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PALAEOZOIC STRATIGRAPHY OF WESTERN AUSTRALIA

by

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## ABSTRACT,

All of the Palaeozoic systems with the exception of the Silurian are represented in Western Australia.

The Cambrian System is known only in the East Kimberley Division where, in synclines, basalts and agglomerates up to 2000 feet thick are overlain by 1000 feet of interbedded limestone and shale and 2000 feet of red shale and sandstone.

The Ordovician System is restricted to small areas in the Fitzroy Basin and in the Ord Basin. Limestone with Lower to Middle Ordovician fossils is about 2000 feet thick in the Fitzroy Basin and glauconitic sandstone with Lower Ordovician conodonts conformably overlies the Cambrian in the north part of the Ord Basin.

The Devonian System outcrops in the Ord Basin (10,000 feet of sandstone, limestone and shale), in the Fitzroy Basin (1200 feet of limestone, shale, and conglomerate) and in the North-West Basin (4700 feet of sandstone, greywacke, conglomerate, fossiliferous limestone and siltstone).

Carboniferous greywacke, conglomerate and limestone <sup>1900</sup>1500 feet thick conformably overlie the Devonian in the North-West Basin and 350 feet of Carboniferous bryozoal limestone overlies Devonian sandstone in the Burt Range (Ord Basin).

The Permian System has the most extensive outcrop of the Palaeozoic rocks in Western Australia. In the Ord Basin, 1700 feet of sandstone, conglomerate and shale overlie the Carboniferous limestone. Marine glacial sediments, shale, sandstone and limestone total 6000 feet in the Fitzroy Basin, 12,000 feet in the North-West Basin and 6000 feet in the Irwin Basin. There is at least 2500 feet of glacial shale and sandstone, coal measures, and limestone in the Collie fault block in the South-west. Glacial shale and sandstone about 200 feet thick in the Eastern Division and under the Cretaceous of the Eucla Basin is probably terrestrial Permian.

Although the total thickness of Palaeozoic sediments is quite large - 11,000 feet in the Ord Basin, 11,000 feet in the Fitzroy Basin, 15,000 feet in the North-West Basin and at least 6000 feet in the Irwin Basin, the environment of deposition in all places was of the epi-continental, unstable-shelf type rather than geosynclinal.

## INTRODUCTION;

Western Australia, by far the largest of the Australian states, stretches from 14° South to 35° South Latitude and from 113° to 129° East Longitude. The main sedimentary basins are arranged peripherally to the Pre-Cambrian shield which forms the greater part of the state.

Teichert in 1947 summarized the post-Proterozoic stratigraphy of the state as known at that date.

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Teichert, C.; 1947; Stratigraphy of Western Australia. Amer. Assoc. Petrol. Geol., Bull. 31, 1-70.

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In 1948, the Commonwealth Bureau of Mineral Resources, Geology and Geophysics, by arrangement with the government of Western Australia, commenced detailed geological reconnaissance of the Fitzroy and North-West Basins. In 1948 and 1949, the R.A.A.F. carried out a programme of aerial photography of these basins and this air-photo survey has since been used as the basis for mapping in the field. In the course of this work several discoveries have been made and as only brief mention of them has been made elsewhere they are included in this summary.

The main areas of Palaeozoic sedimentation in Western Australia at present known are the Ord Basin in the far north-east, the Fitzroy Basin, The North-West Basin stretching from Onslow to the Murchison River and the Irwin-Perth Basin stretching from Geraldton to Busselton.

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Fig. 1. Map of Western Australia, showing main basins of Palaeozoic sedimentation

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## STRATIGRAPHY;

All the Palaeozoic systems except the Silurian are represented in outcrop in Western Australia.

CAMBRIAN

The Cambrian System outcrops only in the north-east of the state, in the valley of the Ord River. Basalt flows and agglomerate about 2000 feet thick rest unconformably on Pre-Cambrian quartzite. Above the basalt is a sedimentary sequence with 50 feet of massive hard limestone at base. Above this is 1000 feet of calcareous shale and limestone with Girvanella and Redlichia forresti (Negri Formation). The Mount Elder Formation, consisting of 650 feet of red shale at base and 1300 feet of ferruginous sandstone above, is conformable with the Negri Formation. These formations are most probably Lower Cambrian in age.

Matheson, R.S. and Teichert, C., 1946; Geological reconnaissance in the eastern portion of the Kimberley Division, Western Australia. Dept. Mines, W. Aust. Rept. for 1945, pp.73-87.

