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PALAEOZOIC ROCKS OF THE DAVEY RIVER SOUTH-WEST TASMANIA

by

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With seven text figures (commented by G. E. A. Hale)

ABSTRACT

A conformable succession in Palaeozoic rocks occurs at the Davey River at the southern end of the Olga-Hardwood syncline in S.W. Tasmania, and consists of the following formations (with approximate thicknesses):

(top)	Unit 6 Sandstone	10 metres
	Unit 5 Shale	15 metres
	Unit 4 Sandstone, minor shale, conglomerate	75 metres
	Unit 3 Shale-sandstone alternation	0-500 metres
	Unit 2 Pebbly sandstone	0-500 metres
(bottom)	Unit 1 Quartzite conglomerate	0-800 metres

Formations 1, 2 and 3 are equivalent, on lithological and structural grounds, to the Bathurst Harbour Sequence of Jennings (1961). Unit 4 has lithological and faunal similarities with the Caroline Creek Sandstone of the West Coast Ordovician succession (Banks 1962b). Equivalents of the Florentine Valley Mudstone and Gordon Limestone are probably also present in the centre of the syncline.

If these correlations are correct the Davey River succession provides a link between the Bathurst Harbour and West Coast successions, with the Long Bay Shale representing a marine formation which is present in the South-west but apparently absent on the West Coast.

INTRODUCTION

The Cambrian and Ordovician succession of Tasmania has been described by many workers and a regional consensus is presented by Banks (1962 a, b). The present paper describes a new, continuous and conformable Lower Palaeozoic section which suggests that there are rock units in the South-west which are not present in other parts of the State. The study was made at the southern end of the regional Olga-Hardwood Syncline near 400,000 yds E, 700,000 yds N, Tasmanian State Grid, where the Crossing River joins the Davey River. Figure 1 is a lithological map showing the distribution of the rock units, which are exposed on the valley sides and flanks of Piners Peak (in the west) and an unnamed range (on the eastern side). The centre of the syncline, by analogy with the northern end of the same structure, is thought to be occupied by Gordon Limestone, but formations above Unit 6 are not exposed.

ACKNOWLEDGEMENTS

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STRATIGRAPHY

Unit 1

Unit 1 is a massive, close framework quartzite conglomerate of variable thickness that unconformably overlies Precambrian basement in the headwaters of Badger Creek. The unit also occurs on the western side of the syncline, on the eastern slopes of Piners Peak. It contains angular to sub-rounded pebbles and boulders of milky quartzite and quartz-schist which make up to 90% of the rock and range in size from 1 cm. to 50 cm. (average 5-10 cm.). The matrix is of granule size angular fragments of white quartz. Figure 2 shows the composition of 21 different outcrops.

At the head of Badger Creek, a crude, very-thick bedding is marked by the orientation of pebble long axes, segregation layers based on pebble size and composition, and minor lenses of matrix. The thickness of the unit varies from 800 m. on Piners Peak to zero in many places.

The unit is post-Precambrian, overlying basement with a marked angular unconformity. Various boulders contain fold hinges and other structures representative of the major tectonic events in the Precambrian of the Davey River. (Maclean and Bowen, in preparation). No fossils were found.

The local source of rocks is joint blocks from subjacent bedrock, the general texture and sedimentary fabric and lack of marine influence suggest the deposit is a terrestrial fanglomerate.

Unit 2

Unit 2 is a siliceous, open framework, pebbly conglomerate that conformably overlies Unit 1 in the headwaters of Badger Creek. It contains 10-25% sub-angular to rounded ellipsoidal pebbles of milky quartzite in a sand to granule size matrix of quartz grains, with

