

REPORT ON THE GONDWANA SYSTEM IN TASMANIA

The Gondwana System in Tasmania includes the rocks of the Permo-Carboniferous and Triassic Systems.

The Permo-Carboniferous rocks occur throughout the eastern part of the State and isolated areas occur in north-western and western districts. It would seem therefore that the Permo-Carboniferous sedimentation took place over the whole what is now Tasmania, with the possible exception of the south-western portion.

The Triassic rocks succeed the Permo-Carboniferous without any apparent break, although it is probable that a disconformity exists. They are not so widespread as the Permo-Carboniferous and are restricted to the eastern half of the island.

The Permo-Carboniferous system contains interbedded series of marine and non-marine rocks (glacial and fresh water series). The Triassic contain no rocks definitely of marine origin, though some may be of estuarine origin the remainder being of fresh water origin. The following table shows the relation of the marine and non-marine series.

Marine	Non-Marine
Triassic	Upper Sandstone series
	Middle or Felspathic Sandstone Series
	Lower or Ross Sandstone Series
	Basal Grit
Permo-Carboniferous	Tomago Series in certain localities only
	Upper Marine Series
	Greta Series
	Glacial Series (local)
	Lower Marine Series
	Fresh Water Series (local)
	Basal Glacial Series
Unconformity	

The Permo-Carboniferous and Triassic strata have been subjected to epeirogenic earth-movements only. Folding is absent, but block faulting has caused tilting, the resultant dips being seldom over 10° and usually ranging from 0° to 10°. Large scale faulting and huge intrusions of dolerite magma accompanied the earth-movements at the close of the Triassic Period.

PERMO-CARBONIFEROUS.

(1) Basal Series (Glacial). Wherever the base of the system

is exposed it is found to rest upon a basement of Proterozoic or Lower Palaeozoic sedimentary (ranging in age up to Silurian) and igneous rocks (ranging in age up to Devonian). The junction is an unconformable one, the basement consisting of highly folded and truncated rock series upon which the Permo-Carboniferous beds rest horizontally. The basement appears to have been reduced to a peneplain in some parts of the State e.g. the north-eastern, before the deposition of the Permo-Carboniferous sediments.

The basal series ranges largely in nature from place to place. At Wynyard it consists of a series of tillites with interbedded conglomerates and sandstones at least 1220 feet in thickness, with several glacial pavements in the series similar conglomerates and tillites occur inland at Preolenna.

In the north-eastern districts the basal members are thin and range from a soft tillite to pebbly sandstones with an occasional marine fossil. The beds here were probably formed under marine conditions with pebbles and boulders dropped from floating ice.

Southwards along the East Coast the basal beds increase in thickness and tillites and massive conglomerates occur at Maria Island and occur in other localities in south-eastern districts.

Only a few marine fossils have been found at a few localities in this series. They represent typical genera and species of the Lower Marine series which generally conformably overlies the basal series.

(2) Fresh Water Series. In the St. Marys District on the East Coast two thin seams of coal occur in a sandstone series between the basal pebbly sandstones, and the Lower Marine series (siliceous shales and limestones).

The occurrences of a fresh water series below the Lower Marine has not been recognized elsewhere in the State and it is apparently a local development.

(3) Glacial Series. At Cape Paul Lamanon Lewis has recognized a glacial horizon above the Lower Marine Series. This has not been recognised elsewhere in the State and may be a local development.

(4) Greta Series. At several localities in southern Tasmania (Bruny Island and Port Cygnet) and in northern Tasmania (Mersey Valley Preolenna) a coal-bearing fresh water series occurs. The Tasmanite oil-shale bearing beds of Mersey Valley, Chudleigh, Quamby Bluff and Oonah are also on the same horizon, but the conditions of deposition were marine. At other localities this series is represented by carbonaceous shales, and in some cases has not been recognized.

The series is composed of medium-grained sandstones and shales. It conformably overlies the Lower Marine series and conformably underlies the Upper Marine series. In conformity with the subdivisions in N.S.W it is therefore referred to the Greta series.

The thickness ranges from 30 feet at Barn Bluff, 140 feet at Preolenna and 850 feet at Bruny Island. The contained fossils in the shales include:-

Gangamopteris	spatulata
	angustefolia
Glossopteris	ampla
"	browniana
Noeggerathopsis	media

(5) Tomago Series. At Preolenna, Barn Bluff and Sandfly-Cygnnet, a fresh water series overlies the Upper Marine Series. It consists of normal sandstones and shales and is 500 feet thick at Preolenna, 740 feet at Barn Bluff and 200 feet at Sandfly-Cygnnet. By analogy with the N.S.W occurrences it is referred to the Tomago series.

Not many fossils are known but it is stated that it is characterised by the *Glossopteris* flora rather than the *Gangamopteris* - *Glossopteris* ore.

TRIASSIC

(1) Basal Grit Series. The basal series of the Triassic consists of fine conglomerates and grits. The pebbles are composed of quartz and quartzitic types and rarely exceed a few inches in size. The matrix consists almost wholly of quartz grains. The thickness of the series is small ranging up to 50 to 100 feet.

This series is apparently restricted to the midland, eastern and south-eastern districts, and is not present in certain parts e.g. St. Marys of the North-eastern districts.

When visible this series overlies the uppermost beds of the Permo-Carboniferous system with an apparent conformity. The uppermost beds of the Permo-Carboniferous system consist of very fine grained marine rocks resembling mudstones but composed principally of silica.

The change in nature of the rocks from the upper Permo-Carboniferous beds (marine siliceous mudstones) to the basal Triassic (fresh water or estuarine conglomerates and grits) indicates a change of conditions of sedimentation and perhaps an interval of time. The junction of the two systems is therefore regarded as a disconformable one.

