COMMONWEALTH OF AUSTRALIA.

224.

DEPARTMENT OF NATIONAL DEVELOPMENT.

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EXPLANATORY NOTES ON THE MINILYA SHEET, WESTERN AUSTRALIA

by

M. A. Condon

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GEOLOGICAL INVESTIGATIONS

The earliest recorded geological work on the area covered by the Minilya four-mile sheet was that of Woodward (1907) who examined the country north of the Minilya River and noted the limestone on the west flank of the Giralia Anticline. In 1909 A. Gibb Maitland described the Carboniferous and Permian succession in the area drained by the Gascoyne, Lyons, Minilya and Lyndon Rivers, but referred the whole sequence to the Carboniferous.

Geologists of Oil Search Ltd., under D. Dale Condit, examined the Carnarvon Basin in 1932, 1934 and 1935. Raggatt (1936) described the stratigraphy of the Permian in some detail and subdivided the Cretaceous sequence. Raggatt and Fletcher (1937) examined the fauna of the Permian of the Carnarvon Basin.

Teichert did detailed stratigraphic work in the Wandagee area from 1938 to 1940.

Geologists of the Bureau of Mineral Resources mapped the Minilya Sheet from 1948 to 1951, using R.A.A.F. aerial photographs.

The present sheet is entirely the result of the mapping of the Bureau geologists although much of the stratigraphic nomenclature is adapted from Raggatt's and Teichert's work.

PHYSIOGRAPHY

The area covered by the Minilya four-mile sheet consists of coastal plains at two levels, the higher at 900 to 1200 feet above sea level and the lower from the coast to about 600 feet above sea level. The two plains are separated by a steep scarp from 100 to 400 feet high. Both plains slope very gently towards the coast. The higher plain in this area is very much dissected, so that only isolated remnants indicate the extent and level of this older surface. Typical remnants are the surface of Moogooloo, of the mesas east of Williambury Homestead and the top of the Black Range. The low level plain occupies the greater part of the area. The area between the coast and Moogooloo Range is probably mainly a plain of marine erosion in which the very gently dipping Cretaceous sediments have been truncated on the area east of the coast for about 40 miles, a thin veneer of Tertiary sediments has been deposited on this erosion surface. The shape of the coast and of the Salt Lake is determined largely by the configuration of large gently dipping anticlines in the Tertiary limestone. The area of the low-level plain eastward of the Moogooloo Range is mainly a plain of river and sheet erosion. The sedimentary bedrock is exposed or covered by a thin layer of sand or alluvium.

The scarp between the two plains is generally very steep and in places precipitous. The resistant lateritized surface of the high-level plain forms the cap of the scarp, the rate of erosion of which is controlled by the erosion of the underlying rocks so that a steep scarp is maintained.

The main rivers, the Yannarie, Lyndon and Minilya rise near the eastern margin of the area, in the Black Range which separates the drainage of these rivers from that of the Lyons River. Although they rise in the area of outcrop of Pre-Cambrian rocks, they are probably not very old streams. At the time of emergence of the Merlinleigh Sandstone the whole area was probably a gently west-sloping coastal plain on the surface of which the ancestors of the present rivers established courses consequent to the slope. These streams are superimposed on the structure of the bedrock so that, although their direction of flow agrees in general with the direction of dip of the sediments, they are not true consequent streams in relation to the Permian strata. There has been some late minor entrenchment of the rivers particularly the Minilya upstream of the Wandagee Hill Fault and the Lyndon upstream of the Mia Mia Homestead. This rejuvenation is believed to be due to uplift of the eastern block along faults. It is possible that the elevation of the high-level plain was produced by movement along these same faults, at an earlier (? post Miocene) time.

Large parts of the surface are occupied by longitudinal (seif) sand ridges. The sand forming these ridges is of two main kinds - the residual sand developed at the surface of the laterite profile on the high-level plain and the deposited sand of the low-level plain. Minor importance is sand produced by weathering of sandy formations exposed on the low-level plain. Though the sand is of different origins, the sand ridges were probably all formed at the same time during one of the very arid stages of the Pleistocene. The sand ridges are now fixed by spinifex and low scrub vegetation.

Around the shores of Salt Lake are a number of low ranges which are young fold ridges, produced by the upfolding of Tertiary limestone at a late period. In the Minilya sheet area, these folds have been named Gnarraloo Yerroora (on the west side) Chargoo, Gerardi, Chirrida, Minilya and Homestead (on the east side of Salt Lake). The breached Giralia Anticline, with Cardabia Creek flowing south along its axial region, has produced cuestas on its west flank. The main east-facing dip scarp is referred to as the Giralia Range. The Chargoo is also a breached anticline.

The Salt Lake is a cut-off arm of the sea, owing its form to the synclinal structure of the Tertiary limestone between the anticlines on either side.

STRATIGRAPHICAL NOMENCLATURE

Rock units are named according to the Australian Code of Stratigraphical Nomenclature. All names used have been formally established (Condon, 1954). The precise age of many of the rock units is still in doubt; where there is any doubt about the age determination of a rock unit the age name is queried.

STRATIGRAPHY AND PALAEONTOLOGY

Pre-Cambrian.

Very little geological work has been done on the Pre-Cambrian rocks of this sheet. The distribution of rock types shown on the sheet is largely a result of air-photo interpretation based on one traverse by M.A. Condon from Lyndon to Maroonah and the information gathered by the Bureau geologists along the margin of the Palaeozoic sediments.

The Pre-Cambrian rocks cover the eastern part of the sheet area and are believed to form the floor of the Palaeozoic sedimentary basin.

Although it is likely that all the Pre-Cambrian rocks in

are of Proterozoic age, no detailed structural work has been done to determine relative ages and no radioactive dating has been carried out. For these reasons the rocks in this area have been mapped according to their lithological grouping without reference to relative age relationships.

Crystalline schists cover the larger part of the area. Biotite schists are very common and quartz schist, hornblende schist and talc schist are important felspar bands alternating with biotite rich bands so that the rock is close to a gneiss. This appears to be an example of 'granitization' for, on the road between Lyndon and Maroonah, there is a range in types from schist through the gneissose types to granite which outcrops only in small areas. The aerial photographs show a large folded structure in the schist, with asymmetrical folds having axes near north-south. The structure in the schist is indicated by the trend-lines, sketched from the aerial photographs. This structure has not been checked in the field. The schists are probably the oldest rocks exposed in the sheet area.

The other main rock type in this area is granitic rock, ranging from gneissic granite to massive granite. West of the north-south fault west of Lyndon Homestead, the granite is medium grained biotite granite, somewhat gneissic. East of Williambury Homestead north and south of the Minilya River, the granite is coarse grained and gneissic. Some of the smaller masses of granite, e.g. those 16 and 24 miles east north east of Towera Homestead, appear to be intrusive into the schist discordantly. The boundary between granite and schist in most other places is very indefinite, indicating the transitional boundary between schist and granite.

A belt of sediments up to four miles wide extends from 16 miles north north east to 16 miles east of Lyndon Homestead. These sediments include well-cleaved slate and slaty limestone, quartzite and tuff or greywacke. They are well indurated but little metamorphosed. The dip is mainly steeply to the east but there may be isoclinal folding. Small drag folds on the road from Lyndon to Maroonah have a steep plunge to the south. It is likely that these sediments occupy a syncline in the schist but, although the boundary of the sediments is roughly concordant with the trends of the schist there may be an unconformity between the schist and the unmetamorphosed sediments. It is unlikely that the boundary is a fault.

Quartz reefs, some of great length and appreciable thickness cut the schist, granite and unmetamorphosed sediments. Amphibolite dykes cut the schist and granite. Gold and Galena are reported from Lyndon Station but the precise location of the deposits is not known.

