

7. The relationship between the Cambrian rocks and the correlate of the June Group at Misery Hill, near Zeehan.

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Abstract A sequence of beds of sandstone and conglomerate (Mt Zeehan Conglomerate) which underlie proved Lower Ordovician sandstone, overlie a proved Upper Cambrian sequence of interbedded mudstone, siltstone and lithic arenite in the Misery Hill area, about 5 km east of Zeehan, western Tasmania. There is no structural evidence to suggest that these rock units are not conformable.

INTRODUCTION

The Misery Hill area has been studied by a number of workers but little has been published on the interpretation of the boundary between the siltstone and immature sandstone of the Climie Formation (Blissett, 1962), and the red-purple conglomerate of the Mt Zeehan Conglomerate. The previous literature is summarised adequately by Blissett (1962), who also includes a detailed discussion of the regional geological setting of the Misery Hill area. A summary of that work is included here.

REGIONAL SETTING

The Mt Zeehan Conglomerate crops out in a strike ridge on Misery Hill. It is underlain by a succession of beds of Cambrian siltstone, mudstone and sandstone and overlain by a white Lower Ordovician sandstone. The age of these units is discussed by Blissett (1962).

The boundary relationship between proved Cambrian rocks and proved Ordovician rocks is of tectonic significance in Tasmania, as the extent, timing and significance of movements between these systems is uncertain. Unconformity has been noted below the correlate of the June Group at Moina (Elliston, 1953), in the Dial Range (Burns, 1965), at Lynchford (Solomon, 1960), at the Cethana dam site (E. Williams, pers. comm.), at the Murchison River and at other localities. In the north of Tasmania the boundary is usually an unconformity. Burns (1965) mentions areas of the Dial Range where there is up to 20° angular discordance of the older beds compared to the younger beds, prior to the Tabberabberan Orogeny. On the West Coast Range there is unconformity in some areas between correlates of the June Group (Jukes Conglomerate) and Cambrian volcanic rocks, but in other areas there is conformity with an Upper Cambrian sequence which at Comstock is unconformable on older volcanic rocks (Corbett et al, 1974). The unconformity at Comstock is upper Middle or lower Upper Cambrian in age (Jago et al, 1972).

Conformity has been noted at other localities. K.D. Corbett (pers. comm.) has mapped relationships between conglomerate and Upper Cambrian siltstone and sandstone which on sedimentary grounds are conformable south of Mt Professor and in the Denison Range area. Corbett confirmed Blissett's reports of conformity at Mt Professor.

Misery Hill was considered as a possible erosional unconformity by some workers (see Solomon, 1962, p. 321). However interdigitation of conglomerate with the Cambrian rocks was reported (A.B. Gulline, pers. comm.) and was the main reason for Blissett to consider the contact as a conformity.

THE MISERY HILL SECTION

The Climie Formation

The rocks of the Climie Formation pass upwards from mauve fine-grained micaceous siltstone to green siltstone and mudstone interbedded with lithic arenite. The micaceous siltstone (73-217)* is a well foliated rock containing quartz and muscovite grains approximately 0.05 mm in diameter, but ranging from clay grade material in the matrix up to 0.2 mm. The quartz grains are very angular and equidimensional. Tourmaline, minor rock fragments, chlorite and opaque minerals (probably ilmenite and leucoxene after ilmenite) also occur.

The green siltstone close to the contact with the conglomerate sequence (73-218) ranges in grain size from very fine silt to very fine sand. It has angular fragments of quartz and chlorite and also contains flakes of muscovite in a very fine-grained matrix which cannot be determined optically. The opaque minerals are dominantly ilmenite(?) but small limonite grains also occur. The matrix constitutes about 30% of the rock.

The rock has well preserved irregular bedding surfaces. The material at the base of a bed is usually sharply in contrast with the finer material at the top of the bed below, and the beds grade upwards into finer-grained material. The irregularities in the bedding surfaces are probably due to load casting.

The third rock type in the sequence is a poorly sorted immature sandstone. The rock fabric has a continuous framework of sand grade grains, consisting mainly of rock fragments: many of these are deformed, have corroded edges and appear to have filled original pore spaces during or after diagenesis. This gives the appearance of a pelitic matrix in the rock.

The grains which are not equant are aligned parallel to the cleavage in the rock, the cleavage being strongly emphasized by iron stained chloritic 'streamers'. The minerals in these 'streamers' are secondary. The cement was probably originally siliceous but the large amount of iron available has caused the majority of the grains to be surrounded by a thin sheath of reddish-brown opaque material.

Quartz grains are usually angular. Rock fragments, although commonly angular are occasionally rounded. The sphericity of the rock fragments is low.

The average grain size of clastic particles is 0.03 mm which classes the material as a medium sand. The range in grain size for the quartz particles is 0.3 mm down to 0.01 mm and for the rock particles 0.6 mm down to 0.02 mm. Thus the two major components spread over five divisions on the Wentworth scale and the total spread for the whole rock is six divisions on that scale.

