THE MESOZOIC STRATIGRAPHY OF THE MERRIWA-MURRURUNDI DISTRICT AND SOUTH-EASTERN LIVERPOOL PLAINS.

By J. A. DULHUNTY, B.Sc.

(With Plate I and two text-figures.)

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INTRODUCTION.

The area described in this paper includes the country situated immediately to the north and south of the eastern portion of the Liverpool Range. It extends to the boundaries of two other districts in which the Mesozoic stratigraphy has been worked out, namely the Goulburn River district to the south-west and the Gunnedah-Coonabarabran district to the north-west.

In the Goulburn River district the presence of Jurassic sediments outcropping along the southern side of the Liverpool Range was first recognised between Merriwa and Cassilis. (1) It was found possible to make a distinction between Jurassic and Triassic rocks by tracing a bed of shales, termed the Comiala Series, to the vicinity of the Talbragar "Fish-Beds" near Ulan (see (2) and references therein). At this point plant and fish fossils of Jurassic age occur at the base of a sandstone series (the Munmurra Beds) which overlies the Comiala shales, while another
sandstone series (the Wollar Sandstone), which underlies the shales, is continuous with the Triassic beds overlying Kamilaroi sediments to the south-east. The Comiala Series has been taken as a line of demarcation between Triassic and Jurassic, giving the following sequence in the Mesozoic strata and underlying Kamilaroi rocks of the Goulburn River district:

<table>
<thead>
<tr>
<th>Jurassic</th>
<th>Munmurra Beds.</th>
<th>Porous sandstone with basal conglomerates in places.</th>
</tr>
</thead>
<tbody>
<tr>
<td>?</td>
<td>Comiala Series.</td>
<td>Mainly shales with some &quot;red beds&quot; and tuffaceous bands.</td>
</tr>
<tr>
<td>Triassic</td>
<td>Wollar Sandstone.</td>
<td>Sandstone and fine conglomerates.</td>
</tr>
<tr>
<td>Kamilaroi</td>
<td>Upper Coal Measures.</td>
<td>Coal seams, shales, white cherts and tuffaceous sandstone bands.</td>
</tr>
</tbody>
</table>

The Mesozoic strata of the Gunnedah-Coonabarabran area, extending south to the Tertiary basalts of the Liverpool Range and occupying the western and north-western portions of the Liverpool Plains, have been mapped and described by Mr. E. J. Kenny\(^3\) in connection with the work of the Geological Survey of New South Wales on the intake beds of the Great Artesian Basin. Kamilaroi coal measures dipping to the west outerop between Curlewis and Gunnedah. These are followed in vertical sequence by lower Mesozoic strata, which have been subdivided into basal sandstones, grits, and conglomerates known as the Digby Beds, and an overlying series of sandstones, sandy shales, and clay shales which have been called the Napperby Beds.

Towards the centre of the area there occur contemporaneous lava flows, which have been termed the Garrawilla Series, overlying the Napperby Beds. The interbedded lavas are followed in turn by the Purlawaugh Beds, which consist of shaly sandstones and shales, and are characterised
by the presence of haematitic ironstone bands or "red beds". These beds are overlain by thick deposits of Jurassic sandstone, known as the Pilliga Beds, which form the main aquifer of the Great Artesian Basin. The following table illustrates the stratigraphical sequence in the Gunnedah-Coonabarabran district:

<table>
<thead>
<tr>
<th>Jurassic</th>
<th>Pilliga Beds</th>
<th>Coarse porous sandstone. Shaly sandstones, shales and &quot;red beds&quot;.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Purlawaugh Beds</td>
<td></td>
</tr>
<tr>
<td>Garrawilla Series</td>
<td>Contemporaneous lava flows.</td>
<td></td>
</tr>
<tr>
<td>Napperby Beds</td>
<td>Mainly sandy shales.</td>
<td></td>
</tr>
<tr>
<td>Digby Beds</td>
<td>Mainly conglomerates.</td>
<td></td>
</tr>
<tr>
<td>Kamilaroi</td>
<td>Gunnedah - Curlewis Coal Measures Coal seams, clay shales,</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>conglomerates and sandstones.</td>
</tr>
</tbody>
</table>

The absence of fossil evidence in the Digby and Napperby Beds and Garrawilla Series has made it impossible to draw a definite line of subdivision between Jurassic and Triassic strata, but it has been suggested by E. J. Kenny and A. C. Lloyd that the sandstones and conglomerates in the basal portion of the Digby Beds may be of Triassic age.