Devonian

The oldest palaeozoic rocks exposed in this sheet area are devonian in age. They rest unconformably on the Pre-Cambrian schists and granite. The surface of unconformity is a mature erosion surface, with sufficient relief to produce variations in the thickness of the basal Nannyarra Greywacke from a few feet up to about 300 feet. This basal formation reflects the lithology of the adjoining bedrock, being arkosic in contact with granite and a greywacke where it is near schist. The Middle Devonian Gneudna Formation, of hard and friable calcarenite and soft siltstone containing Camarotoechia, Atrypa, Cyrtospirifer, Nautiloidea, Rhynchonellids, stromatoporoids and corals, conformably overlies the Nannyarra Greywacke. There is a conformable, transitional passage upwards into the Munabia

Sandstone, consisting of clean quartz sandstone from 1700 to 1900 feet thick. Lepidodendroid plant fossils have been found at the base in one place. The passage upwards into the Willaraddie Formation is conformable and transitional. The Willaraddie Formation consists of greywacke, siltstone, sandstone and conglomerate, 980 feet thick.

Carboniferous

The Willaraddie Formation grades up into the Lower Carboniferous Moogooree Limestone which is about 1000 feet thick. Several fossiliferous beds contain Pleurodictyum, Syringopora, Syringothyris, Rhipidomella, Spirifer, Athyris, Streptorhynchus and Camarotoechia. The lower part of the formation is thin-bedded limestone with clastic intercalation, the upper part is thick-bedded limestone with few beds containing silicified fossils, and much nodular chalcedony.

Conformably overlying the Moogooree Limestone is the Williambury Formation, consisting of pebbly greywacke, siltstone and conglomerate from 900 to 1200 feet thick. No fossils have been found in this formation. This formation is characterized by the abundance of black chert in the pebbles and sand grains, by very large-scale cross-bedding and rapid westward convergence. It is possibly a deltaic deposit.

Grading upwards from the Williambury Formation is the Yindagindy Formation, consisting of coarse to medium grained greywacke with intercalated thin oolitic limestone beds about 260 feet thick. The limestone beds contain crinoids, athyrid, rhynchonellid and spiriferid brachiopods, gastropods, nautiloids and ostracods. Although the Yindagindy has been tentatively referred to the Upper Carboniferous, the presence of an important erosional unconformity between it and the Permian Harris Sandstone indicates that it is more likely to be Lower Carboniferous.

Permian

Harris Sandstone. Clean quartz sandstone containing Lepidodendroid plant remains disconformably overlies the Yindagindy Formation on Williambury and Moogooree Stations. This Harris Sandstone is about 300 feet thick. It is not present farther south and east where the Lyons Group rests directly on the Carboniferous, Devonian and Pre-Cambrian.

Lyons Group. The Lyons Group is the sequence of unnamed formations related genetically to glaciation and consisting of marine glacial sediments, greywacke, siltstone, varied sediments and quartz greywacke with thin calcareous beds containing marine fossils, conformable above the Harris Sandstone and below the Callytharra Formation. The maximum measured thickness is 4600 feet west of Williambury; along the Lyndon the exposed upper part is so much thicker than at Williambury that the total thickness must be greater than 5000 feet. Fossils include foraminifera fenestellid bryozoa, spiriferid brachiopods, crinoids including Calceolispongia, solitary corals, gastropods, pelecypods. Current palaeontological work suggests that the Lyons Group ranges from the Sakmarian to Artinskian Stage.

Callytharra Formation. Conformably overlying the top of the Lyons Group, the Callytharra Formation consists of very fossiliferous hard and friable sandy and silty calcarenite, and calcilutite. Within the sheet area it ranges in thickness from 423 feet south-south-west of Williambury to 765 feet 13 miles east of Mia Mia Homestead. Fossils include Foraminifera, solitary corals, blastoids, crinoids (Calceolispongia and other genera), bryozoa (many species and very many individuals),

brachiopods, (Chonetes, Neospirifer, Spiriferella, Syringothyris, Gleiothyridina, Phricidothyris, Dictyoclostus, Linoproductus, Streptorhynchus) pelecypods, gastropods (Warthia, Ptychomphalina), nautiloids and a single goniatite (cf. Metalegoceras). The age is probably low in the Artinskian Stage. Between the Callytharra Formation and overlying formations is an erosional unconformity. In the northern part of the outcrop the disconformity may be very small but southward the upper part of the Callytharra Formation has been eroded off prior to the deposition of the overlying formation.

Cordalia Greywacke. North of the Minilya River, the Cordalia Greywacke - up to 200 feet of laminated quartz greywacke with calcareous lenses - disconformably overlies the Callytharra Formation.

Wooramel Sandstone. Conformably overlying the Cordalia Greywacke north of the Minilya River and disconformably overlying the Callytharra Formation south of the Minilya River is Wooramel Sandstone - clean quartz sandstone ranging in thickness from 170 feet to 250 feet.

Byro Group. The Byro Group, comprising Coyrie Formation, Mallens Greywacke, Bulgadoo Shale, Cundlego Formation, Quinnanie Shale, Wandagee Formation, Norton Greywacke and Baker Formation, is a lithogenetic unit characterized by quartz greywacke, carbonaceous siltstone and carbonaceous or bituminous shale.

Coyrie Formation. A sequence of siltstone, shale and quartz greywacke with marine fossils conformably overlies the Wooramel Sandstone. The Coyrie Formation is poorly exposed in the sheet area, only the lower part being well exposed in the scarp faces of Moogooloo, and K-55 and in a small area 9 miles west-southwest of Williambury. No fossils have been found in this formation in the Minilya sheet area but a little to the south a varied but rather dwarfed fauna is found. Fossils include wood and Gangamopteris leaves, Foraminifera, bryozoa, crinoid stem ossicles, Calceolispongia plates, brachiopods, pelecypods, small gastropods, small straight and large coiled nautiloids, Propinaceceras, and a trilobite.

None of the fossils is a goof guide fossil but the assemblage is very different from that in the Callytharra Formation and similar to that found in the Wandagee Formation. The age is therefore probably Artinskian.

The Coyrie Formation cannot be directly correlated with formations outside the Carnarvon Basin but probably has about the same stratigraphic position as the Irwin River Coal Measures or part of them.

Mallens Greywacke. The Mallens Greywacke is the formation of quartz greywacke conformable between the Coyrie Formation below and the Bulgadoo Shale above. It is not well exposed on the Minilya Sheet - the only large outcrops are 11 miles east of Mia Mia Homestead and at Burna Burna Hill. The thickness on the Lyndon is about 700 feet. At the type section just south of the southern margin of the Minilya Sheet the thickness is 517 feet. Fossils include pelecypods and spiriferids with streptorhynchids and gastropods.

Bulgadoo Shale. The Bulgadoo Shale consists dominantly of carbonaceous shale and siltstone with minor quartz greywacke, limestone and evaporites. It is conformable between the Mallens below and the Cundlego Formation above. It outcrops along the Minilya River between Middalya Homestead and Cundlego Crossing and in fault blocks to the south west of this stretch of the river. A small area of outcrop is north of the Lyndon River 10 miles east of Mia Mia Homestead. Because of the faulting in

the area of outcrop, no reliable thicknesses are known from the area of the Minilya Sheet. Immediately south, at the type section the thickness is 626 feet. Fossils are few in number of species and individuals. They include foraminifera, bryozoa, corals (Thamnopora) crinoids, Chonetes spiriferids and productids, pelecypods, gastropods, nautiloids and ammonoids (Pseudoschistoceras) and the shark Helicoprion.