The mineralogical components and the approximate volume percentages are given below:

quartz fragments	15-20%
metasedimentary and sedimentary rock fragments	70%

*Sample numbers refer to rocks held and catalogued in the Department of Mines collection, Hobart, Tasmania. All samples described come from a quarry on the northern side of Misery Hill [38/43514268] in the Zeehan quadrangle.

chlorite fragments (detrital)	2%
opaque minerals	5%
muscovite	2%
matrix and alteration products	3-4%

The rock fragments consist of quartz-mica schist, quartzite, cleaved mudstone and siltstone. The opaque minerals are probably ilmenite and limonite.

The rock is thus a fairly typical lithic arenite. Because of the angularity of the quartz it is probably in its first cycle and together with the metasedimentary and sedimentary rock fragments was derived from a low grade metamorphic terrain which contained little or no feldspar.

The lithology of this sequence of rocks is very variable; the siltstone and the lithic arenite being deposited under different conditions or being derived under different conditions. It is not possible to transport cleaved mudstone and siltstone over large distances in dilute suspensions without disintegrating them to below the sand grade. The opaque minerals and the muscovite-bearing fragments are chemically unstable and so the sands are immature. These sands would not survive prolonged exposure to neritic zone conditions without disintegration and decomposition. The most likely environment of deposition of the lithic arenite is therefore an unstable transitional one in which no significant reworking occurred.

The siltstone grains are more disintegrated than those in the lithic arenite, and rock fragments are less abundant. The sedimentary structures also differ somewhat and could occur by a number of mechanisms in different environments. Because the lithic arenite and siltstone are interbedded, it is unlikely that major earth movements occurred between them and there is no evidence that the lithic arenites were faulted into their present position. Consequently the mode of deposition is similar to that of the lithic arenite.

Misery Conglomerate

The rocks overlying the above sequence form a sequence of pebbly sandstone interbedded with strongly cleaved micaceous siltstone. The sequence becomes more arenaceous upwards and passes rapidly into coarse conglomerate. The conglomerate on and around the summit of Misery Hill is very pebbly and contains little matrix material. The pebbles are rounded; elongate pebbles are aligned parallel to the bedding. The constituent rock fragments are dominantly quartzite with occasional cleaved siltstone and chert. The conglomerate is interbedded with coarse sandstone and pebbly sandstone.

The conglomerate has an overall red-brown colour in thin section (73-220). It has a closed framework of grains with approximately 5% of matrix material. There is a strong parallel alignment of grains, probably along the bedding direction. The fragments making up the conglomerate are dominantly pelitic fragments (mudstone and siltstone), quartzite, quartz, chert and occasional volcanic fragments. Many of the pelitic fragments have hematite veins along their cleavage and the quartzitic fragments are often surrounded by hematite rims. The matrix is almost pure hematite. This implies that the hematite is due to a secondary impregnation of the rock and does not reflect the depositional environment.

The texture and composition of the sandstone (73-219) are very similar to those of the conglomerate. The two rocks differ only in grain size and in the percentage of matrix material. There is approximately 10% of matrix material in the sandstone. The boundaries between the silt and sand layers are irregular due to load casting. Graded bedding occurs in both the sandstone and conglomerate units.

The depositional environment for this conglomeratic sequence was most probably alluvial or in an area of very shallow water marginal to a marine basin. It was transported by a rapidly flowing river and deposited where the rate of flow was checked by a change of slope. The river flow was seasonally very variable. Comparison of these rocks with three similar rocks from the Owen Conglomerate in the Queenstown area suggests that the environment of deposition was similar for the specimens compared.

The environment of deposition of this sequence could be compatible with that of the underlying rocks and the two sequences had a similar provenance.

STRUCTURAL COMPARISON OF THE CLIMIE FORMATION AND THE MISERY CONGLOMERATE

The major structural elements in the two sequences are a single penetrative cleavage and the bedding. The bedding is conformable across the zone from the siltstone into the conglomerate-sandstone sequence. Some of the rocks of the Climie Formation have a crenulation cleavage in addition to the penetrative cleavage. The penetrative cleavage in both formations was most probably produced by the same event and the mechanical properties of the conglomerate, siltstone and sandstone did not allow the formation of a crenulation cleavage, which was produced by a later event. A study of the structure in thin section showed no evidence of a structural difference between the two formations.

CONCLUSIONS

The sedimentary and structural comparison between the correlate of the June Group conglomerate and the Upper Cambrian Climie Formation at Misery Hill provides no evidence that the two units are either unconformable or paraconformable. It is also suggested that the sediments which formed the upper parts of the Climie Formation were deposited in shallow water and did not pass through the neritic zone. Further studies of this formation are necessary to discover when the depositional environment changed dramatically from deep water turbidite deposits to shallow marine and finally non-marine deposits.

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