Stubblefield, C.J., 1942; Specimens of the Trilobite Redlichia from the Cambrian of W. Aust. Proc. Geol. Assoc. 53, 107.

In the northern part of the Ord Basin Reeves, in 1947, discovered eolitic limestone with the Trilobite Solenoparia of Middle Cambrian age. (in Korea and Northern China).

Teichert, C., 1950; Some recent additions to stratigraphy of Western Australia. Amer. Assoc. Petrol. Geol., Bull. 34, p.1789.

In 1950, a conformable sequence from the Lower Cambrian Mount Elder Formation up to fossiliferous Lower Ordovician was discovered by geologists of the Bureau of Mineral Resources in the northern part of the Ord Basin. (W.C. Smith, Personal communication).

#### ORDOVICIAN

The first indubitable Ordovician strata in Western Australia were discovered in 1949 by A.W. Lindner of the Bureau of Mineral Resources. Four bores for oil had been drilled through these rocks (in 1923) without their age being recognized.

The Ordovician consists of 1670 feet of limestone and calcareous shale with 780 feet of dolomite above. Devonian limestone rests unconformably on the dolomite and the bottom of the system is faulted.

Guppy, D.J. and Opik, A.A., 1950; The discovery of Ordovician rocks, Kimberley Division, Western Australia. Aust. Jour. Sci. 12 (6), 205.

Dr. Opik has identified the following fossils indicating a Lower Ordovician age: Obolus and Xenostegium. From the dolomite Asaphids, Phemerids, Gastropods, Nautiloids and Dichograptids indicating a Middle Ordovician age (cf. Lower Trenton).

In 1950, Dr. Opik (personal communication) found Lower Ordovician conodonts (cf. Drepanodus and cf. Acontiodus) in glauconitic sandstone from a formation conformably above Lower Cambrian sandstone in the northern part of the Ord Basin. No detailed work has been done in this area yet.

DEVONIAN

The Devonian System outcrops in three areas in Western Australia - in the Ord Basin, the Fitzroy Basin and the North-West Basin.

In the Ord Basin the Devonian, resting unconformably on Pre-Cambrian quartzite, comprises in ascending sequence about 4300 feet of fine- to coarse-grained sandstone, pebble beds and conglomerate with Laptophloeum australe (Middle or Upper Devonian in Eastern Australia); 4000 feet of fossiliferous limestone with interbedded shale and calcareous sandstone, the limestone containing Syringopora, Fenestella, Athyris, Chonetes, Camarotoechia, Mariatella, Productella, Spirifer, Strophomenella; Ostracoda; Bythocypris, Haploprimitia, Macrocypris, Primitia (this fauna is Upper Devonian in aspect (Matheson and Teichert, 1946, p.84); at the top of the sequence is about 1000 feet of well-bedded fine-grained sandstone with burrows.

In the Fitzroy Basin, Middle Devonian limestone 2700 feet thick rest unconformably on the Ordovician and Pre-Cambrian.  
Corals;  
Fossils include/ Amphipora ramosa, Prismatophyllum, Thamnophyllum, Thamnopora, Brachiopoda: Atrypa, Hypothyridina, Productella, Pugnax? Spirifer, Uncinulus; Gastropoda: Murchisonia; Ammonoidea; Bactrites, Maenioceras. More than 2000 feet of Upper Devonian limestone, siltstone and calcareous sandstone conformably overlies the Upper Devonian limestone. Fossils include Anthozoa: Amphipora, Prismatophyllum, Cystiphyllum kimberleyense, Diaphyllum; Bryozoa; Brachiopoda: Athyris, Atrypa, Camarotoechia, Hypothyridina, Productella, Pugnax, Schizophoria, Spirifer; Nautiloidea: Michelinoceras, Stereoplasmodoceras, Wadeoceras; Ammonoidea: Beloceras, Cheiloceras, Manticoceras, Sporadoceras, Tornoceras; Trilobitae: Ceratocephale, Harpes, Scutellum; Ostracoda Bythocypris, Cytherella. Above this formation, 1100 feet of bedded and reef limestone of Upper Devonian age contains Crinoids; Brachiopoda: Productella, Rhipidomella, Schizophoria, Spirifer; Ammonoidea: Pseudoclymenia, Sporodoceras, Tornoceras

T There is an unconformity between this formation and the overlying Permian. The outcropping Middle and Upper Devonian of the Fitzroy Basin is a near-shore facies with reef limestone, reef-lagoon sediments and coarse elastics.

