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DISCUSSION: A review of the Corella Formation, Mount Isa Inlier, Queensland

I.H. Wilson[1]

Blake (1982) has emphasised small differences between very similar sequences of metamorphosed and brecciated laminated calcareous siltstone, shale, limestone, and minor volcanics to establish his three zones in the Corella Formation. Variations in thickness and metamorphic grade within one unit could easily account for most of the differences. Erosion and preservation of an incomplete sequence in the faulted synclines in his Zone A could account for the thinner sequences and scarcity of volcanic rocks in this area. It should be noted that Blake acknowledges that large thickness variations occur within the individual unnamed members of the Corella Formation in Zone A (p. 113), but he uses differences in thickness of possibly incomplete sequences of the formation as evidence for different stratigraphic units.

Some of the lithological evidence Blake uses for zones in the Corella Formation is also debatable. He states that Zone B contains more volcanics than Zone A, and supports this (p. 115) with the conjecture that much of the Tommy Creek Microgranite, amphibolite, and 'dolerite' in the zone is extrusive. Volcanics are present in Zone A, but their extent is limited by erosion and the unconformable overlap of the Mount Albert Group (Wilson & others, 1977).

Blake states that the metasediments in Zone B are more calcareous than in Zone A and, although this is partly true for the east of Zone A, Derrick & Wilson (1981, p. 269) indicated an increase in the carbonate content to the west and northwest in Zone A, noting a change to dolomite. There is thus ample evidence that extensive facies variation occurs within Zone A, and facies variation is a likely explanation for the differences between Zone A and Zone B.

Resolution of stratigraphy in Zone B is difficult, because of intense structural deformation and facies variation, but it is important, as this zone contains the type sections of the Corella Formation. Major faults such as the Ballara–Corella River Fault Zone and the Cameron Fault have displacements of several kilometres, and effectively bound three distinct domains in Zone B. Within the western domain, a consistent stratigraphic sequence from the Ballara Quartzite to the basal Corella Formation has been mapped from near Mary Kathleen to Kajabbi (Wilson & others, 1977; Derrick, 1980). About 10 km northeast of Mary Kathleen, the central domain contains a tightly folded, but well-defined stratigraphic sequence, which I have reinterpreted for the second edition of the Cloncurry 1:250 000 geological map as the upper part of the Corella Formation and the overlying Knapdale Quartzite. Wilson & Hutton (1980) were able to locate the Corella Formation type section with reasonable certainty. It traverses the three domains of Zone B and includes a relatively complete sequence of the formation. Contrary to Blake (1982), sufficient facing evidence is available and the stratigraphic succession has now been firmly established.

Blake (p. 115) concludes that there were no tectonic events between 1870 and 1670 Ma, because bedding in rocks of these ages in the south of the inlier is concordant. This conflicts with the timing of the unroofing of the Kalkadoon and Ewen Granites, the onlap of the Haslingden Group sediments and volcanics onto the older basement (Wilson & others, 1977), and marked angular discordance beneath the Fiery Creek Volcanics, Surprise Creek Formation, and Mount Isa Group in the north of the inlier (Wilson & others, 1979). The apparent parallelism of bedding in the south has probably been imposed by intense folding during the main deformational event that accompanied the regional metamorphism about 100 Ma after deposition of the Mount Isa Group. The deformations that caused the angular discordances in the north of the inlier do not appear to have been associated with regional metamorphism.

The evidence that the rocks in the west of Zone B were deformed and metamorphosed before intrusion of the Burstall Granite resulted from the belief that the skarn alteration that replaces previously metamorphosed rocks in the Mary Kathleen mine and surrounding areas was caused by the Burstall Granite (Derrick, 1980). The skarn alteration is now known to replace dykes related to the Burstall Granite, and metasomatism has recently been dated near Mary Kathleen as several hundred million years younger than the granite (Page, 1981a). There is thus no evidence for an 'older' Corella Formation in Zone B. The evidence for a 'younger' Corella Formation in this zone depends on the interpretation of the field relationships of a felsic rock in the Milo mine area, which is dated at 1607 Ma (Page, 1981b). Blake contends that the felsic rock is an extrusive in a sequence unconformably overlying folded calc-silicate rocks intruded by 'Burstall-type' granite. My interpretation from field work and a re-examination of aerial photographs is that the felsic rock is discontinuous and possibly discordant; features which are more consistent with an intrusion. Also, the area in which Blake describes the unconformity, is poorly exposed; few rocks are in situ, they are near a granite contact, and they consist of laminated calc-silicate rocks that are commonly folded and brecciated in the region. The granite is mapped as Naraku Granite and has not been dated, but it is unfoliated and suspected of being younger than the Burstall Granite. Because of these observations, the proposed unconformable relationship is doubtful.