No fossil plants or animals have been found in this series.

(2) Ross or Lower Sandstone Series. This series occurs throughout the south-eastern, midland and eastern districts, but is absent in certain parts of the north-eastern districts e.g. St. Marys and Dalmayne. When this series and the basal grits are absent the Middle or Felspathic sandstone series (see below) directly overlies the Permo-Carboniferous system.

In the Midland and south-eastern districts this series attains a maximum thickness of 800 feet, but apparently is thinner to the north-east.

The rock types are quartzose sandstones with inter-bedded shales and mudstones. The sandstones are of medium grain size, the grains often having glistening faces (crystal or fracture). Mica (both biotite and muscovite) is plentiful being particularly developed along the bedding planes. False or current bedding is common and while generally it is referable to the action of currents in shallow water, it may sometimes possibly be due to wind action in the formation of dunes. Clay pellets (flat and ellipsoidal) are common in the sandstones and also in the mudstones and in extreme cases form mudstone or "clay-pellet" conglomerates.

The mudstones and shales are generally present in thin beds and present a considerable diversity of types. The mudstones are unstratified and range from white to grey in colour. There is however, a more

or less complete gradation to the thinly stratified shales. Carbonaceous types are present, but no seams of good coal occur.

Certain zones of the sandstones are slightly saliferous and solutions percolating them deposit halite and epsomite.

Thus basal grits pass by gradual reduction of grain size into the Ross Series and the relation is undoubtedly a conformable one. The Ross Series is overlain apparently conformably by the Felspathic sandstone series. The Ross Series has the following fossil animals and fish:-

Two humeri of labyrinthodonts (Hobart)
Acrolepis hamiltoni (Hobart)
 " *tasmanicus* (Tinder Box Bay)

Fossil plants have also been found especially in the shales and mudstones, but they are not nearly as plentiful as in the overlying Felspathic Sandstone series. A complete record of the fossil plants in this series is not possible as the fossils from this and the overlying series have not been kept separate. It can be said that the fossils include the more common genera of those occurring in the Felspathic sandstone series. Such would include *Phyllothea*, *Cladophlebis*, *Thinnfeldia*, *Phoenicopsis* and a cone described as *Lepidostrobus mulleri* (of which the generic determination is apparently wrong).

The false bedding, saliferous nature, and nature of the fossils (plants, fish and animals) point to origin in shallow waters (estuarine and or lacustrine) with possible terrestrial conditions at intervals, under possibly sub-arid conditions.

(3) The Middle or Felspathic Sandstone Series. This series is more extensively developed than the underlying series and occurs throughout the south-eastern, midland and north-eastern regions of the State.

The rock types include felspathic sandstone, mudstones, shales, quartzose sandstones and coal seams. The most common type is the felspathic sandstone which is medium to coarse in grain and consists of feldspar (more or less decomposed,) quartz and mica (biotite and muscovite) with clay pellets similar to those in the Ross Sandstones. The mudstones and shales are white to grey in colour and are highly fossiliferous. Sandstones similar to the Ross are interbedded but are subordinate in amount. Carbonaceous shales are common and coal seams ranging in number to light, have been found to occur.

The following thirty-four species have been determined:-

Equisetales:

Neocalamites Carrerei, Zeiller.
Neocalamites hoerensis (found later)
Phyllothea australis, Brongn.

Filicales:

Cladophlebis australis (Morris).
 " *tasmanica* (Johnston).
Thinnfeldia Feistmanteli, Johnston.
 ? *Phlebopteris alethopteroids*, Eth. Jr.
Thinnfeldia odontopteroids (Morris)
 " *lancifolia* (Morris)
 " *acuta*, Walkom
 " *cf. talbrangarensis*, Walkom.
Cladophlebis Johnstoni, Walkom.

Johnstonia coriacea (Johnston).
 " dentata, Walkom.
 " trilobita (Johnston).
 Linguifolium diemenense, Walkom.
 " Lillieanum, Arber.
 Sphenopteris Morrisiana, Johnston.
 Pecopteris (cf. Hillae, Walkom)
 Taeniopteris Morrisiana, Johnston.
 " Carruthersi, Tenison-Woods.
 Sagenopteris moribunda, Johnston.
 Chiropteris tasmanica, Walkom.

Cycadophyta:

Pterophyllum Strahani, Johnston.
 " riddonensis, Johnston.
 " (Anomozamites) inconstans (Braun).
 Pseudoctenis sp.
 Sphenozamites Feistmantelli, Johnston.

Ginkgoales:

Ginkgoites digitata (Brongn).
 " salisburyoides (Johnston)
 Baiera tenuifolia, Johnston.
 ? Baiera bidens, Tenison-Woods
 ? Czekanowskia sp.
 Phoenicopsis elongatus.

These have been examined and determined by Dr. Walkom, who considers the beds to be Upper Triassic.

The series are conformable with the underlying Ross series but the change in the conditions of sedimentation from those of the later to the lacustrine or swampy conditions of the former indicate a slight break. The Felspathic Sandstone series pass up conformably into an over-lying series of sandstones similar to the Ross Series.

(4) Upper Sandstone Series. This series has been reported from one district only viz St. Marys, where 200 feet of sandstones similar to the Ross, overlie it. No fossils have been discovered.

(5) Dolerite (Diabase) Intrusions. The Triassic sedimentation was apparently brought to a close by epeirogenic earth movements, involving considerable faulting and the intrusions of enormous bodies of dolerite into the Permo-Carboniferous and Triassic rocks. The general form of these must be huge, irregular sills with large transgressive bodies and dykes rising into the overlying strata.

P.B. Nye (Sgd)
GOVERNMENT GEOLOGIST.

Hobart.
 7th May, 1930.