The Devonian System of the North-West Basin rests unconformably on a mature surface of Pre-Cambrian schist and granite. In ascending sequence the system comprises 350 feet of greywacke and siltstone, 1550 feet of very fossiliferous greywacke, limestone and siltstone, 1100 feet of sandstone with few plant fossils at the base, 100 feet of interbedded siltstone and limestone and 1800 feet of greywacke, conglomerate and siltstone. Fossils include Stromatoporoids; Corals; Brachiopoda; Athyris, Atrypa, Hypothyridina, Rhipidomella, Rhynchonella; Spirifer; Actinophoronate nautiloids. Little detailed work has been completed on this fauna but Teichert states (Teichert, 1960, op. cit.) that the assemblage is of Middle to Upper Devonian affinities.

This system and the overlying Carboniferous was discovered in 1949 by a party of the Bureau of Mineral Resources.

#### CARBONIFEROUS

In Western Australia, the Carboniferous is known only from small areas in the Ord Basin and the North-West Basin.

In the Ord Basin, Carboniferous rocks, conformably overlying the Upper Devonian, comprise 350 feet of bryozoal limestone. The fauna includes rugose corals, Bryozoa, Brachiopoda; Athyris, Camarotoechia, Dialasma, Orthotetes, Productus, Spirifer, Rhipidomella; ~~and~~ and Gastropoda; Platyceras. It is probable that as the underlying rocks are uppermost Devonian, and as this fauna is older than Permian, it is Carboniferous in age (Matheson and Teichert, 1946, p.85). In the North-West Basin the Carboniferous System, conformable on the Devonian, comprises in ascending order 900 feet of bedded limestone and dolomitic limestone with few fossiliferous beds containing Brachiopoda; Rhipidomella, Syringothyris, spiriferids and productids. The abundance of Syringothyris indicates that this formation is probably of Lower Carboniferous age. Above this is 700 feet of pebbly greywacke and 300 feet of interbedded limestone (with ostracoda and brachiopods) and coarse arkose. This formation conformably underlies a ferruginous coarse sandstone with lycopod plants and striated erratics - probably the base of the glacial sediments of the Permian System.

PERMIAN

The outcrop of the Permian System extends from the Ord Basin to Collie in the south-west of Western Australia.

In the Ord Basin, an unsorted conglomerate about 500 feet thick rests with a slight angular unconformity on the Carboniferous limestone. Above the conglomerate is 500 feet of coarse sandstone. About 700 feet of shale and sandstone probably overlie the coarse sandstone. These beds are possibly Permian (Matheson and Teichert, 1946, p.85).

In the Fitzroy Basin, the Permian System rests unconformably on the older systems. Little work has been done on these rocks recently. The sequence so far established (chiefly by Wade, with additions by GUPPY'S party) follows, in ascending order:

The Grant Range Sandstone - 3000 feet of poorly-sorted sandstone with erratics including Upper Devonian limestone (LINDNER - personal communication) and varved shale is unfossiliferous, as far as it is known. The POOLE Range Sandstone - 200 to 700 feet of felspathic sandstone with marine fossils of Permian affinities - rests conformably on the Grant Range Sandstone.

The Nura Nura Limestone is only 20 feet thick but is of importance as it contains the ammonoids Matalegoceras clarkii and Thalassoceras wadei which indicate an Artinskian age.

The Noonkambah Shale - 1000 feet of sandy claystone, flaggy sandstone and flaggy limestone - is very fossiliferous. Fossils include Bryozoa, Corals, Crinoids, Brachiopoda, productids, spiriferids, Strophalosia, Claithroedina, Streptorhynchus?, Chonetes, Gastropods and Cephalopods.

The Liveringa Sandstone - 1400 feet of flaggy micaceous sandstone - contains a rich fauna including:

Plantae: Glossopteris, Arucaria.

Brachiopoda: Aulosteges, Claithroedina, Lineoproductus, Spirifer,

Streptorhynchus, Strophalosia, Waagenoconcha

Gastropoda: Pleurotomaria, Bellerophon, Conularia.

Foraminifera: Verbeekina, Naeschwagerina

Erskine Formation consists of 350 feet of conglomerate, sandstone and thin shale with Lepidodendron, Cordaites, and Phyllothea.