In the present paper the Mesozoic strata are described in the Merriwa-Murrurundi district which lies to the south of the eastern end of the Liverpool Range, and also the strata in the south-eastern portion of the Liverpool Plains, situated to the north of the range. The latter area extends as far north as a line through Quirindi and Caroona, while it is terminated to the east by the New England Highway between Murrurundi and Quirindi, and on the western side the work was carried across the Mooki River for about ten miles to connect with the country already mapped by E. J. Kenny. The geological mapping of these two areas was undertaken with the object of determining the south-eastern distribution of Jurassic sediments, and also to carry the distinction between Triassic and Jurassic beds.
round the eastern end of the Liverpool Range into the Mesozoic strata of the Gunnedah, Coonabarabran and Binnaway districts, and adjoining areas.

**Stratigraphy of the Merriwa-Murrurundi District and South-eastern Liverpool Plains.**

**Triassic Beds.**

In the Triassic rocks of the Goulburn River district, to the south-west of Merriwa, there is a considerable difference in the lithology of the upper and lower portions of the series. The lower portion, which is about 400 feet in thickness, is decidedly conglomeratic, being made up of coarse-grained sandstone packed with small rounded pebbles, mainly white quartz with a limited amount of red and black jasper. The upper portion, some 250 feet in thickness, is a homogeneous medium-grained sandstone. The change in lithology is fairly sharp and divides the series into two distinct types. In the Merriwa-Murrurundi district, the distinction between the fine-grained upper and coarse-grained lower portions of the Triassic is well marked, especially along the western scarp of the Middle Hunter Valley and Kingdon Ponds Valley, where it was observed by H. G. Raggatt, who drew the writer's attention to the feature. Certain changes take place within the two portions of the series as it passes to the east and north-east from Merriwa to the Kingdon Ponds Valley. The lower beds become coarser and assume the nature of a true conglomerate, with pebbles up to five and six inches in diameter consisting largely of black, red, and greenish-blue jasper, as well as a considerable amount of white quartz. The upper beds of the Triassic do not vary in grainsize as they pass to the east, but interbedded lenses of sandy shale commence to make their appearance towards the top of the formation between Merriwa and Bunnan, and become quite a pronounced feature in the section through the Triassic at Owen's Gap (Fig. 1) between Bunnan and Scone. The outcrop of Triassic strata is illustrated in the accompanying geological map (Plate 1).

From Owen's Gap the outcrop of the Triassic beds runs north to Murrurundi (mapped by Geol. Surv. N.S.W., 1932). It can be followed continuously along the margin of the Tertiary basalt flows which extend down from the Liverpool Range, although it is largely covered by basalt between Wingen and Blandford. At Murrurundi it forms low cliffs which stand out prominently on the hillside about one mile
from the township on its southern side. At this point the lower beds of the Triassic still retain their marked conglomeratic nature, but appear to have become considerably reduced in thickness. The upper fine-grained portion of the Triassic is present at Murrurundi but it is much thinner than at Owen’s Gap and in the vicinity of Dart Brook. The strata have been much disturbed by faulting in the vicinity of the gap about two miles to the west of Murrurundi, where the New England Highway crosses the Main Divide, and the ridge at this point is largely covered by basalt. On the western side of the Divide, between Ardglen and Willow Tree, Triassic rocks again make their appearance from beneath the Tertiary basalt flows, and their outcrop continues to run north-west along the south-western side of Borambil Creek to the vicinity of Quirindi. The Triassic beds as a whole decrease in thickness as they pass to the north-west, and the upper fine-grained portion cuts out completely about three miles north-west of Willow Tree. The conglomerates of the lower portion continue till they reach a point about five miles west of Quirindi, where they become submerged in the black soil alluvium of the Liverpool Plains. The Plains continue to the north-west for about nine miles to Caroona on the Mooki River, where the Triassic again outcrops, but the lower coarse portion is alone represented.

The thinning of the Triassic beds to the east and north, and the gradual lateral passage of the lower portion into conglomerates, strongly suggest that the beds outcropping between Scone and Quirindi represent shoreline facies of the Triassic sediments. It is evident from the contortion of the beds that considerable post-Triassic faulting has occurred between Murrurundi and Quirindi, and that the present eastern margin of the Triassic has been determined by this faulting, but it is probable that the Triassic sea did not extend much further to the east than is indicated by the present position of its sediments. The cutting out of the upper portion without the development of coarse-grained phases suggests a receding shoreline accompanied by quiet conditions of deposition towards the close of Triassic sedimentation in this part of the State.

The Comiala Series and the Demarcation of Triassic from Jurassic.