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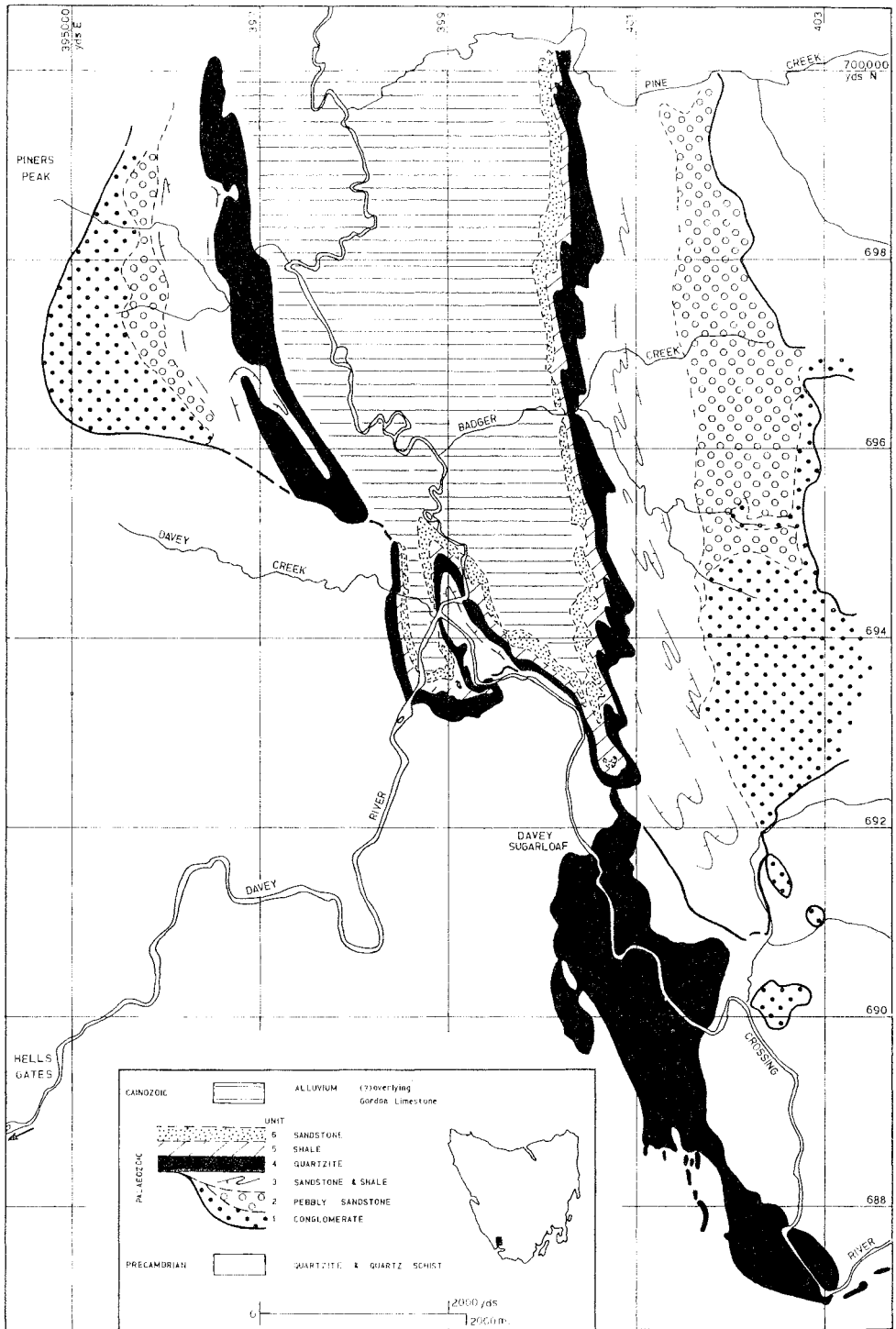


Fig. 1.—Lithological Map of the Davey River Area, with Tasmanian State Grid Co-ordinates.

a range of compositions as shown by the heavy black area of Figure 2. The pebbles range in size from 0.5 cm. to 12 cm., with an average of 3 cm.

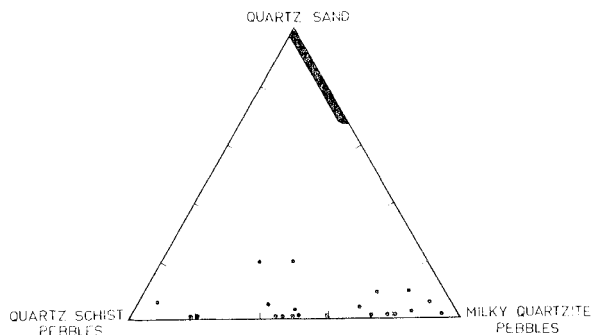


Fig. 2.—Triangular diagram showing the composition of 21 typical outcrops of Unit 1 (black dots), and the range of composition of samples from Unit 2 (dark area).