Discussion of the Corella Formation and its correlatives in Zone C is complicated by poorly resolved stratigraphic relations (Blake & others, 1981) and because numerous workers have studied small parts of the zone and reached incompatible conclusions. A maximum age for the Corella Formation in this zone is provided by the underlying Argylla Formation of the Duck Creek Anticline (1760 Ma, Page, 1981b). A further constraint on the base of the Corella Formation is provided by the Overhang Jaspilite, which underlies the Corella Formation in Zone B, and the Staveley Formation (Blake & others, 1981) and 'undivided' Corella Formation in Zone C (Derrick, 1980). The possibility of an unconformity at this stratigraphic level is raised by Blake. There is thus good evidence for the Corella Formation in Zones B and C commencing at similar times. The stratigraphic evidence is consistent with the correlation of the Corella and Doherty Formations. The latter formation contains a felsic volcanic dated at 1720 ± 7 Ma (Page, 1981b; Blake, 1982). Blake distinguishes the Staveley and Doherty Formations because of a slight change in the proportion of clastics and carbonates and differences in metamorphic

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grade. Neither of these criteria are reliable elsewhere in the region, and the validity of this distinction is doubted. The Roxmere Quartzite, which overlies the 'undivided' Corella and Staveley Formations in Zone C, is correlated with the Knapdale Quartzite in Zone B (Derrick & others, 1977). Both of these quartzites appear to overlie the Corella Formation unconformably. The Corella Formation and similar rocks in all three zones are thus confined between two unconformities.

In conclusion, there are no substantial reasons for renaming the Corella Formation in Zone A or subdividing the unit in Zone B. The sequence in the existing type section has a well-defined base and top and its stratigraphy *is* capable of resolution. The status of the Corella Formation should not be down- graded to beds. No real evidence has been presented for the existence of a younger sequence previously referred to the Corella Formation in Zone C, and the introduction of the name Doherty Formation is unnecessary.

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REPLY

D.H. Blake

The discussion by Wilson highlights the subjectivity inherent in firstly observing and secondly interpreting geological field evidence. Differences in interpretation arise, inevitably, from the different experiences, interests, and pre-conceived ideas of the geologists involved. In this discussion, matters of opinion, rather than facts, are mainly in dispute, as was also the case in an earlier related discussion (Derrick & Wilson, 1981; Blake, 1981). Hence, on basically the same facts, differences in lithology, thickness, deformation, metamorphism, and internal and external stratigraphic relationships of the Corella Formation, the most extensive formation mapped in the Precambrian Mount Isa Inlier, are considered by Wilson to be of minor stratigraphic importance, whereas I have suggested that they are likely to be of major significance in stratigraphic correlations. Similarly, igneous rocks regarded by Wilson as probably intrusive are considered by me to be probably extrusive. Specific points raised by Wilson are discussed below.

Lithologic and other differences between the various parts of the Corella Formation, as previously mapped in my Zones A, B, and C, can be considered comparable to those in the Mount Isa Inlier between different units of sandstone (e.g., Mount Guide, Ballara, Mitakoodi, and Warrina Park Quartzites), or of felsic volcanics (such as those of the Leichhardt Volcanics/Metamorphics, Bottletree Formation, Argylla Formation, Corella Formation, and Carters Bore Rhyolite) or of mafic volcanics (such as those of the Bottletree Formation, Eastern Creek Volcanics, Magna Lynn Metabasalt, Marraba Volcanics, and Soldiers Cap Group).

Wilson acknowledges that the stratigraphy of the Corella Formation in Zone B is difficult to resolve because of intense structural deformation, but, unlike me, considers that the stratigraphic succession here is now firmly established. I also do not share his confidence that the original type section of the Corella Formation selected by Carter & others (1961) has been located with reasonable certainty and that the sequence in the type section area has a well defined base and top.

As stated previously (Blake, 1982, p.115), there is no evidence of a major tectonic event involving significant regional metamorphism during the period from about 1870 Ma to about 1670 Ma in the southern part of the Mount Isa Inlier. Wilson apparently agrees with this conclusion. However, there is abundant evidence of widespread volcanism, plutonism, uplift and erosion, down-warping and deposition, tilting, and faulting during this 200 Ma period, readily accounting for unroofing of granites, onlapping of sediments and volcanics, and local angular discordances between units of widely different to closely similar ages. The suggestion of Wilson that parallelism of bedding in this part of the inlier is a deformational effect is not in accord with the layer-cake stratigraphy convincingly documented by Derrick & others (1980) and discussed by me (Blake, 1980, 1981).