In the Goulburn River district between Merriwa and Cassilis the Comiala Series consists mainly of clay shales,
mudstones and shaly sandstones. There is a marked tendency towards the development of tuffaceous bands near the middle of the series, forming a natural subdivision into upper and lower portions. This forms an important feature in correlating the Comiala Series with the Mesozoic beds of adjoining areas, as will be pointed out later in this paper. A limited quantity of haematitic ironstone bands, known as "red beds", occurs in the Comiala Series. These beds possess a deep brownish-red colour, giving a brilliant red streak, and may be somewhat sandy or argillaceous. They are typical of the Jurassic sediments in the Dunedoo, Coonabarabran, and Gunnedah districts, and provide valuable indicators when tracing discontinuous outcrops of a series which contains them. (These beds should not be confused with the chocolate shales of the Triassic Narrabeen beds, which are quite different lithologically.) Up till the present the Comiala Series has been taken as a line of demarcation between Triassic and Jurassic strata, the age of the series itself being uncertain. During recent work, however, the writer has found Jurassic plant fossil assemblages at the base of the Comiala beds. The fossil evidence, together with the presence of the "red beds", is considered sufficient to establish the Jurassic age of the Comiala Series. This being so, the horizon represented by the base of the series may be taken as the top of Triassic strata and the base of Jurassic sediments in those areas into which the horizon can be traced.

At Merriwa the thickness of the Comiala beds is about 30 feet, the tuffaceous beds and upper portion of the series having cut out. As the horizon passes to the east, clay-shales occur only as large lenticular masses, but the presence of the lower portion of the series is well marked by "red beds" and some sandy shales. Between Gungal Creek and Guan Creek (see Plate I) the lower Comiala beds are largely covered by Tertiary basalt, but towards Owen's Gap they outcrop at the edge of the flows, where they are well characterised by "red beds", and commence to increase in thickness, although soft clayshales are limited in quantity. At the highest point on the main road where it passes through Owen's Gap there is a thin veneer of Comiala sediments, about thirty feet in thickness, lying on the rather shaly beds of the upper portion of the Triassic series. The Jurassic beds dip to the west at about 3°, and occupy a dip-slope on the western side of the Gap. This is illustrated in the following section (Fig. 1) through
a high basalt ridge on the southern side of the road, where the Jurassic beds amount to about 200 feet in thickness, having been protected from erosion by the basalt flow.

Fig. 1.—Geological Section at the southern side of Owen’s Gap.

From Owen’s Gap the outcrop of the Comiala beds passes to the north round the heads of Dart Brook and Middle Brook, and then becomes covered by Tertiary basalt until it again emerges on the eastern side of the Main Dividing Range, one mile to the south-west of Murrurundi. At this point the outcrop of the beds is covered to a large extent by talus from the high basalt ridges, but their presence is indicated by some ferruginous shales and “red beds”. The Jurassic age of the Comiala Series is confirmed at Murrurundi by the presence of a soft ferruginous rock, blue-grey to brown in colour, which is crowded with fragmentary plant remains and some reasonably well preserved plants which constitute a typical Jurassic assemblage. The material appears to occur near the base of the series, and contains Coniopteris hymenophylloides, Cladophlebis australis and Tœniöpteris daintrei. Dr. A. B. Walkom, who identified the fossils, considers that they constitute an assemblage similar to that found in Jurassic sediments at Bexhill, near Lismore, and Beaudesert, about 50 miles south of Brisbane, and also that the rock material from Murrurundi closely resembles the material from the above localities.

The possibility of Jurassic sediments outcropping at the margin of the Tertiary basalt flows in the vicinity of Owen’s Gap and Dart Brook was first suggested by H. G. Raggatt, who found plant fossils in Dart Brook Valley closely resembling Jurassic types. He exhibited a section
The lavas are overlain by a formation consisting of sandy ferruginous shales and "red beds which is equivalent to the Purlawaugh Beds of the Gunnedah-Coonabarabran district. The outcrop of these beds can be followed from the edge of the Liverpool Range basalt across the plains to Caroona and Spring Edge (see Plate I). The Purlawaugh Beds are followed in vertical sequence by beds of massive sandstone which become the Pilliga Sandstone to the west of Spring Edge. It is evident from their stratigraphical position and lithological types that the Purlawaugh Beds represent the upper portion of the Comiala Series. It follows that the Garrawilla lavas, which become thinner as they pass to the south, actually split the Comiala Series, but the thinning of the flows causes them to cut out before reaching the Goulburn River district, where the lavas are definitely absent from the Jurassic sequence, but their horizon is indicated by the tuffaceous bands which occur near the middle of the series. In the Merriwa-Murrurundi district thick flows of Tertiary basalt cover those areas in which the Garrawilla Series may be expected to outcrop. The Jurassic Munmurra Sandstone of the Goulburn River district overlaps the upper portion of the Comiala Series at Merriwa as it passes to the east, and does not outcrop from beneath the Tertiary basalts in the Merriwa-Murrurundi area any further east than Gungal Creek. On the northern side of the Liverpool Range the same sandstone beds appear on the western side of Warrah Edge, overlying the Purlawaugh Beds. Its outcrop is rather indefinite, but becomes more pronounced as it passes to the north-west. In the vicinity of Pine Edge and Spring Edge it forms typical Jurassic sandstone country, and to the west it is continuous with the Pilliga Beds. The above results indicate that the Purlawaugh Beds overlap the Garrawilla Series in the vicinity of the Liverpool Range as they pass to the south-east, and that the Purlawaugh Beds are in turn overlapped by the sandstone of the Pilliga Beds in the Merriwa-Murrurundi district. These features are illustrated in the accompanying geological section. Fig. 2. It is possible that an anticlinal structure may occur under the basalt of the Liverpool Range, which would mean that the thickness of the Pilliga sandstone is less than indicated in the section.