The unit has a crude bedding (45-60 cm. thick) defined by internal features such as weak grading, pebble layers and occasional silty layers showing planar and festoon cross-bedding. The pebbly sandstone rests conformably on Unit 1 with a distinct boundary. Thickness of the unit varies from zero to 500 m.

The matrix of Units 1 and 2 is similar in size and composition, but Unit 2 differs in that the framework is open, the pebbles are generally rounded and the less resistant types are not present. Units 1 and 2 have the same source area but Unit 2 has been deposited by a different transport mechanism, probably as a fluvial wash derived from Unit 1.

The isopach map of Figure 3a indicates that Units 1 and 2 form an east-west trending lens which thins to the north and south of Badger Creek. The northern and southern boundaries of the outcrop are probably close to the boundaries of the original sedimentary basin.

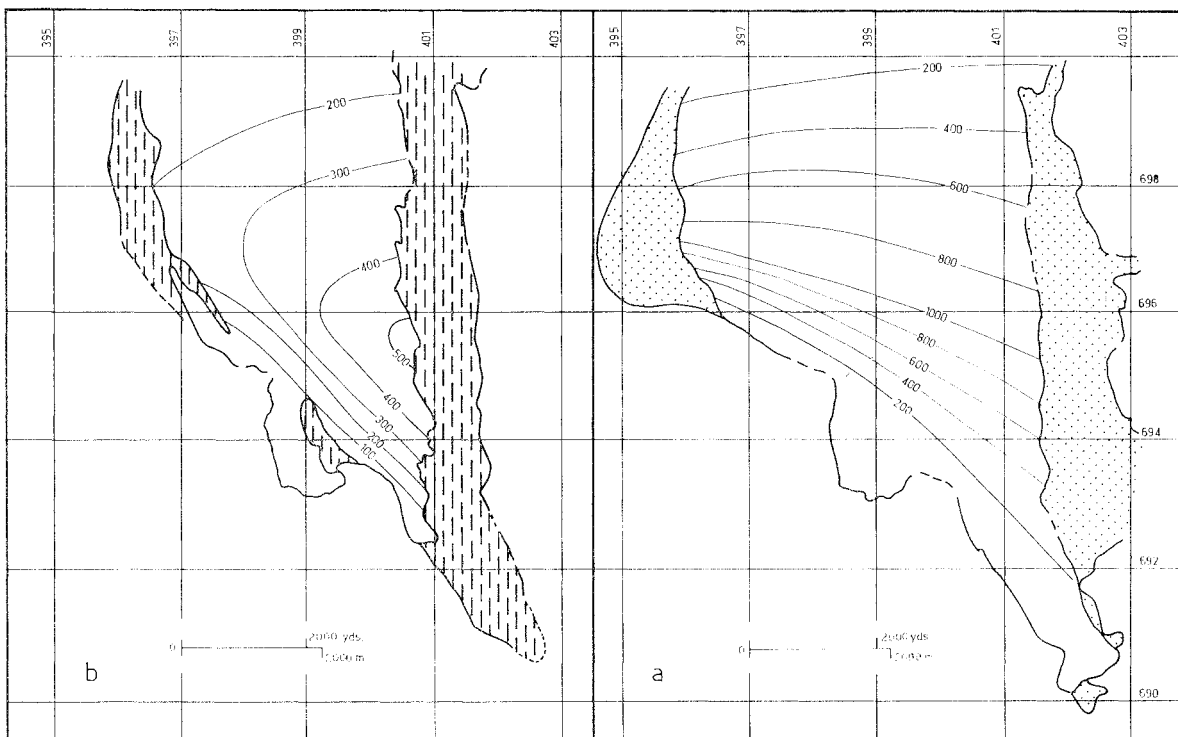


Fig. 3.—Isopach maps showing the shape and trend of the depositional basin. Figure 3a is for Units 1 and 2 combined; formline interval 200 m. Figure 3b is for Unit 3, with formlines at 100 m. intervals.

