

THE STRATIGRAPHY AND STRUCTURE OF THE LOWER PALAEOZOIC  
SEDIMENTARY ROCKS OF TASMANIA.

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1. Introduction.

Lower Palaeozoic sedimentary rocks occur at numerous localities throughout the western, north-western, north-eastern, eastern, and south central districts.

Cambrian, Ordovician, and Silurian fossils have been collected and determined, and while rock systems corresponding to these periods are present, the stratigraphy and structure have not been worked out in detail.

Several series have been recognised in the different regions, but correlation has not always been satisfactorily established. The Silurian system is generally readily recognizable and easily correlated; but the position is not so satisfactory as regards the Cambrian and Ordovician systems. The rocks below the Silurian basal conglomerate, and between it and the Proterozoic rocks, are generally grouped as the Cambro-Ordovician system. It is the correlation of the series within this dual system, and the reference of the rocks to either the Cambrian or the Ordovician that offers the greatest difficulties.

Considerable advancement in knowledge has generally taken place, and much information gained during the past ten years; but most correlations are still more or less tentative.

II Stratigraphy

A. Cambro-Ordovician System.

- (1) Base. Schists of various types exist in south-western, western, and north-western regions are referred to the Proterozoic group; but the relations between these rocks and those assigned to the Lower Palaeozoic have not been satisfactorily determined. In some cases the relationship is a faulted one; but in others the field occurrences are such that in the absence of detailed surveys, the relationships are obscure. In recent years the position has become somewhat more difficult as field work along the recently opened West Coast road and in the Smithton-Wynyard district has shown that the rock series referred to the Proterozoic are not all schists; but contain slates, quartzites, etc. It is, therefore, more or less impossible to decide in certain districts e.g. Smithton-Wynyard (Sister's Hills), whether the slates, quartzites, etc., should be referred to the Proterozoic or the Lower Palaeozoic systems.

In only two localities viz. the South Coast and the Frankford-Beaconsfield district, have heavy conglomerates, possibly representing basal ones, been observed in contact with the schists, but detailed work has not been carried out in either district. In the South Coast district the conglomerates may possibly be of the West Coast Range series in faulted relation to the schists. In the Frankford district the conglomerates apparently rest unconformably on or against the schists, and while the overlying rocks of the Frankford-Beaconsfield district are referred to the Cambro-Ordovician system, the possibility of their age being Silurian, has not been definitely eliminated.

In view of the more or less general absence

of a definitely proved Cambro-Ordovician basal conglomerate, and the difficulty in some districts of determining (on lithological grounds), whether the rocks belong to the Proterozoic or Lower Palaeozoic systems, the possibility of the Proterozoic rocks passing up conformably into the Lower Palaeozoic, cannot be overlooked.

- (2) Cambrian. Cambrian fossils have been determined from the following districts:- Florentine Valley, Caroline Creek, Hadfield Plains and Arthur River, only one, however, from each of the latter two localities. The fossils are mainly trilobites, with some brachiopods etc.

In the Florentine Valley locality the rocks are slates and quartzites which are overlain, apparently unconformably, by West Coast Range conglomerates. At Caroline Creek the rocks are ferruginous sandstones; but the structure is obscure and neighbouring beds yield brachiopods determined by Mr. F. Chapman as Silurian. At Hadfield Plains, (?) *Hurdia davidi* was determined by Mr. F. Chapman; but the containing black slates are probably in faulted relation to West Coast Range Conglomerates. The Arthur River fossil was *Tasmanadia Twelvetreesi* contained in black slate. In general, the Cambrian fossils appear to come from a series of slates (generally black), quartzites and sandstones.

- (3) Ordovician. Apart from Lower Ordovician graptolites from boulders in the Permo-Carboniferous Glacial conglomerates near Wynyard, only a few indistinct graptolites have been discovered. These came from black slates on the North East Dundas tramway, and were recently re-examined by Mr. R.A. Keble, who considered that they indicated an age at the summit of the Lower, or the base of the Upper Ordovician system.

In a reconnaissance survey in 1931, Mr. K.J. Finucane determined that the graptolite bearing slates were interbedded with the Dundas series probably about the central portion.

A few cephalopods from the Railton limestone have been determined by Mr. F. Chapman as indicating an Ordovician age.

Apart from the above districts where the rocks are fossiliferous, the Cambro-Ordovician rocks have to be described as a number of series.

- (4) Balfour Series. This series was described by Dr. L.K. Ward in the far North Western districts in 1910 (Bulletin No. 10). It comprises slates (light coloured), quartzites and fine conglomerates intruded by granite and by basic dykes of probably Devonian age. No other evidence of age is available.
- (5) Rosebery Series. This series was instituted by Mr. K.J. Finucane in 1931 (forthcoming bulletin) to include the slates and quartzites of the Rosebery district, apparently situated stratigraphically below the Dundas series. The rocks exist for the most part as small "islands" in the

intrusive Devonian porphyries.