Cundlego Formation. The Cundlego Formation consists of fine-grained laminated quartz greywacke with calcareous lenses, and carbonaceous siltstone. It is conformable between the Bulgadoo Shale below and the Quinnanie Shale above. It is 1090 feet thick at the type section 1 mile south east of Cundlego Well on the Minilya River. On the Lyndon River it is at least 1250 feet thick. Fossils include foraminifera, bryozoa, crinoid stem ossicles, brachiopods (mainly Chonetes and spiriferids), gastropods, pelecypods and corals.

Quinnanie Shale. The Quinnanie Shale consists of carbonaceous shale and minor quartz greywacke conformable between the Cundlego Formation below and the Wandagee Formation above. It is 515 feet thick on the Minilya River and 400 feet at the head of Norton Creek (to the south of the Minilya Sheet). There is a facies variation south-eastward towards the Cundlego Formation type. Fossils include foraminifera, Calceolispongia, brachiopods, Bellerophontidae, Aviculopectinidae and Permonautilus.

Wandagee Formation. The Wandagee Formation consists of quartz greywacke, siltstone and thin beds of limestone and evaporites. It is conformable between the Quinnanie Shale below and the Norton Greywacke above. The thickness of the type section in the Minilya Syncline on the Minilya River 9 miles west of Wandagee Homestead is 425 feet. The outcrop area in Minilya Sheet is confined to Wandagee Station between the Minilya River and Barrabiddy Creek. The Wandagee Formation includes many very fossiliferous beds, particularly in the lower part. Fossils include Calceolispongia, Neospirifer, and other brachiopods, foraminifera, bryozoa, corals, pelecypods, gastropods, ammonoids and nautiloids. The Wandagee Formation may be correlated with the Noonkanbah Formation of the Fitzroy Basin.

Norton Greywacke. The Norton Greywacke consists of thin-bedded greywacke and quartz greywacke conformable between the Wandagee Formation below and the Baker Formation above. The type section is to the south of the Minilya Sheet. In the Minilya Sheet area, the only outcrops of the Norton Greywacke are in the Minilya Syncline on the north side of the Minilya River and in the Coolkilya Syncline between the river and Wandagee Hill. In this area it is 180 feet thick. Fossils are restricted to a few beds and include pelecypods, brachiopods, gastropods and Calceolispongia. It is now reasonably certain that the Norton Greywacke may be correlated with the Nalbia Sandstone (Teichert, 1950). It may be correlated with the upper part of the Noonkanbah Formation of the Fitzroy Basin.

Nalbia Greywacke. The Name 'Nalbia Sandstone' was used by Teichert (1950) to replace the informal name 'Schizodus' beds'. As the type locality (Teichert, personal communication) north of Wandagee Hill is in a fault block and the exposure is so poor as to make relations to the rest of the sequence doubtful, the name can be applied only to those outcrops in the Wandagee Hill area where the Schizodus coquinites exposed in the type locality are exposed. Although, from the evidence of the sequence north of Paddys Outcamp (south of the Minilya Sheet), it is reasonably certain that the Nalbia Greywacke may be correlated with the Norton Greywacke, the presence of Schizodus coquinites in the Coolkilya Greywacke and the correlation in heavy mineral content between the type Nalbia Greywacke and the

type Coolkilya Greywacke leave some residual doubts on the validity of the correlation.

Baker Formation. The Baker Formation (Condon, 1954) consists of siltstone and laminated quartz greywacke conformable between the Norton Greywacke below and the Coolkilya Greywacke above. Exposures in the Minilya Sheet area are poor. It outcrops in the Minilya Syncline and on the flats immediately east of Wandagee Hill. It is 150 feet thick in the Minilya Syncline. Sparse fossils include Chonetes, Strophalosia, Linoproductus, bryozoa, pelecypods, gastropods, Thamnopora. The Baker Formation which is the uppermost formation of the Byro Group may be correlated with the uppermost Noonkanbah Formation of the Fitzroy.

Kennedy Group. The Kennedy Group consists of dominantly arenaceous sediments conformably overlying the Byro Group, (Condon, 1954). The formations comprising the Kennedy Group, in ascending order, are: Coolkilya Greywacke, Mungadan Sandstone, Binthalya Subgroup.

Coolkilya Greywacke. The Coolkilya Greywacke, the lowermost formation of the Kennedy Group, consists of thin-bedded quartz greywacke with calcareous beds and many fossiliferous beds. The only one on the Minilya Sheet where this formation is exposed is on Wandagee Hill. There only the upper part of the formation is exposed, although this was Teichert's type locality (personal communication). An amended type section on the north western end of the Kennedy Range was proposed by Condon (1954). Only the upper 308 feet of the formation is exposed at Wandagee Hill although it is likely (from consideration of air-photo patterns) that the total thickness there is about 600 feet. Fossils include pelecypods, gastropods, brachiopods, Calceolispongia, bryozoa. Some of the diagnostic ammonoids and Helicoprion which were reported as coming from the Coolkilya Greywacke (Teichert, 1940, 1942, 1951) most probably came from the Nalbia Greywacke. The Coolkilya Greywacke is very similar lithologically to the lowermost Liveringa Group of the Fitzroy Basin and the fossil content confirms that correlation. It is probable that the age of the Coolkilya Greywacke is younger than Artinskian, probably Kungurian.

Mungadan Sandstone. The Mungadan Sandstone (Teichert, 1950, defined by Condon, 1954) consists of thin-bedded medium - grained quartz sandstone conformable between the Coolkilya Greywacke below and the Binthalya Subgroup above. The type locality is on the east flank of Wandagee Hill in the only area of outcrop of the formation in the Minilya Sheet area. There it is 145 feet thick. Fossils are very rare, including pelecypods and Serpulites.

Binthalya Subgroup. The Binthalya Subgroup (Condon, 1954) is the sequence of arenaceous formations in the Kennedy Range area, the base of which rests conformably on the Mungadan Sandstone. Only the lowermost part of this sequence is exposed in the Minilya Sheet area, on the top of Wandagee Hill. Only 30 feet thickness is exposed and no fossils have been found. Coarse-grained quartz greywacke forms the base and is overlain by medium-grained thin-bedded quartz greywacke. This is the youngest Permian formation in the Minilya Sheet area.

?JURASSIC

Curdamuda Sandstone. A small exposure of fossiliferous sandstone was described by Teichert (1940) as occurring in a fault block between Cretaceous and Permian sediments.

Examination by the author has shown that, although there is much faulting in the area, the Curdamuda Sandstone rests unconformably on an uneven surface of Permian sediments and is

conformable beneath sandstone of the same type as in the Birdrong Formation. The fossiliferous lenses are found in small hollows on the surface of unconformity.

As there is no local or regional evidence of a break in sedimentation between the Curdamuda Sandstone and the Lower Cretaceous Muderong Shale, the Middle Jurassic age of this formation is doubtful.

CRETACEOUS

The Cretaceous System exposed in the Minilya Sheet area comprises the following stratigraphic units, in ascending order: Birdrong Formation, Winning Group (Muderong Shale, Windalia Radiolarite and Gearle Siltstone) and Korojon Calcarenite and Miria Marl of the Cardabia Group.

Birdrong Formation. The Birdrong Formation consists of quartz sandstone, glauconitic sandstone, quartz greywacke and siltstone resting unconformably on the Permian or conformably on the Curdamuda Sandstone and conformably beneath the Muderong Shale.

It outcrops near Curdamuda Well on the Minilya River and in the area between Kialiwibri Creek and Lyndon River at the base of the mesas. As it forms the main artesian aquifer of the Carnarvon Basin it is known in bores throughout the western part of the basin. The Birdrong Formation is about 50 feet thick near Curdamuda Well, more than 40 feet in the Kialiwibri-Lyndon area, 87 feet in Manberry No.1 Bore, 54 feet in Mia Mia No.1 Shed Bore, 23 feet in Gerardi Bore, Minilya Station, and 132 feet in Centenary Bore, Cardabia Station (just north of the Sheet boundary).