The maximum exposed section of the Permian System in Western Australia outcrops north of the Minilya River in the North-West Basin. The conformable sequence, in ascending order, comprises;

The Lyons Group - more than 3500 feet of marine glacial sediments including poorly sorted greywacke, shale, thin limestone with marine fossils, and boulder beds. Fossils have not been examined in detail but include

Plantae; Lycopeds (near the base of the group)

Bryozoa; Fenestellids, Hexagonella

Corals; Plerophyllum

Brachiopoda; Productids, spiriferids Rhipidomella

Lamellibranchs; Aviculopacten

Crinoidea; Calceolispongia? stem ossicles, cf. Platyerinus

This group rests conformably on the Carboniferous Yindagindy Formation.

The Callytharra Limestone - up to 800 feet of dense fossiliferous crystalline limestone, calcareous graywacke and calcareous siltstone.

The rich fauna includes;

Foraminifera; Calcitornella, Hamigordius, Spandelineoides

Bryozoa; Evactinopora, Fenestella, Hexagonella, Monilepora

Corals; Dibunophyllum, Plerophyllum

Crinoidea; Cyathocrinus, Platyerinus

Brachiopoda; Aulosteges, Chonetes, Dialasma, Productus, Spirifer

Lamellibranchs; Nuculana

Ostacoda; Bairdia, Cytherella, Healdia.

This formation with its characteristic lithology and fauna is by far the best marker in this basin and can be correlated with certainty with the Fossil Cliff Formation of the Irwin Basin and with the Nura Nura Limestone of the Fitzroy Basin.

The Weeramul Sandstone - up to 800 feet of medium to coarse-grained current-bedded sandstone with carbonaceous shale and greywacke in the upper part - contains lamellibranchs and nautiloids near the top.

The Bulgadeo Shale - up to at least 2000 feet of black carbonaceous shale with thin calcareous, phosphatic siltstone beds. Relatively rare fossils include;

Foraminifera;

Crinoidea; Calceolispongia barrabiddiensis, C. acuminata

Gastropoda: Bellerophon

Cephalopoda: Ammonoidea: El Pseudoschistoceras simile

Ostracoda:

Vertebrata: Elasmobranchs: Helicoprion

The Cudlago Sandstone - 700 feet of laminated sandstone, calcareous sandstone and thin siltstone - is poorly fossiliferous but contains Calceolispongia truncata and Neospirifer

The Quimanie Shale- 600 feet of carbonaceous shale with phosphatic siltstone beds containing Foraminifera (Ammodiscus? Hyperammonoides), Calceolispongia, Productids, Spiriferids, Gastropods and Pelecypods.

The Wandagee Formation - 600 feet of very fossiliferous interbedded siltstone and calcareous sandstone. Fossils include Foraminifera: Grithionina, Hyperammina, Hyperamminoides

Bryozoa;

Crinoidea: Calceolispongia

Elastoidea: Pteroblastus

Brachiopoda: Aulosteges, Chonetes, Cleiothyridina, Dielasma,

Neospirifer, Linoproductus, Productus, Strophalosia

Pelecypods, Gastropods

Nautiloidea: Stearoceras, Titanoceras

Ammonoidea: Prolinaceoceras australe

Trilobita: Ditenonyx meridionalis

Two thousand feet of sandstone - laminated, ferruginous and massive overlies the Wandagee Formation. The lower part contains many fossils including:

Crinoidea: Calceolispongia robusta

Brachiopoda: Dielasma, productids, spiriferids

Ammonoidea: Paragastrioceras wandageense, Pseudogastrioceras goochi

Vertebrata: Helicoprion davisi

About 1000 feet of interbedded thick shale and limestone overlie these sandstones in cores in the western part of the basin.

In the Irwin Basin much of the detailed stratigraphy remains to be worked out but the general section is as follows, in ascending order;

The Nangetty Formation - perhaps 2000 feet of poorly sorted siltstone and greywacke with at least five boulder beds and some thin limestone beds. No fossils have been found in this formation but its lithology is so similar to the lower part of the Lyons Group that it is most probably a marine glacial formation.

The Holmwood Shale - 2500 feet of shale with limestone beds and Metalegoceras jacksoni

The Fossil Cliff Formation - 200 feet of fossiliferous calcareous siltstone with limestone lenses. Fossils include: Foraminifera;

Bryozoa: Hexagonella, Streblotrypa

Corals: Cyathophyllum australe, Euryphyllum, Pterophyllum

Crinoides: Stem ossicles

Brachiopoda: Aulosteges, Chonetes, Cleiothyridina, Dialama,

Linoproductus, Strophalosia

Pelecypoda: Aviculopecten, Dalmanella, Warthia

Gastropoda: Conularia

Nautiloids, Trilobites, Ostracods

High Cliff Sandstone - 110 feet of unfossiliferous friable sandstone and carbonaceous siltstone.