Unit 3

Unit 3 is a poorly exposed, topographically negative sequence of well-bedded sandstones and shales that conformably overlies Unit 2 in Badger Creek and outcrops as shown on the lithological map (figure 1). The top 125 m. of the unit at Badger Creek is a monotonous alternation of sandstone and siltstone beds and although the remainder of the sequence is poorly exposed, the limited outcrop suggests it is similar in character.

The sandstone beds range in thickness from 5 cm. to 1 m. with occasional beds up to 3 m. thick in the lower part of the sequence. Grain size varies from fine to coarse sand. Many beds are graded and some contain up to 30% rock fragments. A secondary mica foliation gives the sandstones a well marked cleavage and those near the top of the sequence often contain scattered pyrite cubes up to 2 mm. in width.

The shale beds are finely laminated and generally grey or green in colour. Beds range in thickness from 5-125 cm. and average about 20 cm. The shale has a well developed slaty cleavage with secondary mica on the foliae. Some siltstone beds near Badger Creek have a primary detrital carbonate content.

The isopach map of figure 3b shows Unit 3 as an east-west oriented tongue thickening eastwards and thinning north and south from a maximum of 500 m. in the vicinity of Badger Creek. The boundary with the overlying Unit 4 appears to be conformable in Badger Creek, and over a wide area the bedding in Units 3 and 4 is not discordant, as shown by the stereogram in figure 4.

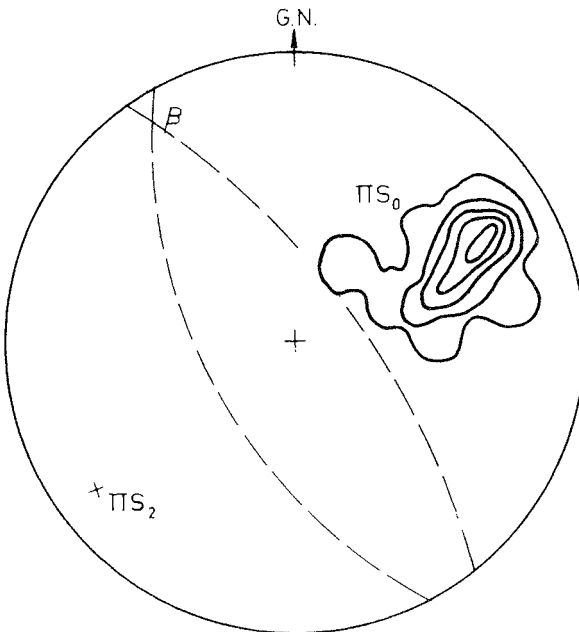


Fig. 4.—Stereogram of 50 poles to bedding (S_0) from near the boundary of Units 3 and 4 at Badger Creek. Contour interval 10% mode 48% at 26-062.

The unit resembles a turbidite sequence and is restricted to the same basin of deposition as Units 1 and 2. It contains no fossils, and sedimentary features include load casts and grooving. The mica foliation is due to low grade metamorphism and is equivalent in grade to the silicification of Unit 4 (see discussion under Unit 4).

Unit 4

Unit 4 is a sequence of bedded shales, quartzose, sandstones and conglomerates containing fossils and organic markings, which rests conformably on Unit 3 in Badger Creek. In places where Unit 3 is absent, Unit 4 rests unconformably on Precambrian basement. The thickness of the unit is consistently about 75 m., but the lithology changes markedly away from the source of sediment.

The sandstones and conglomerates have recrystallised and often resembles meta-quartzites. Petrological examination indicates the rocks were: 1) laid down as quartz clastics, 2) recrystallised to quartzites by the addition of intergranular quartz, and 3) weathered at the surface causing the grain boundaries to be etched and restoring the clastic appearance. The rocks consequently appear massive and structureless on fresh surfaces but the sedimentary features become obvious on weathered outcrop. Many samples possess a slaty, or possibly, a very fine crenulation cleavage. Quartz grains often have undulose extinction and contain deformation lamellae. It is assumed these features formed during the Tabberabberan deformation of these rocks and that similar features in Unit 3 probably have the same origin.

In fine-grained beds, or in the silty tops of graded beds there are abundant organic markings. These include gastropod and ribbed bivalve casts, worm trails and burrows perpendicular to bedding. Sedimentary features include ripple marks, mud cracks and festoon and planar crossbedding. Current direction was towards the south and east.