The only fossils found are pieces of silicified wood.

This formation includes the oil sand at Rough Range Bore No.1 between 3605 and 3622 feet, and as it continues under the western part of the basin from there to Murchison River it must be regarded as an attractive drilling target for oil wherever structure is suitable.

The Birdrong Formation is correlated with the Butte Sandstone (Clarke and Teichert, 1951) of the lower Murchison River area.

Muderong Shale. The Muderong Shale (Condon, 1954) consists of bentonitic shale, claystone and siltstone. It is conformable between the Birdrong Formation below and the Windalia Radiolarite above.

The Muderong Shale outcrops near Curdamuda Well on the Minilya River and at the base of the mesas at the north end of the Pleiades and is exposed in the excavation of the Cundy Dam on Wandagee Station. Its thickness is about 40 feet near Curdamuda Well on the Minilya River and 40 feet in the area south of Windalia Hill.

The only fossils so far found in the Muderong Shale are radiolaria and foraminifera which indicate an upper Albian age (Edgell, 1952).

The Muderong Shale forms the cap rock to the artesian aquifer and oil sand, the Birdrong Formation.

Windalia Radiolarite. The Windalia Radiolarite (Condon et al., 1954) consists of radiolarite, silty and sandy in places, and thin beds of chert. It is conformable between the Muderong

Shale below and the Gearle Siltstone above. The type section of the formation is at Windalia Hill where only the lower part of the formation is exposed.

The lower part of the formation is exposed in The Pleiades, near Winning Pool along the banks of the Lyndon near Mia Mia and along the Minilya River west of Curdamuda Well. The upper part is exposed in the axial part of the Giralia Anticline. No complete sections of the formation are known in outcrop. Bore logs indicate that the thickness of the Windalia Radiolarite is about 170 feet near Mia Mia and about 210 feet 12 miles west of Winning.

Foraminifera and radiolaria are abundant, ammonites, belemnites and molluscs are rare. The microfossils indicate that the age of the Windalia Radiolarite is upper Albian (Edgell, 1952) but the ammonites suggest a Cenomanian age (Brunnschweiler personal communication).

The Windalia Radiolarite is correlated with and is similar to the Thirindine Shale (Clarke and Teichert 1951) which outcrops in the lower Murchison River area.

Gearle Siltstone. The Gearle Siltstone (Condon et al., 1954) consists of soft dark bentonic siltstone and claystone with barites in the upper part. The formation conformably overlies the Windalia Radiolarite and is overlain disconformably by the Korojon Calcarenite.

In the area of the Minilya Sheet, the Gearle Siltstone outcrops in the axial area of the Giralia Anticline, in the lower part of the rise west of Chinkia Creek and in the excavation of Warrarie Dam, Wandagee Station. On Giralia Anticline, east of Remarkable Hill, the formation is about 535 feet thick; in Centenary Bore it is possibly 1150 feet thick; and in the Warrarie Dam area possibly 200 feet thick.

Foraminifera and radiolaria are abundant throughout the formation. Belemnites are plentiful in the lowermost part and a few pelecypods are present. Although there is some doubt on the precise age correlation of the Gearle Siltstone, it is possible that it is of Cenomanian and Turonian Age.

Cardabia Group. The Cardabia Group (Condon et al, 1954) consists dominantly of clastic calcareous sediments. It disconformably overlies the Winning Group and disconformably underlies the Giralia Calcarenite. It comprises the Korojon Calcarenite, Miria Marl, Boongerooda Greensand, Wadera Calcarenite, Pirie Calcarenite, Cashin Calcarenite and Jubilee Calcarenite. These formations range in age from Campanian to Danian.

Korojon Calcarenite. The Korojon Calcarenite consists of friable and hard white and cream calcarenite and calcilutite with abundant fragments of Inoceramus. The formation disconformably overlies the Gearle Siltstone and is overlain disconformably by the Miria Marl.

In the Minilya area, the thickness of the Korojon Calcarenite is 130 feet immediately east of Remarkable Hill, 175 feet one mile west of Korojon Pool on Cardadia Creek, and possibly 235 feet in Centenary Bore, Cardabia. The Korojon Calcarenite outcrops on the Giralia Anticline, the Warroora Anticline, the Chargoo Anticline, along the scarp west of Chinkia Creek and in the low ridge south of Warrarie Dam, Wandagee.

The formation contains a rich fauna of foraminifera, pelecypods, cephalopods and brachiopods which indicate a Santonian age.

The Korojon Calcarenite is correlated with the Toolonga 'Chalk' and Second Gully 'Shale' (Clarke and Teichert, 1951) of the lower Murchison River area and with the Gingin Chalk (Teichert, 1946). It may possibly be correlated with the Pondicherry Beds of Southern India.

Miria Marl. The Miria Marl is a thin formation of fossiliferous marl and calcarenite disconformable between the Korojon Calcarenite below and the Boongerooda Greensand above.

It outcrops on the Giralia Anticline where it is two to seven feet thick, on the Chargoo Anticline and on the Warroora Anticline.

Its rich fauna of ammonites, brachiopods, molluscs, foraminifera, corals and nautiloids indicates an age from upper Campanian to lower Maestrichtian.

TERTIARY

Boongerooda Greensand. The Boongerooda Greensand is a thin formation, consisting of fossiliferous quartz and glauconite sand, disconformably overlying the Miria Marl and conformably underlying the Wadera Calcarenite.

It is exposed on the Giralia Anticline (two to eight feet thick), the Warroora Anticline and the Chargoo Anticline.

The foraminifera have been described by Edgell (1952) as indicating a Palaeocene (Tertiary) age. Brunnschweiler regards the mega-fossils as indicating a Danian (Cretaceous) age. Part of this inconsistency is bound up with the problems of the relative ages of the Danian and Palaeocene and of the stratigraphic position of the boundary between the Cretaceous and the Tertiary. The presence together of 'Palaeocene' micro-fauna with a 'Danian' mega-fauna indicates a correlation between the two. The absence of ammonites (the standard Mesozoic zone-fossil) and the presence of typical Tertiary genera of foraminifera indicate that this fauna belongs more properly in the Tertiary.

There is no formation in Western Australia which may be correlated with the Boongerooda Greensand.

Wadera Calcarenite. The Wadera Calcarenite (Condon et al, 1954) consists of friable and hard fossiliferous glauconitic calcarenite. It is conformable with the Boongerooda Greensand below and the Pirie Calcarenite above.

On the Minilya Sheet, it outcrops on the Giralia Anticline mainly on the west flank, with a thickness of 50 feet; on the Warroora Anticline (thickness about 20 feet) and on the Chargoo Anticline (thickness about 10 feet).

Abundant foraminifera and bryozoa, and common echinoids and brachiopods indicate a Palaeocene (Edgell, 1952) or Danian (Brunnschweiler, 1952) age.

Pirie Calcarenite. The Pirie Calcarenite (Condon et al, 1954) consists of friable bryozoal calcarenite, soft calcilutite and thin hard chorty calcilutite. It is conformable with the Wadera Calcarenite below and the Cashin Calcarenite above. It is exposed (on the Minilya Sheet area) on the west flank of the Giralia Anticline (thickness 40 feet) on the Warroora Anticline (thickness about 40 feet), on the Chargoo Anticline (about 20 feet) and on the Chirrida Anticline (about 30 feet).

The Pirie Calcarenite contains abundant foraminifera, radiolaria and bryozoa, common echinoids and some brachiopods

and molluscs. The age indicated by the fossils is Palaeocene (Edgell, 1952) or Danian (Brunnschweiler, 1952).