- (6) Farrell Series. This series was set up by Dr. L.K. Ward in 1908, to include the dark slates and sandstones of the Mt. Farrell district, which appeared to be older than the Silurian rocks of the district. They are probably identical with the Rosebery series.
- (7) Dundas Series. This series - one of considerable thickness - is extensively developed in the Western, North Western, and South Central regions. The typical rocks are slates (red when weathered, grey and green when unweathered), fine grained breccias composed of felspar, augite, etc., but cherts, tuffs, and basic volcanic rocks also occur to a slight extent. In the Rosebery district, dark slates and quartzites are interbedded with the above, while in the Smithton district, a limestone bed and enormously thick dolomite beds are also interbedded with them. The base of the series appears to be present at Rosebery and Smithton, and to consist of slates, cherts, etc., underlain by dark slates, quartzites, fine conglomerates etc. The Smithton district provides the best section, and has been worked out in detail (Bulletin No. 41). Below the series in this district, dark slates and quartzites and fine conglomerates appear to occur conformably and to extend eastwards to the white quartzites and dark slates of Sister's Hills (previously referred to the Proterozoic).

The upper part of the series has not been recognised, as the series is usually found in faulted relationship to the Silurian system, although at Adamsfield the West Coast Range conglomerates appear to overlie it; but even there, faulting has affected the relations.

Apart from being older than the Silurian and younger than the Proterozoic, the only evidence of age depends upon the graptolites contained in the interbedded black slates along the N. E. Dundas tramway (see above). The evidence of the graptolites suggests that the Dundas series includes part of the Lower and Upper Ordovician systems.

- (8) Porphyroid Series. The "porphyroid" series was formerly regarded as one of acid lava flows, pyroclastic sediments, etc., overlying the Dundas series. Field surveys in recent years have proved that the felsites, keratopyries are mostly, if not wholly, igneous rocks (porphyries) of the Devonian suite intrusive into all sedimentary rocks up to and including the Silurian. This series does not exist as a unit in the Cambro-Ordovician sedimentation. The associated sedimentary rocks of the Read-Rosebery district are referred to the Rosebery series, and in other districts may represent those of any system up to and including the Silurian.
- (9) Mathinna Series. This series is a very thick one of slates and quartzites extensively developed throughout the gold-fields of North Eastern Tasmania. Breccias and tuffs have also been reported to occur to a small extent. No fossils have been found, and the only evidence of age is that it is unconformably overlain by Permo-Carboniferous rocks and is intruded by granite of probably Devonian

age. The rocks are lithologically and structurally similar to the Ordovician system of Victoria.

The series extends westerly as far as Lefroy, while somewhat similar rocks occur at Beaconsfield. If the Frankford conglomerate is a basal one, the Beaconsfield rocks would be the lower portion of the series and pass up into the typical Mathinna series.

The Mathinna series has been correlated with the Dundas; but although some tuffs and breccias may occur, typical rocks of the latter series are absent.

- (10) Correlation. The above descriptions reveal the difficulties met within the Cambro-Ordovician system. The base of the system has not been recognized, and the rocks may pass down into the so-called Proterozoic system. Both Cambrian and Ordovician fossils have been collected and determined; but many districts yield no fossils and correlation is difficult. The following correlation is that adopted by the Geological Survey; but is more or less tentative.

	Western	North Western	South Central	North Eastern	North Central
Ordovician	Dundas Series of Dundas, Rosebery, etc. <u>Graptolite beds, N. E.</u> Dundas Tram.	Dundas Series of Waratah, Magnet, Smithton, Leven River.	Dundas Series of Adamsfield.	Mathinna Series.	Dundas Series of Leven River, etc. Limestones at Railton.
Cambrian	Rosebery and Farrell Series.	<u>Balfour Series.</u> <u>Pre-Dundas Series</u> of Smithton-Sisters Hills District. <u>Fossiliferous</u> slate of Arthur River and Hatfield Plains?	<u>Fossiliferous</u> rocks of Florentine Valley and Mount Mueller Dist. <u>South Coast.</u>	Frankford and Beaconsfield.	Fossiliferous rocks of Caroline Creek.

It will be noted that, excepting in the north-eastern districts, there is a general similarity in that the Dundas Series occurs throughout, while Cambrian fossils have also been found. In the north-eastern district, however, only the Mathinna series is present, and the contrast is probably due to different

conditions of sedimentation.

### B. Silurian System

The Silurian system occurs in numerous districts throughout the western portion of the State; but is absent from the eastern portion.

