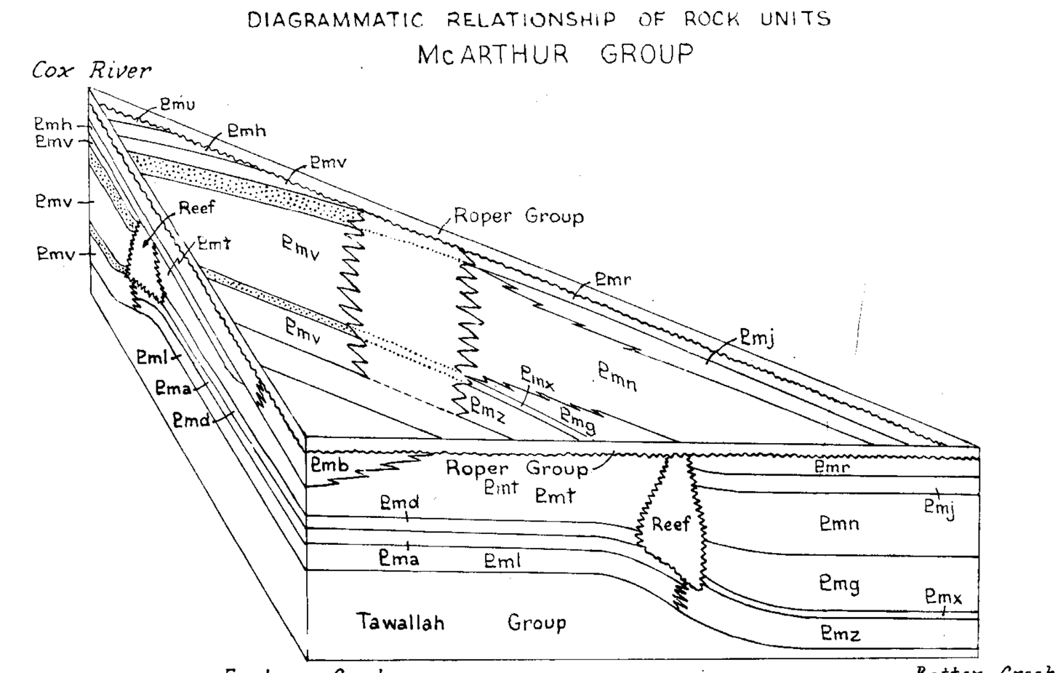
Geology, 1960-61, by: P.R.Dunn, A.G.L.Paine, K.A.Plumb, H.G.Roberts, J.M.Rhodes, K.R.Yates.

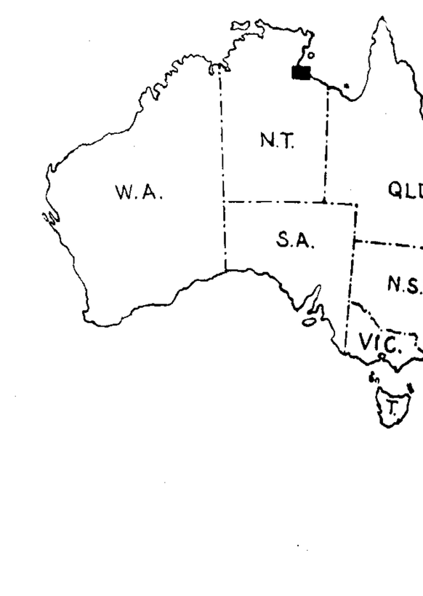
Compiled, 1961, by: K.A.Plumb, K.R.Yates, F.J.Roberts.

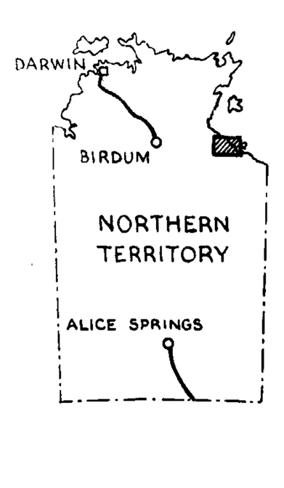
Drawn, June 1962, by: F.J.Roberts.

DIAGRAMMATIC RELATIONSHIP OF ROCK UNITS

McARTHUR GROUP







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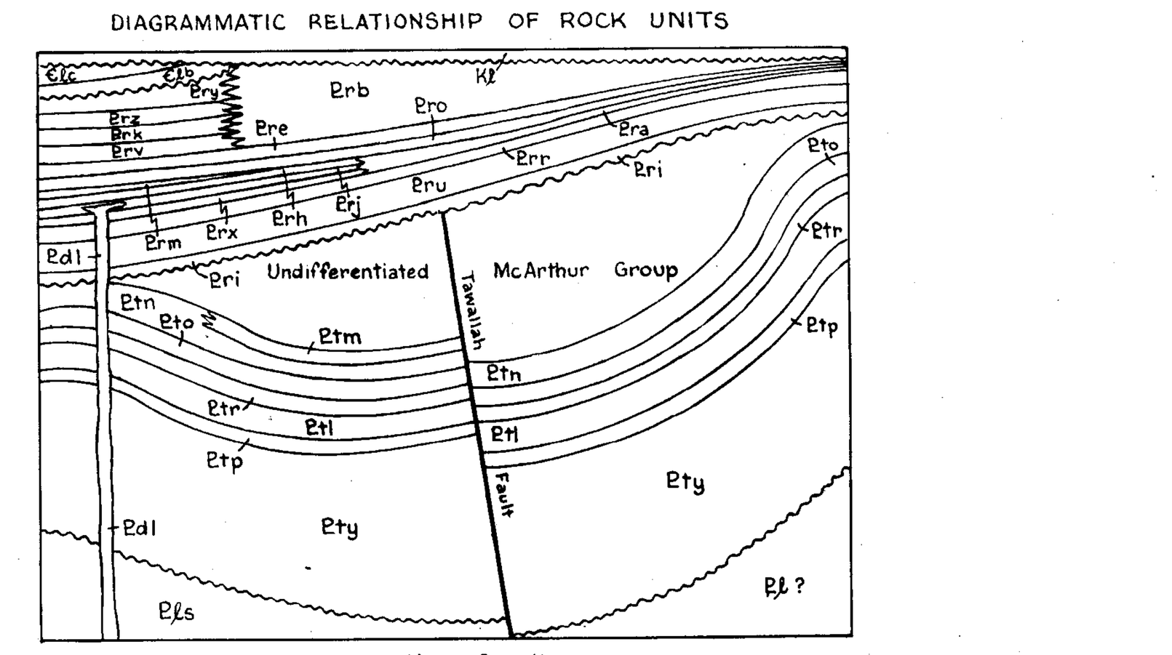

Section A-B-C-D

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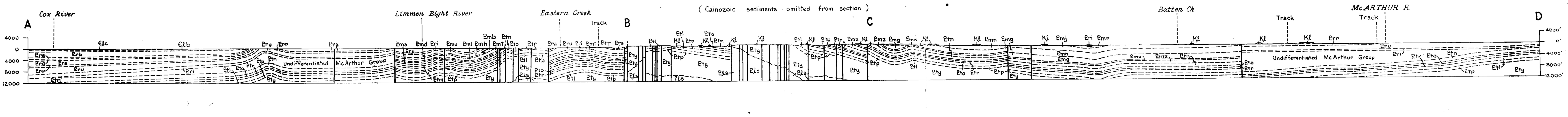
(Cainozoic sediments omitted from section)



MT. YOUNG

SHEET SD 53-15