Cashin Calcarenite. The Cashin Calcarenite (Condon et al, 1954) consists of friable and hard fossiliferous calcarenite conformable above the Pirie Calcarenite and possibly disconformable beneath the Jubilee Calcarenite. On the Minilya Sheet it is exposed only on the west flank of the Giralia Anticline, where it is about 40 feet thick.

The Cashin Calcarenite contains foraminifera and echinoids, brachiopods and molluscs of Danian age (Brunnschweiler, 1952).

Jubilee Calcarenite. The Jubilee Calcarenite (Condon et al, 1954) consists of friable and hard fossiliferous glauconitic calcarenite. It is possibly disconformable with the Cashin Calcarenite below and is disconformable with the Giralia Calcarenite above. It is exposed, in the Minilya Sheet area, only on the west flank of the Giralia Anticline where it is wedged out between the Cashin Calcarenite and the Giralia Calcarenite. The maximum thickness is about 20 feet.

The Jubilee Calcarenite contains foraminifera of Palaeocene age (Edgell, 1952) and molluscs which Brunnschweiler (personal communication, 1953) regards as of Eocene age. It is the uppermost formation of the Cardabia Group.

EOCENE

Giralia Calcarenite. The Giralia Calcarenite (Singleton, 1941 and Condon et al, 1954) consists of friable and hard fossiliferous calcarenite with limonite coliths, and hard brown crystalline limestone. It is disconformable on the upper formations of the Cardabia Group and unconformable below the Miocene Lamont Sandstone and Trealla Limestone.

In the Minilya Sheet area, the Giralia Calcarenite outcrops on the lower west flank of the Giralia Anticline. Its thickness there ranges from about 100 feet at the northern end to none. Most of this variation is caused by the post-Eocene erosion of the top of the Giralia Calcarenite before the Miocene transgression.

Abundant foraminifera and few large molluscs indicate the age of the formation as "a" to "b" state (East Indies) i.e. middle to upper Eocene.

Merlinleigh Sandstone. The Merlinleigh Sandstone (Teichert, 1950) consists of coarse-grained and medium-grained quartz sandstone resting unconformably on Palaeozoic formations and generally lateritized at the surface. Only sand deposits, probably derived from the surface of the laterite profile, are found above it.

In the Sheet area, it outcrops as small outliers capping buttes and in a somewhat larger area north-west of Ebra Well, Lyndon Station where there are plentiful fossils. It forms the cap of the butte at the edge of the scarp east of K-55, of the Moogooloo mesa and of the Pleiades Hills. The thickness of this formation is generally less that 30 feet; it is controlled largely by the pre-deposition level of the underlying surface.

The Merlinleigh Sandstone has been thought to be of Miocene age (Teichert, 1950) as it contained Aturia clarkei which is present in the Plantagenet Beds which had been given a Miocene age on the evidence of a large fauna including Aturia australis, (Chapman and Crespin, 1934). Recent examination of the fauna from near Ebra Well by Miss Crespin, Dr. Brunnschweiler and Mr. Dickins has shown that the Merlinleigh Sandstone is of Eocene age (personal communication). The Merlineigh Sandstone may be correlated with the Giralia Calcarenite of the coastal area.

MIOCENE

Lamont Sandstone. The Lamont Sandstone (Condon et al, 1954)

is a lenticular formation of quartz sandstone with few fossils resting in erosion hollows of the Giralia Calcarenite and overlain unconformably by the Trealla Limestone.

It outcrops on the southern plunge near Korojon Pool and on the south-west flank of the Giralia Anticline and on the east flank of the Chargoo Anticline.

Its thickness there ranges up to five feet. Its stratigraphic position and the few fossils contained indicate a lower Miocene age.

Trealla Limestone. The Trealla Limestone (Condon et al, 1953) consists of hard white fossiliferous fine-grained crystalline limestone. It rests unconformably on either the Lamont Sandstone or formations of the Cardabia Group and is unconformable beneath the superficial Quaternary deposits.

In the Minilya Sheet area it is 70 feet thick on the west flank of the Giralia Anticline at the north edge of the Sheet area, 30 feet near Korojon Pool, Cardabia Creek; 50 feet on the east flank of Chargoo Anticline; 40 feet on Yankie Tank Anticline; 50 feet on Chirrida Anticline and about 60 feet on Warroora Anticline. It outcrops over much of the surfaces of the Warroora, Gnarraloo, Chargoo, Gerardi, Chirrida, Minilya and Homestead Anticlines. It is not known east of the North Coast Highway.

The abundant foraminifera indicate an age equivalent to 'f-1' to'f-2' stage of the East Indies i.e., lower Miocene (Crespin, in Condon et al, 1954). Gastropods and echinoids are believed by Brunnschweiler (personal communication) to indicate a somewhat older age.

QUATERNARY

PLEISTOCENE

Joolabroo Formation. The only named formation in the Sheet area is the Joolabroo Formation which consists of consolidated sand, silty sand, pebbly sand and travertine unconformably overlying Permian and Cretaceous formations. Only recent loose sand is deposited above it.

No fossils have been found in the Joolabroo Formation, the Pleistocene age of which is indicated by its physiographic position - deposited on the flat floor of the wide valleys cut in the post-Eocene lateritized surface, and dissected by the present stream action.

Sand. The loose red sand on the surface of the mesas is derived from the surface of the profile of lateritization. It is included in the Pleistocene as it is possible that its movement and deposition by wind during a very arid period may have coincided with one or more of the main glacial stages of the Pleistocene.

This high-level red sand is in longitudinal dunes trending north-north-west in the area south of the Pleiades.

Marine Deposits. On the shores of the Salt Lake and extending north from it, and extending along the Lyndon and Minilya Rivers is a deposit of calcarenite and molluscan coquinite up to 20 feet thick. The uppermost limit of this deposit is about 30 feet above the bed of Salt Lake.

The abundant fossils include molluscs, echinoids and foraminifera. Although these fossils have not been examined critically, they are thought to indicate a Pleistocene age, although the relation of the deposit to the 20 foot eustatic sea level may indicate an early Recent age.

RECENT

Recent deposits are mainly the superficial soils still in process of deposition. In some of these, the process has been in operation for a considerable time.

Sand. The red sand covering large areas between the coast and Salt Lake and Giralia Anticline, and between the North Coastal Highway and the outcrops of the Permian sediments is regarded as of recent age. In places it is deposited on the surface of the Joolabroo Formation, but elsewhere it is on the truncated surface of Permian and Cretaceous formations and disconformably on the surface of the Tertiary Limestone. The uppermost level at which it is found is about 400 feet above sea level. The sand is not derived from the underlying formations, many of which have very little sand, and it seems not to be derived directly from the rivers. Consideration of its wide even spread and its uniformity of type suggests that it may be a marine deposit. Its movement into longitudinal dunes possibly took place during an arid period in the early Recent.

Marine deposits. Recent beach sands, and possibly the 'salt marsh' near Cardabia Homestead are Recent marine deposits. The Cardabia 'Salt marsh is probably a little above sea level. It has been cut off from the sea by sand dunes which possibly originated as a spit from Point Maud.

Lake Deposits. The floors of Salt Lake and of the bigger clay pans (north and west of Winning Homestead) are covered by freshwater deposits brought in by flood waters from the rivers. In Salt Lake these deposits consist of thin beds of clay and gypsum down to a depth of at least two feet. Similar deposits with probably less gypsum may be expected in the larger claypans.

Travertine. Deposits of travertine are formed in two types of locality - at the surface of calcareous formations and within some sand deposits. The first type is found above Trealla Limestone around the Salt Lake and above the Korojon Calcarenite between Cardabia Creek and Chinkia Creek and in a small area between the North Coast Highway and the north side of Lyndon River. The second type is developed mainly in the sand between the coast and Salt Lake and Giralia Anticline. It forms a hardpan at from 2 to 10 feet from the surface. In some places the travertine is exposed by the erosion of the surface sand.