It contains several thousand feet of rocks and is divisible into the following series:-

- (1) West Coast Range Conglomerate Series. This is the basal series of the system, and is 2,000 to 3,000 feet thick. It is, as its name implies, particularly prominent along the West Coast Range and forms other mountains in western and north-western districts. It consists mainly of coarse conglomerates which become finer towards the top, and contain interbedded quartzites and sandstones. The prevailing colours are white and some shades of red or pink. The pebbles are quartz schist, quartzite and reef quartz.

The series is practically non-fossiliferous, but towards the top, the sandstone beds contain a few typical fossils. It is found to pass upwards into quartzites, etc., of the succeeding series. Although the relations are not also clear, it appears to definitely overlie the Dundas and other Cambro-Ordovician series.

- (2) Tubicolor or Quartzite Series. The Tubicolor series of quartzites, sandstones, etc., was recognised in some western and north-western districts, as succeeding or forming the upper part of the West Coast Range series; but is not always present. In the Ludden Valley its place was taken by the "discoidal" series, while at Adamsfield, a series of quartzites containing gasteropods, overlies the conglomerates. The thickness is several hundred feet and probably does not anywhere exceed 1,000 feet.
- (3) Gordon River Limestone Series. This series apparently succeeds the above, but the succession is not always clear, and not necessarily always the same. By a greater development of slates, it is possible that the limestone member may become a part of the Queen River Series.

In general the series is considered to include the thick beds of limestone of bluish-grey colour, common throughout the western half of the island. The limestone is sparingly fossiliferous; but has yielded gasteropods, brachiopods, corals etc.

- (4) Queen River Series. In the type locality this series consists of slates, quartzites or sandstones, and interbedded limestones (possibly the Gordon River Limestone). The soft friable white sandstones with slates and limestones of the Zeehan, Dundas, Middlesex/and Adamsfield districts, is considered  
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to be the equivalent of this series. It is very fossiliferous, the friable sandstones and shales containing numerous brachiopods, trilobites, etc., and it is to the determinations of the fossil collection from this and the Gordon River limestone that the rocks have been referred to the Silurian system.

### III Structure

#### A. General.

A tract of Proterozoic rocks with a general north-south trend, extends from the south-west part of the island to within forty miles of the north coast. Lower Palaeozoic rocks occur to the west of this tract from Low Rocky Point north-western extremity of the State. A similar belt appears on the eastern side; but becomes hidden under the diabase, etc., of the Central Plateau.

From the northern end of the above tract of Proterozoic rocks, an extension appears to trend eastwards as far as Frankford, and then in one or more narrow zones northwesterly to the shores of Bass Strait. In general the Lower Palaeozoic rocks west of this tract show a similar easterly and then north-westerly trend.

The Lower Palaeozoic rocks of the north-eastern districts occur to the east of the Frankford-Beaconsfield zone of Proterozoic schists.

The Proterozoic rocks have only small intrusions of granite in them. The intrusions of granite, etc., attain their greatest development in the western and north-eastern tracts of Lower Palaeozoic rocks, while only minor intrusions of serpentine, etc., exist in the south central tract (east of the Proterozoic tract).

#### B. Cambro-Ordovician.

These rocks have general north-north-westerly strikes and high dips. The structure has not been worked out in detail in many districts; but the strata have probably been closely folded. This applies particularly to the north-eastern districts where recent surveys of the Mathinna and Alberton goldfields have proved the presence of closely folded zones. The whole of the north-eastern rocks appear, in fact, to represent a synclitorium with more open folds on the western margin.

In the Smithton district, a large open syncline has been developed, in the Dundas series, and the folding is not so close as would be expected for the remainder of the western tract.

Considerable faulting and igneous intrusions exist, and have rendered the structure more complicated and difficult to decipher.

#### C. Silurian.

The Silurian rocks were apparently deposited unconformably over practically the whole of the proterozoic and Cambro-Ordovician rocks of the

western half of the State. The system was not subject to all the earth movements which affected the Cambro-Ordovician rocks, some of the movements being pre-Silurian, and the Silurian rocks are therefore not so closely folded as the Cambro-Ordovician ones. The system has, however, been affected by large scale block faulting associated with the Devonian intrusions. It is due to such block faulting that the upper members of the system are preserved in blocks faulted down into the Proterozoic and Lower Palaeozoic rocks. In such blocks, the Gordon River and Queen River series are often steeply inclined and closely folded as at Mt. Bischoff, Queen River, etc. The West Coast Range Conglomerate series generally form mountains, and represent the blocks which have not been downfaulted, and from which the overlying series have been denuded. In these blocks the Conglomerate series have low to moderate dips, and have escaped the folding movements to which the downfaulted blocks were subjected. The Conglomerate series were, however, extensively faulted, and the blocks on the mountains are traversed by numerous faults as at Mts. Lyell, Owen, etc.

Many of the Devonian basic and ultrabasic intrusions, and to a less extent, the acid and intermediate porphyries, occur along the margins of the down-faulted blocks, and between them and the Cambro-Ordovician rocks into which they were faulted.

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7/1/35