Irwin Coal Measures - 200 feet of laminated sandstone, carbonaceous siltstone and coal - includes Glossopteris and Gangamopteris.

Carynginia Shale - 800 feet of shale with erratics of granite and quartzite. Aviculopecten is among the few fossils found.

Wagina Sandstone - about 300 feet of unfossiliferous sandstone and thin siltstone, at the top of the Permian section.

The lithological correlation between the Permian of the Irwin and North-West Basins is very striking and is confirmed by the fossil evidence. There are some peculiar absences in the fossil assemblages of the two areas - the absence of Metalegoceras and of Glossopteris and Gangamopteris in the north-west Basin and the absence of calceolipora and Helicoprion in the Irwin Basin. This may be due to the

chances of collection in very large areas of generally poor outcrop, but may be partly due to facies changes.

The only other well-established area of Permian sediments is in the Collie fault block where the sequence in ascending order is:  
Shale and sandstone with boulders

Marine mudstone, shale and limestone 350 feet thick

Coal Measures (1900 feet of micaceous shale and sandstone with 24 coal seams); fossils include Glossopteris browniana G. indica, G. gangamopteroides, Gangamopteris cyclopteroides, Angustifolia, Vertebraria, Rhizomopteris.

Unfossiliferous sandstone

This area is being deep-drilled at present so that more precise knowledge of the stratigraphy of this area may be expected very soon.

There is a large area in the east part of the state where glacial sediments outcrop. This Wilkinson Range Formation rests unconformably on Pre-Cambrian rocks. There are about 200 feet of poorly-sorted siltstone and sandstone with faceted and striated boulders. No fossils have been found in these beds. In a bore on the Trans-Continental Railway, there are rocks of lithology similar to the Wilkinson Range Formation underlying fossiliferous Lower Cretaceous shale. There can be little doubt that this formation is the terrestrial equivalent of the marine glacial sediments of the western coast of the state.

### MESOZOIC

There are no beds of indubitable Triassic age in the state, although sandstone in the south-west have been regarded as Triassic on the evidence of the fossil & footprints of a small four-footed animal.

Middle and Upper Jurassic beds, marine in Daupier Land and at Minilya, non-marine at Derby, Irwin River and Meera rest unconformably on Palaeozoic or Pre-Cambrian rocks.

Marine Lower Cretaceous rocks overlie the Jurassic in the North-West Basin and in the Perth Coastal Basin.

Marine Upper Cretaceous rocks are known only from the North-West Cape area of the North-West Basin.

#### CORRELATION;

**Cambrian:** As the Cambrian System outcrops only in the Ord Basin there is no question of correlation within the state. For purposes of wider correlation, the trilobite genus Redlichia is very important. In southern and Eastern Asia this genus is restricted to the Lower Cambrian and the lower part of the Middle Cambrian. This is supported by the algae Girvanella which occurs in the Lower Cambrian of China and Sardinia. These Ord Basin beds with Redlichia may therefore be considered Lower Cambrian and correlated with Beds containing Redlichia in Northern Territory, Western Queensland and Flinders Range of South Australia.

The correlation with China is maintained in the Middle Cambrian, ~~the~~ Solenoparia, ~~which is~~ <sup>which is</sup> characteristic of the Middle Cambrian of northern China and Korea, ~~occuring in the~~ occurring in the northern part of the Ord Basin.

**ORDOVICIAN:** The two genera of Conodonts found in the Ord Basin are restricted to the Ordovician and are characteristic of the Lower Ordovician (Tremadocian) of Estonia. The benthonic faunas of the Ordovician of the Fitzroy Basin include genera of trilobites, (Xenostegium) brachiopods (Obolus), nautiloids indicating a Lower Ordovician age and faunal affinities with the faunas of China and cordilleran America rather than southern Asia and Europe. Asaphids, Phomericids, Nautiloids and Discograptids of genera indicative of Middle Ordovician age and of affinities with the Middle Ordovician of Central Australia and western Queensland, and of Tasmania, Korea, and France occur in the upper part of the Fitzroy Basin sequence. However, this fauna represents a special development and perhaps indicates a separate Indian Ocean province (Opik, personal communication).