Residual Soil. Residual soil is developed from outcropping rock where the surface is flat or only very gently sloping Red lime soil develops over the calcareous formations of the anticlines in the western part of the sheet area and in more restricted areas of outcrop of Palaeozoic sediments. Residual soils are common on the outcrop of the Lyons Group and Gneudna Formation but rare on other formations.

Alluvium. Deposits of alluvium cover large areas around the lower reaches of the Lyndon and Minilya Rivers and Cardabia Creek, along the western side of the Giralia Anticline, and along the rivers.

The thickness of the alluvium ranges from a few feet up to perhaps 100 feet in the delta of the Minilya River. The lithology is dominantly arenaceous with silt and clay both as matrix and beds and some gravels.

The alluvium is in process of deposition - every flood deposits sediment on the alluvial flats.

Wash. Wash, the very thin veneer of alluvial gravel, sand and clay over bedrock, covers large parts of the area of outcrop, particularly the lower slopes of the scarps and areas of sheet flow. In places, small areas of outcrop are exposed through the wash but in other areas the wash completely covers the underlying rock.

STRUCTURE

The main structural features of the Sheet area are shown in Figure 1. The contours of Bouguer gravity anomalies, from an unpublished map by I.B. Everingham are also shown.

The structure of the Pre-Cambrian is known only by photo-interpretation based on a single traverse. Two large anticlines, both very asymmetrical with steeper west flank, and plunging northward, occupy the eastern part of the Sheet area. Granite intrudes the structurally high part of these anticlines but is not completely concordant.

To the west of the folded schist, and separated from it by a fault is a large area of granite with minor amounts of schist. This granite forms the westernmost outcrop of the Pre-Cambrian rocks.

The major faults in the Pre-Cambrian rocks are north-south in strike. They probably originated at the time of the orogeny which resulted in the folding and metamorphism of the schists and the intrusion of the granite. Post-Permian movement along these faults is indicated at Williambury where the extension of one of the major faults in the Pre-Cambrian is a fault between the Pre-Cambrian schist and granite and the Devonian to Permian sediments.

The regional dip of the Palaeozoic sediments in the area of outcrop is south of west, at angles ranging from about 35 near the eastern margin to about 4 near Middalya. The regional dip is interrupted by the major north-south faults; on the east side of the fault there is commonly a syncline resulting from the movement upward of the western block.

Nothing definite is known of the structure of the Pre-Cambrian west of its area of outcrop or of the Palaeozoic west of its outcrop. The gravity anomaly map may indicate that the axis of the basin in the Sheet area runs north-south from Remarkable Hill through Minilya Homestead.

In the area west of the North Coast Highway there are a number of anticlines - the south end of the Giralia Anticline, the Warroora, Chargoo, Chirrida, Gerardi, Minilya, Homestead, Gnarraloo Anticlines and the north end of Yankee Tank Anticline. Geological and seismic evidence in the Cape Range and Giralia Anticlines to the north of this Sheet indicate that these coastal anticlines are almost certainly the result of faulting in the Pre-Cambrian Basement and also in the Palaeozoic sediments.

ECONOMIC GEOLOGY

The only mineral of any economic importance produced in this area is the underground water on which the pastoral industry depends. Although good stock water is produced in many places, there are many areas in which good underground water is available but not sought. Water is available in the Wooramel Sandstone west of the Moogooloo Range from K-55 to the Lyndon River and west of the K-52 Range from the Minilya River to Pleiades Outcamp. On Middalya and Wandagee Stations water would be available in the Mallens Greywacke but up to 2000 feet deep in some parts of Wandagee. West of the area of Palaeozoic outcrop, water is available in the Birdrong Formation. This water is artesian (flowing) west of the North Coast Highway. Ground water may be found in stream gravels and in quartz reefs in the Pre-Cambrian area.

Within the sheet area, the following rocks and minerals of interest and possible economic significance have been found:- Limestone (for sealed road surfacing, cement and lime manufacture, agricultural lime) in the coastal anticlines, in the Callytharra Formation on the east side of the ridges extending from K-52 and

K-55 to the Lyndon River, in Devonian and Carboniferous limestone on Williambury Station and in pre-Cambrian limestone north-east of Lyndon; gypsum in the surface weathering zone of shale in the central part of the Giralia Anticline and in the Bulgadoo Shale on either side of the Minilya River on Wandagee and Middalya Stations and as evaporite beds in the Bulgadoo Shale on Middalya; nodular phosphate in the Wandagee Formation, Quinnanie Shale and Bulgadoo Shale on Wandagee and Middalya Stations; bentonitic shale in the Gearle Siltstone on the Giralia Anticline in the eastern part of Cardabia Station; barytes as nodules and beds in the Gearle Siltstone on the east part of Cardabia Station; radiolarite (for filtering, insulation and fine abrasive) in the apical area of Giralia Anticline on the east part of Cardabia Station, along the Lyndon River south and south-west of Mia Mia Homestead, along the Minilya River west of Curdamuda Well, and south of Wandagee Woolshed.

The following have not been found but geological evidence suggests the probability of their presence with the sheet area:-

(a) Petroleum: (Possible reservoir beds include the Birdrong Formation, Mallens Greywacke, Wooramel Sandstone, Harris Sandstone, Munabia Sandstone and Nannyarra Greywacke; suitable structures in the Birdrong Formation include the Giralia Anticline on Cardabia Station, Warroora Anticline on Warroora, Gnarraloo Anticline in the north eastern part of Gnarraloo, Chargoo, Gerardi, Chirrida, Minilya, Homestead and Yankie Tank Anticlines on Minilya Station, and the west side of Wandagee Hill Fault; suitable structures in the Palaeozoic sequence may include the above structures and fault-line structures along the Barrabiddy Creek, Middalya Fault, Harris Fault and Williambury Fault).

(b) Salt. Presence of evaporite gypsum in the Bulgadoo Shale on Middalya Station and on Wandagee Station on the Barribiddy Creek, and the finding of brine in some bores in this formation perhaps indicate that, below the water table, there may be deposits of salts.

(c) Metalliferous minerals. Although no detailed geological work has been done on the Pre-Cambrian rocks of the eastern part of the sheet area, it is likely that the schists there are of the same general type as those at Uaroo to the north and Yinnietharra to the south east where lead, copper and mica have been found.

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Table 1 - STRATIGRAPHY OF MINILYA SHEET AREA.

ERA	PERIOD	EPOCH	AGE	ROCK UNITS WESTERN AREA	ROCK UNITS EASTERN AREA
CAINOZOIC	QUAT.	RECENT		Alluvium; lake & marine deposits	Alluvium; sand
		PLEISTOCENE		Exmouth Sst.	Joolabroo Fm.
	TERTIARY	MIOCENE	Lower	Trealla Lst Lamont Sst	Merlinleigh Sst.
		EOCENE		Giralia Calc.	Merlinleigh Sst.
		PALAEOCENE	Danian	Jubilee Calc Cashin Calc Pirie Calc. Wadera Calc. Boongerooda Gnsd.	
MESOZOIC	CRETACEOUS	UPPER	Maestrichtian	Miria Marl	
			Santonian	Korojon Calc	
			Turonian	Gearle Siltst.	
			Cenomanian	Windalia Radlte	Windalia Radiolarite.
		LOWER	Albian	Muderong Shale	Muderong Shale
					Birdrong Fm.
PALAEOZOIC	PERMIAN	MIDDLE	Kungurian		Binthalya Subgroup Mungadan Sst Coolkilya Gwke
			Artinskian		Baker Fm. Norton Gwke Wandagee Fm. Quinnanie Shale Cundlego Fm. Bulgadoo Shale Mallens Gwke Coyrie Fm. Wooramel Sst. Cordalia Gwke Callytharra Fm.
		LOWER			LYONS GROUP Harris Sst.
	CARB	LOWER			Yindagindy Fm. Williambury Fm. Moogooree Lst.
	DEVONIAN	UPPER			Willaradie Fm. Munabia Sst. Gneudna Fm.
		MIDDLE			Nannyarra Gwke
					Precambrian.