Evidence for Corella rocks in Zone B being deformed and metamorphosed before being intruded by 1720–1740 Ma Burstall Granite and similar granites to the south is based not only on the development of skarns in the vicinity of many of the granite bodies, as assumed by Wilson, but also on the observation that dykes of granitic rock spatially, and probably genetically, related to the granites cut previously folded calc-silicate rocks. The dykes are deformed, but much less so than the rocks they intrude. The difference in age between dyke intrusion and earlier folding is conjectural — the dykes and associated granites may be more than 150 Ma younger than the folding, as I have suggested (Blake, 1980, 1981, 1982), but could conceivably be only slightly younger.

Wilson prefers to interpret as intrusive the felsic igneous rock dated by Page (in press–a) at about 1600 Ma from the Zone B Corella Formation near the Milo mine in the Tommy Creek area, because it is 'discontinuous and possibly discordant'. Such an interpretation is at variance with the expressed views of geologists who examined the sample site during an excursion in September 1981, following the joint meeting on Mount Isa geology conducted by the Australasian Institute of Mining and Metallurgy, BMR, and the Geological Survey of Queensland. The dated sample is a metamorphosed, fine-grained, flow-banded quartzofeldspathic rock, associated with felsic agglomerate and tuff of apparently similar composition, in a sequence containing several concordant bands of both felsic and mafic metavolcanics, together with interlayered biotite schist, black slate, and bedded calcareous metasediments. The sequence dips uniformly northwards and differs markedly in lithology and deformation from a sequence of highly contorted, thinly banded calc-silicate rocks, also mapped as Corella Formation, to the south. It is the strongly discordant contact between these two sequences, marked by a fragmentary zone, a few metres wide, aligned parallel to the bedding in the northern sequence and strongly discordant to the southern sequence, that is regarded by me (Blake, 1982, p.116), but doubted by Wilson, as a possible major unconformity.

In spite of the views expressed by Wilson, there is no good evidence for correlating the Corella Formation of Zone B with the Doherty Formation of Zone C. On the contrary, geochronological evidence is against such a correlation — Corella Formation rocks in Zone B are intruded by granite and gabbro dated at 1720–1740 Ma (Page, in press–b), whereas the Doherty Formation includes metarhyolite dated at 1720+ 7 Ma, a significantly (beyond experimental error) younger age. Wilson considers that the distinction of the Doherty Formation from the Staveley Formation on the basis of mappable differences in lithology and metamorphic grade is unreliable. However, in my view this distinction is probably significant stratigraphically, is better based than his correlation of the Roxmere Quartzite rocks overlying, apparently conformably, the Staveley Formation in Zone C with isolated outcrops mapped as Knapdale Quartzite in Zone B, and follows normal stratigraphic nomenclature principles (Hedberg, 1976).

Hopefully, many of the present problems concerning the status of the Corella Formation will be resolved in the near future, when results of proposed detailed structural and metamorphic studies in the Mount Isa Inlier by BMR and university geologists, supplemented by geochronological data, become available.

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DISCUSSION: A Proterozoic rift zone at Mount Isa, Queensland, and implications for mineralisation

I.P. Sweet

There are three main points in the paper by Derrick (1982) on which I will comment: (1) definition of the Leichhardt River Fault Trough (LRFT); (2) nature of the western margin of the LRFT; and (3) the extent of the Mount Gordon Arch.

Definition of the Leichhardt River Fault Trough

Derrick's paper perpetuates the confusion over the definition of the term Leichhardt River Fault Trough (LRFT), and of the geological character of the trough. As defined by Glikson & others (1976) the LRFT '. . . refers to the north-trending structurally complex area bounded to the east by the Gorge Creek–Quilalar Fault Zone . . . and the Kalkadoon–Leichhardt acid igneous complex and to the west by the Mount Isa and Mount Gordon Fault Zone . . .'. Although Glikson & others' definition states nothing about the timing of faulting, they conclude that 'early pre-depositional faulting took place along the eastern border of this trough'. Derrick (1982) has carried the conclusions further, and sees the LRFT as 'an 1800–1650 m.y. old intracontinental or continental margin rift structure'. He regards its western boundary as being *west* of the Mount Isa–Mount Gordon Fault Zone, because it 'also occurs within and extends beneath the Proterozoic Lawn Hill Platform'. The extent of the LRFT is based largely on magnetic and gravity anomalies caused by the effects of large volumes of basic volcanics in the region.

Derrick's rift-fill sequence is the Haslingden Group, which was 'deposited between about 1800 m.y. and 1740 m.y. ago'