The composition of individual beds and the bulk composition of the unit varies systematically from west to east, localities A to C, as shown in figure 5. In the Piners Peak area (locality A), about 30% (in particular the basal part) of the Unit consists of open and closed framework, subangular, quartzite conglomerate. Locally a roundstone conglomerate is often dominant. These conglomerates resemble Unit 1 in lithology, but are here closely associated with the more varied lithology and fossil horizons characteristic of Unit 4. The components were derived from the same source as Unit 1. A further 60% is medium to coarse grained sandstone with occasional subrounded to rounded quartz pebbles. The silty fraction is minor and restricted to the fine grained tops of some sandstone beds. Such beds often contain mud-cracks, in other cases, fossil markings.

Near the junction of the Davey and Crossing Rivers (area B), the unit is 20% granule and pebble conglomerate in beds 10-20 cm. thick. The pebbles are generally rounded, ellipsoidal shapes which lie parallel to bedding. About 60% of the unit is composed of fine to coarse grained sandstones which often contain scattered pebbles. Near the top of the unit is a mudstone bed 60 cm. thick and a few fossiliferous horizons.

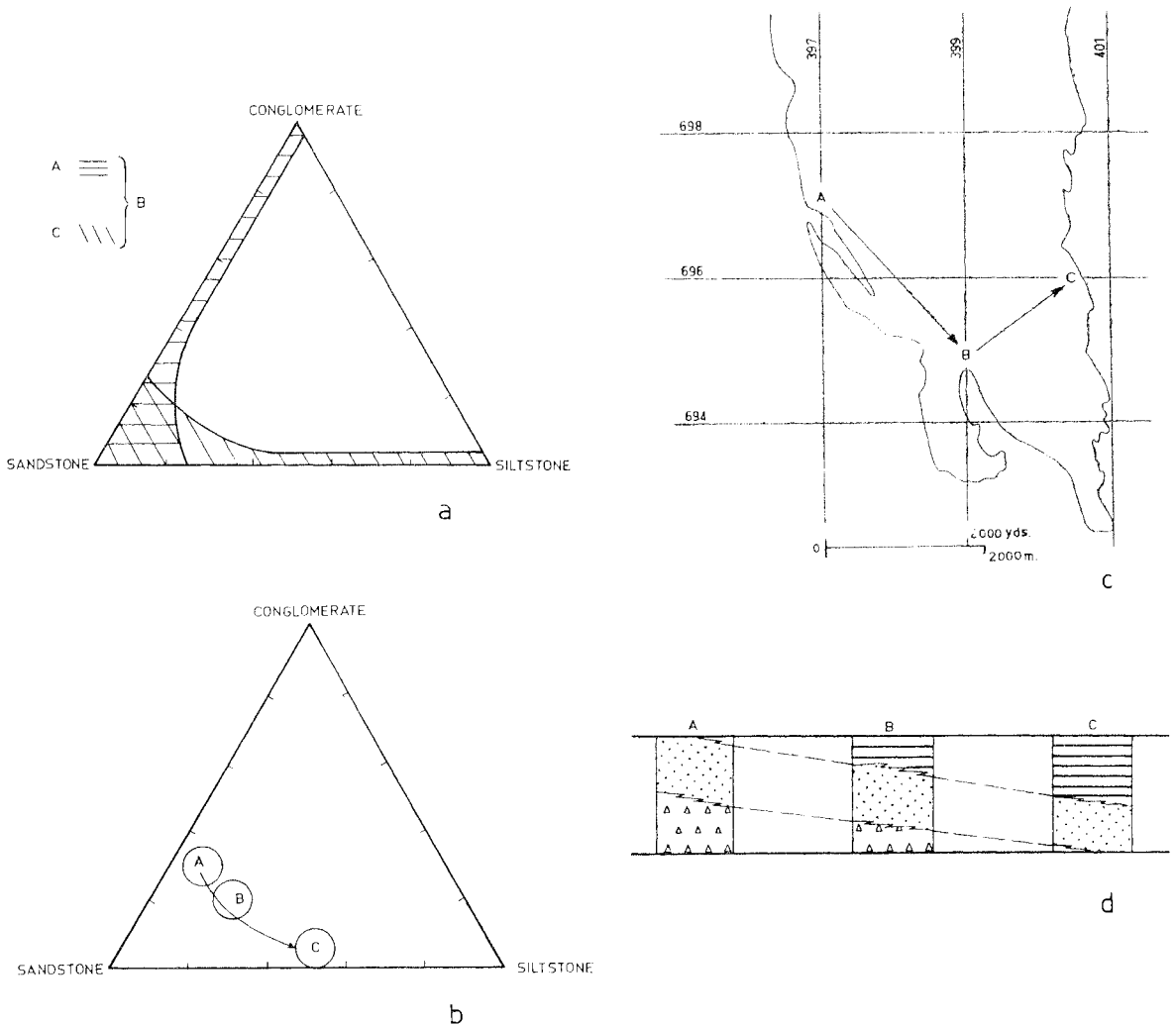


Fig. 5.—Variation in the composition of Unit 4 between localities A, B and C.
 (a) range of composition of beds at each locality.
 (b) bulk composition of Unit 4 at each locality.
 (c) locality map.
 (d) summary of the lithological change in Unit 4 across the basin.

In the Badger Creek area (locality C), the Lower half of Unit 4 is a fine to coarse sandstone with granule bands and occasional rounded quartzite pebbles. Beds range in thickness from 30 cm. to 5 m. and are often haematite stained. The upper part of the sequence consists of beds of silt and fine sand with some scattered milky quartzite pebbles. The tops of some beds are highly fossiliferous and contain gastropod casts, worm trails and tubes.

Figure 5 is a diagrammatic summary of the way in which the composition of Unit 4 varies from west to

east. Conglomerate becomes less important in the east, the silty fraction increases while the sandstone percentage remains about constant. Although the facies changes quite markedly away from the source of the sediment in the west the unit is quite distinctive and easily identified in the field. Unit 4 overlaps Units 1, 2 and 3 and is transgressive onto Precambrian basement as indicated on the lithology map (figure 1). The unit has a strong lithological and faunal resemblance to the shallow water marine Ordovician Caroline Creek Sandstone and its correlates as defined by Banks (1962b).