**DEVONIAN:** The near-shore facies of the Fitzroy Basin are correlated with the off-shore facies of the North-West Basin in only a general way. Corals (Thamnopora), Brachiopods (~~XXXX~~ Athyria, Atrypa, Camarotoechia, Hypothyridina, Productella), and Tentaculites are found in both areas.

Teichert, C., 1949: Observations on stratigraphy and palaeontology of Devonian, western portion of Kimberley Division, Western Australia. Commonwealth of Aust., Bur. Min. Res. Geol. and Geoph., Rep. 2

Teichert (1949) gives the age of the Fitzroy Basin Devonian as Middle to Upper Devonian and (1950) of the fossiliferous Devonian of the North-West Basin as late Middle to early Upper Devonian. "The general aspect of the Devonian fauna of the Fitzroy Basin is Central European and Mediterranean rather than Asiatic and Australian." (Teichert, 1949, p. 7).

**Carboniferous:** The Syringothyris fauna of the North-West Basin indicates a Lower Carboniferous age and has generic affinities with the fauna of the Ord Basin and with that of the Lipak Series of Spiti. However, insufficient work has been done on this fauna to allow a detailed correlation.

**PERMIAN:** More palaeontological work has been done on the Permian fossils than on the more recently discovered Ordovician to Carboniferous faunas, but, because so much of the material consists of new species or varieties, progress in the study of the faunas is slow. Significant parts of the faunas (corals, ammonoids, trilobites, and some brachiopods) have been studied. Only one ammonoid (Metalegoceras jacksoni) of Sakmarian affinities has been found in Western Australia, in the Holmwood Shale of the Irwin Basin. the Nura Nura Limestone of the Genera of Artinskian affinities & occur in the Fitzroy Basin (Metalegoceras clarki, M. striatum, Thalassoceras wadei) and the Wandagee Formation of in the North-West Basin (Paragastrioceras Kuttungense, Pseudogastrioceras snechi, Propinacoceras paucilobatum).

The trilobite Ditomopyge meridionalis Teichert resembles D. artinskiensis and is associated with species of Pseudogastrioceras, Paragastrioceras and Helicoprion. This association fixes the age of the Wandagee Formation as Artinskian.

The Kuttung Tillite of Eastern Australia has been referred to the Upper Carboniferous mainly on the presence of the Generally Lower Carboniferous Rhaopteris.

David, T.W.E., 1950: "The Geology of the Commonwealth of Australia" Ed. Arnold, London, p.293.

BUT THE MARINE GLACIAL SEDIMENTS of Eastern and Western Australia are Lower Permian in age and are correlated with the Talchir Tillite

of India, the Dwyka Tillite of South Africa and the Itarare Series of South America

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Raggatt, H.G., and Fletcher, H.C., 1937; A contribution to the Permian-Upper Carboniferous Problem .... Aust. Mus. Rec. 20, (2) 159-166.

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It is extremely ~~likely~~ likely that the Kuttung Tillite is the terrestrial equivalent of the lower part of the marine glacial sediments of eastern and Western Australia and that it belongs in the Permian rather than in the Upper Carboniferous.

No Permian younger than Artinskian is known from Western Australia, the interval between the Artinskian and the Middle Jurassic being generally represented by an unconformity.

The western and north-western margin of the continent of Australia has a much more complete Palaeozoic succession, mainly marine, than the other countries bordering on the Indian Ocean and would appear to have been in contact with the Tethys Ocean through much of the Palaeozoic Era. This would seem to indicate that the Indian Ocean as such is essentially young - at least post-Palaeozoic for if it had been in existence in contact with the shields of India and Africa one would expect some evidence of Palaeozoic marine deposition on the Indian Ocean margins of India and Africa, comparable to that on the Indian Ocean margin of Australia. The sedimentational history of the Indian Ocean margin of Western Australia is strikingly different from that of the Southern Ocean margin which has no marine ~~like Palaeozoic~~ sediments older than Lower Cretaceous. It is possible that the mid-Indian Ocean Ridge

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Fairbridge, R.W., 1948; The juvenility of the Indian Ocean. Seope (Jour. Sci. Union, Univ. W. Aust.), 1 (3), 31.

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separates an ocean of Pacific type, which has never been continental from one of Atlantic type which is merely a submerged continent and which during the Palaeozoic Era was almost entirely and always continental.