TABLE 2.

FORMATIONS OF THE MINILYA SHEET AREA.

AGE (See Table 1A)	GROUP	FORMATION	THICKNESS (in feet) West	Wandagee	East	LITHOLOGY	FOSSILS	SYMBOL
RECENT		Alluvium	Up to about 250			Sand, gravel, silt, clay		Qra
		Marine muds	possibly up to 50			Ligneous silt, clay	Living species	Qrm
		Residual soil	up to about 20			Clay, loam, gypsite		Qrr
		Wash	up to about 10			Gravel, sand, clay		Qrw
		Travertine	up to about 10			Travertine, some sandy		Qrt
		Lake deposit	?? possibly 20			Clay, evaporites		Qrl
		Sand	up to about 100 in dunes			Red quartz sand, white shell sand		Qrs
		Joolabroo		20		Sand, pebbly sand, calcareous sand		Qpj
PLEISTOCENE		Marine shelly deposits		?30		Calcarenite, shell beds	Molluscs, echinoids	Qpm
		Exmouth Sandstone				Red calcareous sandstone, limestone conglomerate	Forams, corals	Qpe
LOWER MIOCENE	CAPE RANGE	Trealla Limestone	40			Hard foraminiferal limestone	Forams, molluscs, corals	Tmt
						Hard limestone	Fresh-water gastropods	
EOCENE		Merlinleigh		20	20	Friable quartz sandstone	Nautiloid, corals, pelecypods	Tem
		Giralia Calcarenite	240			Friable and hard foraminiferal calcarenite	Forams, bryozoa, echinoid, Aturia, molluscs.	Teg
DANIAN	CARDABIA	Jubilee Calcarenite	0-35			Friable and hard calcarenite	Brachiopods, forams, bryozoa, echinoids, corals.	Taj
		Cashin Calcarenite	0-50			Friable and hard calcarenite	Bryozoa, brachiopods, forams, crabs	Tac
		Pirie Calcarenite	100			Friable calcarenite	Bryozoa, echinoids, forams, radiolaria	Tap
		Wadera Calcarenite	100			Friable and hard calcarenite	Bryozoa, brachiopods, forams, echinoids, molluscs, corals	Taw
		Boongerooda Greensand	10			Friable glauconite sand	Forams, brachiopods, molluscs	Tab
UPPER CRETACEOUS		Miria Marl	10			Friable fossiliferous glauconitic marl	Ammonites, forams, molluscs, brachiopods, nautiloids, corals, shark teeth	Kum
		Korojon Calcarenite	127	50		Friable coquinoid calcarenite	Inoceramus, forams, brachiopods	Kuk
	WINNING	Gearle Siltstone	550			Soft dark bentonitic siltstone	Forams, radiolaria, belemnites	Kug
		Windalia Radiolarite	50+	120?	110+	Thin bedded radiolarite silty radiolarite	Radiolaria, forams, ammonites, belemnite	Kuw
?LOWER CRETACEOUS		Muderong Shale		40?	40	Bentonitic shale and siltstone	Forams, radiolaria	Klm
		Birdrong Formation		40	40	Quartz sandstone, glauconitic sandstone, siltstone	Fossil wood	Klb
?MIDDLE PERMIAN	KENNEDY	Binthalya Sub-group		30	30	Quartz sandstone & quartz greywacke	Few pelecypods	Pat
		Mungadan Sandstone		145	145	Quartz sandstone	Few pelecypods	Pas
		Coolkilya Greywacke		620		Quartz greywacke, greywacke	Pelecypods, brachiopods, ammonoids, trilobite, shark	Pal
LOWER PERMIAN (Artinskian)	BYRO	Baker Formation		153		Siltstone, quartz greywacke	Brachiopods, molluscs	Pak
		Norton Greywacke		177		Greywacke, quartz greywacke	Pelecypods, bryozoa, brachiopods	Pan
		Wandagee Formation		425		Siltstone, quartz greywacke	Brachiopods, crinoids, forams, molluscs	Pag
		Quinnanie Shale		515		Shale, thin quartz greywacke	Lingula, brachiopods, forams, crinoids	Paq
		Cundlego Formation		1090		Quartz greywacke (some calcareous), siltstone	Bryozoa, crinoids, brachiopods, molluscs	Pau
		Bulgadoo Shale		1000		Siltstone, carbonaceous shale, thin quartz greywacke	Forams, bryozoa, corals, crinoids, brachiopods, nautiloid, ammonoid.	Pab
		Mallens Greywacke			300	Quartz greywacke	Pelecypods, brachiopods, gastropods	Pam
		Coyrie Formation			855	Siltstone, quartz greywacke	Ammonoid, nautiloid, forams, molluscs, brachiopods, wood, Glossopteris	Par
		Wooramel Sandstone			250	Quartz sandstone	Wood	Paw
		Cordalia Greywacke			200	Quartz greywacke	Bryozoa, brachiopods	Pad
		Callytharra Formation			760	Calcarenite, quartz greywacke, limestone	Bryozoa, brachiopods, forams, corals, crinoids, molluscs, nautiloids, ammonoid, Gangamopteris	Pac
LOWER PERMIAN (Sakmarian)	LYONS				4600	Silty & sandy tillite, quartz greywacke, varved siltstone, thin fossiliferous limestone	Bryozoa, brachiopods, Calcealispongia, forams, molluscs corals	Pal
		Harris Sandstone			280	Clean quartz sandstone	Lepidodendron	Psh
CARBONIFEROUS		Yindagindy Formation			260	Coarse greywacke, quartz greywacke, sandy oolitic limestone	Crinoids, brachiopods, gastropods, nautiloid, ostracoda	Cuy
		Williambury Formation			1200	Pebbly greywacke, siltstone, conglomerate		Cuw
		Moogooree Limestone			1180	Hard bedded limestone	Bryozoa, corals, brachiopods	Clm
DEVONIAN		Willaraddie Formation			980	Greywacke, siltstone, sandstone, conglomerate	Bryozoa, brachiopods (few)	Duw
		Munabia Sandstone			1900	Quartz sandstone	Club-moss	Dum
		Gneudna Formation			1750	Greywacke, limestone, siltstone	Stromatoporoids, corals, Brachiopods, nautiloids	Dmg
		Nannyarra Greywacke			265	Greywacke, siltstone		Dmn
PROTEROZOIC						Quartzite, greywacke, slate, limestone		Esed
						Basic dyke rocks, Pegmatite, Granite Gneiss, Schist		