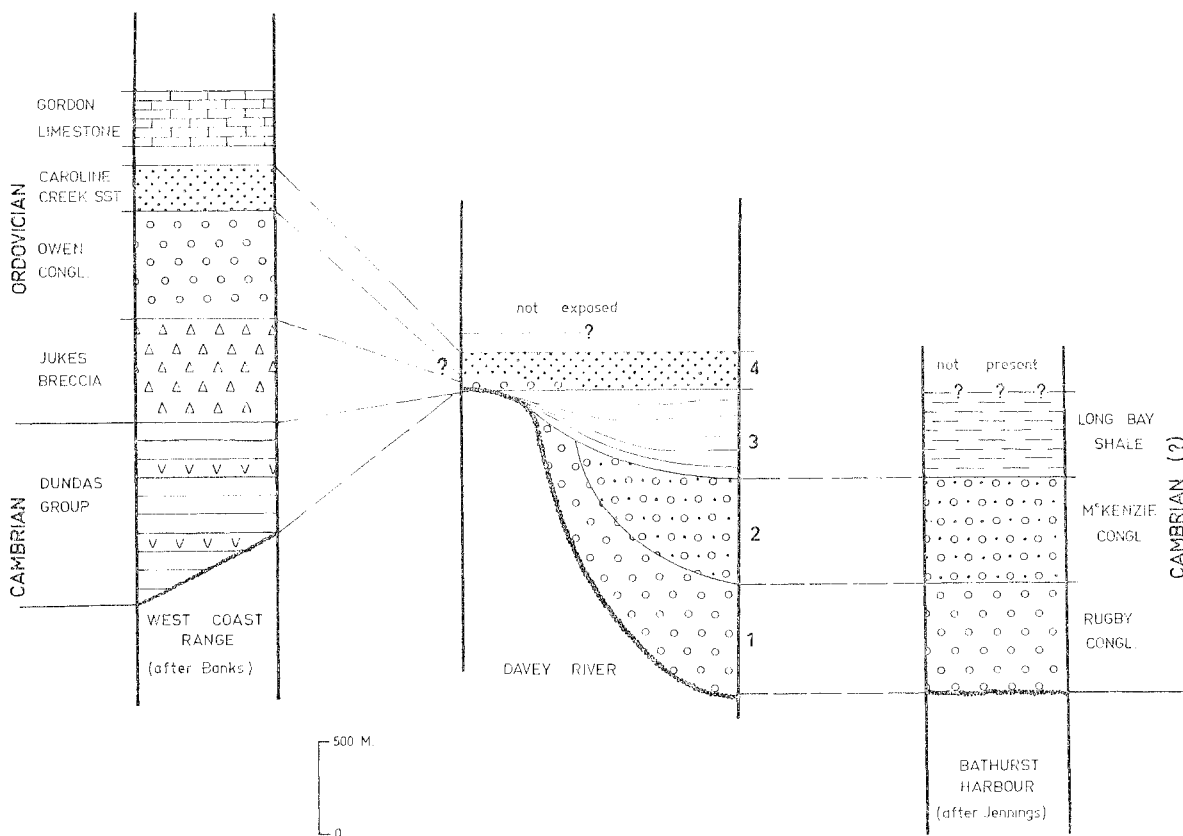


Fig. 6.—Possible correlation of the Davey River sequence with the Bathurst Harbour and West Coast Range successions.

There are scattered outcrops of conglomerate to the S.E. of the Davey Sugarloaf that may belong to this unit. The conglomerate has a closed framework and occurs as discontinuous plates up to 5 m. thick resting directly on Precambrian quartzites. Close to basement it is a breccia formed by the slight disorientation of joint blocks in the underlying rocks, but upwards, the boulders are more rounded and occasional imbricate roundstone conglomerates are present. In this paper the conglomerate is considered the basal member of Unit 4 and is identified with the basal conglomerate in Unit 4 at Piners Peak. It could, alternatively, be considered as a limited expression of Unit 1 on the basis of lithology and its unconformable boundary with Precambrian basement.

Formations Above Unit 4

Immediately overlying Unit 4 is a poorly exposed shale up to 15 m. thick. It has a strong negative topographic expression and is shown on the lithological map (figure 1) as Unit 5. Above this is about 10 m. of friable, argillaceous, white sandstone in beds 7-30 cm. thick which is shown as Unit 6 on figure 1. The section above

this is not exposed but is assumed, from the mapping of Hall (pers. comm.) and work on the Olga Dam site (Hale, pers. comm.), to be Gordon Limestone.

CORRELATION

Unit 4 is a distinctive horizon and is identified with the Caroline Creek Sandstone (Banks, 1962b) on the basis of lithological and faunal similarities. This is shown in both figures 6 and 7. Units 5 and 6 may also belong to the Caroline Creek Sandstone, or may be equivalents of the Florentine Valley Mudstone (Banks, 1962b). The formations above Unit 6 are not exposed but the regional mapping of Hall (pers. comm.) makes it probable that Gordon Limestone occupies the centre of the syncline.

The lower part of the Davey River section may be equated with the Bathurst Harbour sequence of Jennings (1961), on the basis of lithology, sequence and proximity. Figures 6 and 7 show Units 1, 2 and 3 equivalent to, respectively, the Rugby, McKenzie and Long Bay formations of Bathurst Harbour in lithology and position in the sequence.