A series of contemporaneous lavas equivalent to the Garrawilla Series outcrops in the south-eastern Liverpool Plains and occupies a position immediately overlying the lower Comiala beds. The outcrop passes down the western side of Warrah Creek Valley, and then across through Pine Ridge to Caroona (see Plate I), where it swings more to the west, passes through Spring Ridge, and thence becomes continuous with the Garrawilla Series to the north-west.
The lavas are overlain by a formation consisting of sandy ferruginous shales and "red beds", which is equivalent to the Purlawaugh Beds of the Gunnedah-Coonabarabran district. The outcrop of these beds can be followed from the edge of the Liverpool Range basalt across the plains to Caroona and Spring Ridge (see Plate I). The Purlawaugh Beds are followed in vertical sequence by beds of massive sandstone which become the Pilliga Sandstone to the west of Spring Ridge.

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The Jurassic Munnurra Sandstone of the Goulburn River district overlaps the upper portion of the Comiala Series at Merriwa as it passes to the east, and does not outcrop from beneath the Tertiary basalts in the Merriwa-Murrurundi area any further east than Gungal Creek. On the northern side of the Liverpool Range the same sandstone beds appear on the western side of Warrah Ridge, overlying the Purlawaugh Beds. Its outcrop is rather indefinite, but becomes more pronounced as it passes to the north-west. In the vicinity of Pine Ridge and Spring Ridge it forms typical Jurassic sandstone country, and to the west it is continuous with the Pilliga Beds.

The above results indicate that the Purlawaugh Beds overlap the Garrawilla Series in the vicinity of the Liverpool Range as they pass to the south-east, and that the Purlawaugh Beds are in turn overlapped by the sandstone of the Pilliga Beds in the Merriwa-Murrurundi district. These features are illustrated in the accompanying geological section, Fig. 2. It is possible that an anticlinal structure may occur under the basalt of the Liverpool Range, which would mean that the thickness of the Liverpool Range is less than indicated in the section.
Fig. 2.—Geological Section (along A-B, Plate I) from Merriwa to Caroona.
Correlation with Adjoining Areas, and Introduction of Uniform System of Nomenclature.

In view of the fact that it is now possible to correlate the Mesozoic strata of the districts on the southern side of the Liverpool Range with those to the north and west, it has been decided, after consultation with Mr. E. J. Kenny, that uniform names should be adopted for the principal subdivisions of the Mesozoic which have been recognised over large areas. The terms decided upon are shown in the following table under the heading of "Proposed Subdivisions," and it is intended that they shall be used, rather than local place names, in referring to the various strata throughout the different districts in which they occur. No special names have been given to the Triassic beds, as they have not yet been correlated in detail with the Triassic sequence overlying the Kamilaroi sediments to the south, and consequently their stratigraphical position in relation to Triassic sedimentation is still uncertain. The terms "Upper Portion" and "Lower Portion" used in the accompanying table refer to the upper and lower portions of that particular stage of the Triassic which occurs in the districts concerned, and have no reference to upper and lower Triassic age.

In conclusion, the writer wishes to acknowledge assistance given by members of the Geological Survey of New South Wales in making available detailed information concerning adjoining areas, and also helpful discussion with Professor W. R. Browne.

References:


### Table of Correlation of the Mesozoic Strata in the Merriwa-Gunnedah Region.

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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Jurassic</td>
<td>Pilliga Beds</td>
<td>Munmura Sandstone</td>
<td>Munmura Sandstone (No outcrops.)</td>
<td>Pilliga Beds.</td>
<td>Pilliga Beds.</td>
</tr>
<tr>
<td></td>
<td>Gowen Beds</td>
<td>Upper Comiala Series</td>
<td></td>
<td>Purlawaugh Beds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Garrawilla Series</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Pottinger Beds</td>
<td>Lower Comiala Series</td>
<td>Lower Comiala Series</td>
<td>Napperby Beds.</td>
<td>Napperby Beds.</td>
</tr>
<tr>
<td>Triassic</td>
<td>Upper Portion</td>
<td>Wollar Sandstone</td>
<td>Upper</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Lower Portion</td>
<td>Wollar Sandstone</td>
<td>Lower</td>
<td>Digby Beds.</td>
<td>Digby Beds.</td>
</tr>
</tbody>
</table>

(MESOZOIC STRATIGRAPHY.)
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