STRUCTURAL SKETCH MAP, MINILYA SHEET

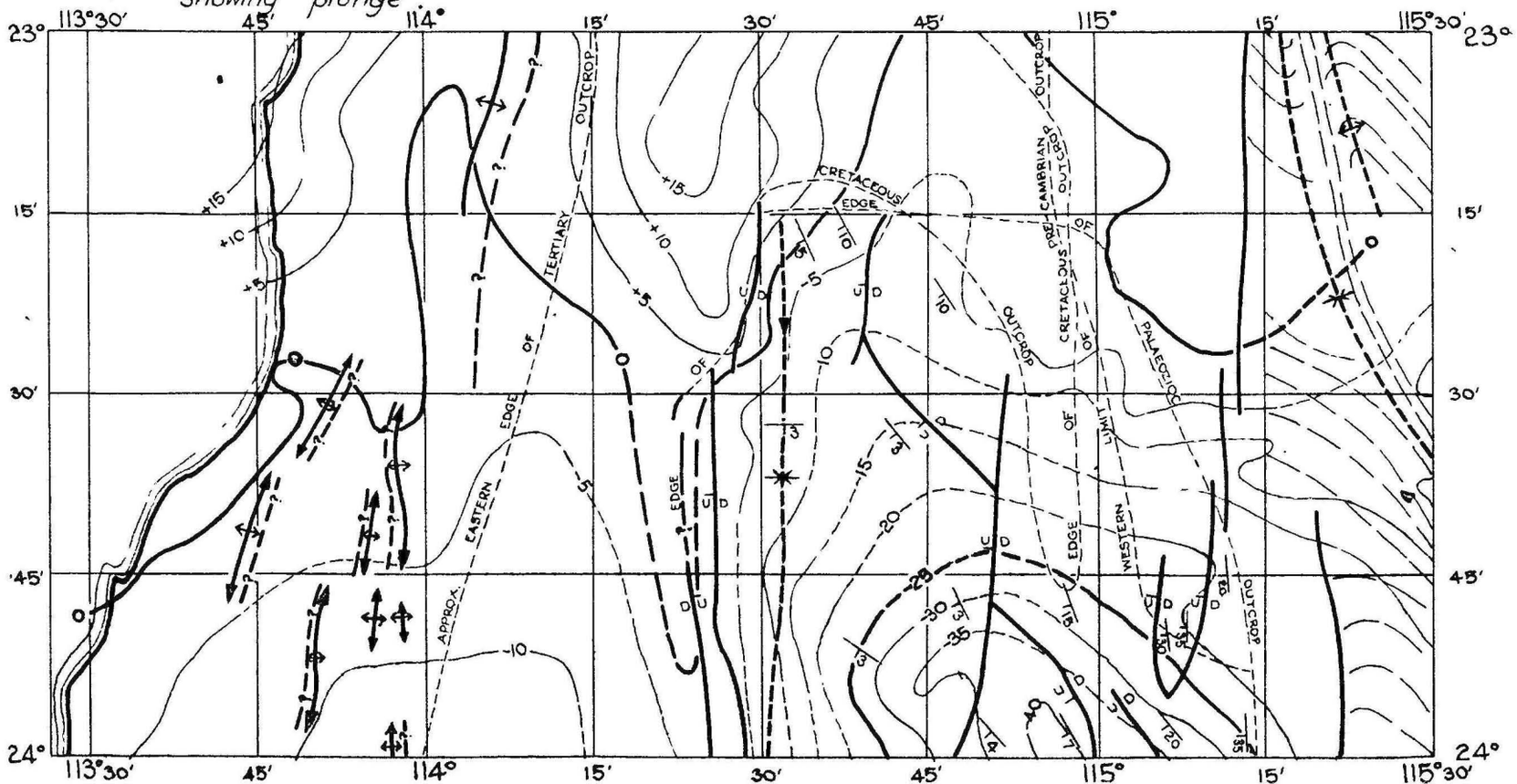
Fig 1.

SCALE

10 0 10 20 30 40 MILES

REFERENCE

- Fault established – position accurate – showing dip of plane and throw.
- Fault inferred.
- Anticlinal crest – position accurate – showing plunge.
- Synclinal trough – position accurate – showing plunge.
- Synclinal trough – position approximate – showing plunge.
- Trend lines in pre-Cambrian – from photo-interpretation.
- Regional dip.
- Bouger anomaly contours – in milligals.
- Bouger anomaly contours – position approximate – in milligals.



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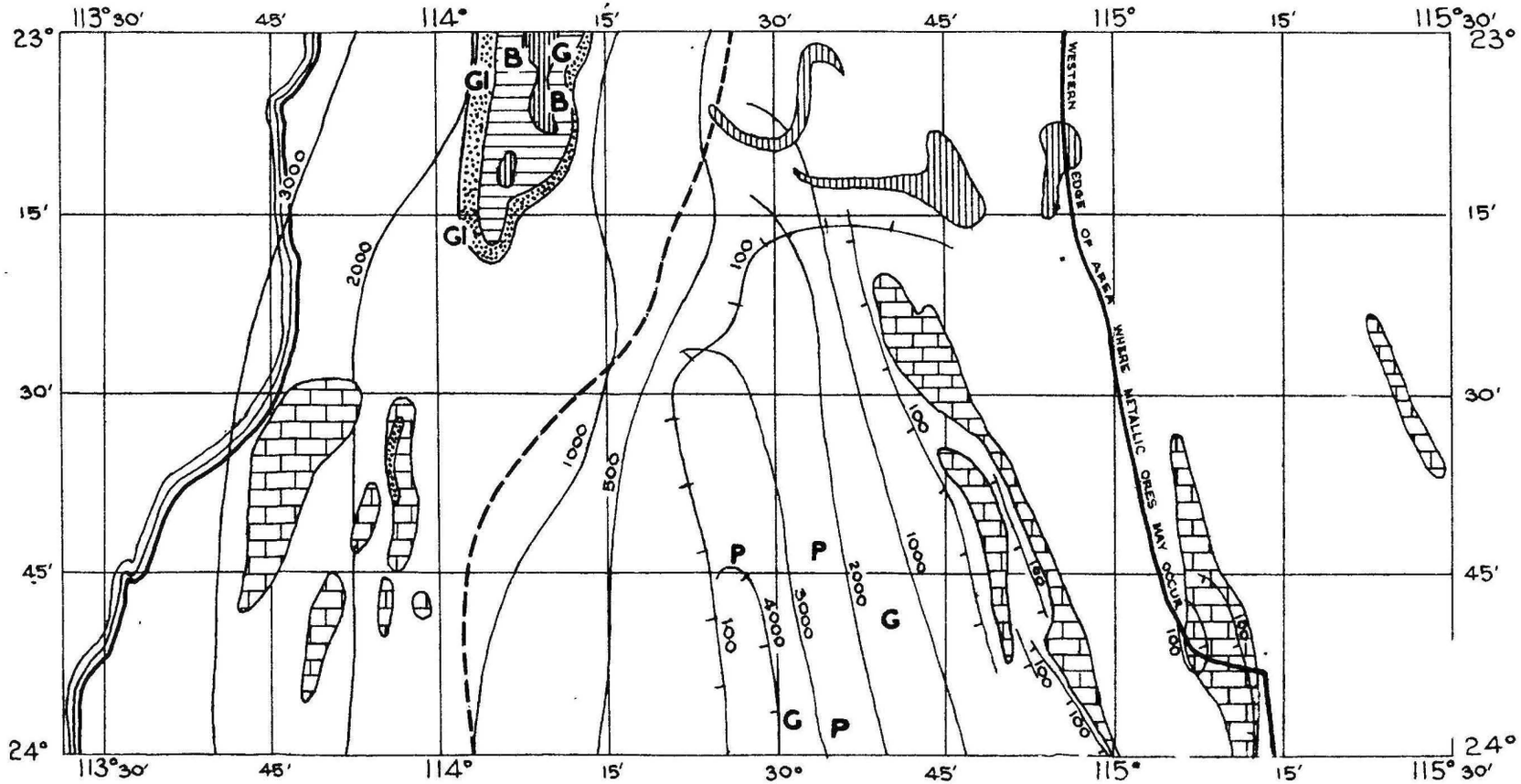
ECONOMIC GEOLOGY, MINILYA SHEET

Fig 2.

SCALE
10 0 10 20 30 40 MILES

REFERENCE

- Bentonitic Shale.
- Radiolarite.
- Hard Limestone.
- Friable Limestone.
- B Barite.
- G Gypsum.
- P Phosphate Rock.
- Gl Glauconite.
- ---- Eastern limit of artesian water.
- Depth to abundant stock water (below plain level) and direction in which depth of water is increasing.



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