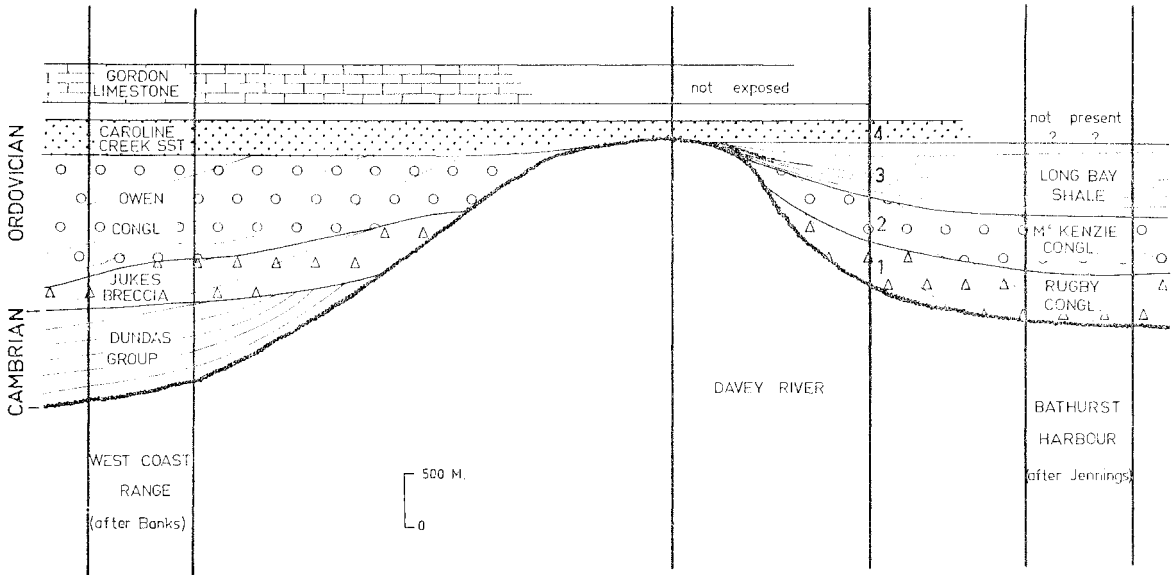


Fig. 7.—Correlation between the Davey River, Bathurst Harbour and West Coast successions, showing the separate depositional basins.

The Davey River succession, if these identifications are correct provides a link between the Bathurst Harbour and West Coast sections. The mapping of Hall (pers. comm.) and Stefanski (reported in Jennings 1961, p. 182) suggests that equivalents of the Caroline Creek Sandstone are probably also present in the Bathurst Harbour and Ironbound Range areas of S.W. Tasmania.

The time relationships between the Davey River and West Coast successions is open to conjecture. Jennings (1961) gave the Bathurst Harbour succession a probable Cambrian age, but pointed out the marked lithological similarities between the Rugby Conglomerate and the Owen Conglomerate of the West Coast Range. Hall (pers. comm.) has alternatively assigned the Davey River Units 1 to 3 to a Younger Proterozoic 'Bathurst Group', on the basis of structural differences between Units 3 and 4 which are suggestive of a major unconformity between them. Intensive mapping at the Davey River has found no evidence of a stratigraphic discordance, and in this region the passage from Unit 3 to 4 is considered to be conformable. Apparent differences on the air photographs in structural style between Units 3 and 4 are found in the field, and in thin section, to be due to differences in lithology and not significant differences in deformational history.

Using the lithological identifications made earlier, it is possible to correlate the Port Davey succession in either

of two ways. The first alternative, shown in figure 6, is to assign everything below Unit 3 to the Cambrian so that any similarity between the Rugby and Owen Conglomerates is a similarity in provenance and depositional mechanism, and not one of age. The Owen and Jukes formations may possibly be represented by the conglomerate at the base of Unit 4 at the Davey River.

The second alternative shown by figure 7, is to regard the Rugby and McKenzie Conglomerates as time equivalents of the Jukes and Owen, and the Long Bay Shale as a rock unit which was deposited in the Port Davey area but which is not recognised on the West Coast. This correlation is regarded as more likely and a depositional history may be reconstructed on this basis.

The depositional basin in South-West Tasmania was separate from the West Coast Basin, which probably developed earlier and contains Cambrian Dundas Group sediments and interbedded lavas, as described in Banks (1962a). The basin in the South-West formed in the early Ordovician and large thicknesses of conglomerate accumulated, as they did in the West Coast Basin at about the same time. The Long Bay Shale finally filled the South-West Basin and may, or may not, have correlates in the West Coast Range succession. The deposition of Caroline Creek Sandstone followed and represents a marine transgression across both basins and the adjacent Precambrian basement.

CONCLUSION

The conformable succession of Long Bay Shale (top), McKenzie Conglomerate and Rugby Conglomerate (bottom) which occurs at Bathurst Harbour (Jennings 1961) and at the Davey River (this report) may be of Ordovician age in which case the Long Bay Shale represents a marine incursion apparently not present on the West Coast. Alternatively the Davey River and Bathurst Harbour successions may contain Cambrian formations although this appears extremely unlikely.

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