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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BMR Journal of Australian Geology & Geophysics, 8, 163-165

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'

(Derrick, p. 85). It is conformably overlain by the Quilalar Formation, considered by Derrick & others (1980) to be part of a blanket deposit that extended beyond the eastern boundary of the LRFT. Similarly, the Fiery Creek Volcanics and Bigie Formation, which overlie the Quilalar Formation, have correlatives beyond the LRFT to the west (Carrara Range Group — Hutton & Sweet, 1982) and northwest (Peters Creek Volcanics — Sweet & others, 1981). The youngest Proterozoic rocks preserved in the region under discussion are the Mount Isa Group, dated at around 1670 Ma (Page, 1981), and its correlative, the McNamara Group. The McNamara Group is even more extensive than the other formations overlying the Haslingden Group. The Quilalar Formation and Mt Isa/McNamara Groups are designated 'rift cover' in Derrick's figure 3, yet figures 4 and 5 clearly show them to be part of the LRFT. They cannot be both. If the LRFT is a rift, then it ceased to exist as a tectonic entity by about 1740 Ma, *before* deposition of the Quilalar Formation. Derrick presents no evidence that the Mount Isa Group was deposited in a rift structure.

Nature of the western margin of the LRFT

Following on from the above discussion it is apparent that the western margin of the LRFT is not satisfactorily defined. In the northwest the Haslingden Group forms the basement to the Lawn Hill Platform Cover (Hutton & Sweet, 1982). Here the Haslingden Group is at least 2800 m thick, suggesting that although it may have thinned westward, the thinning is gradual, not abrupt. No conglomerates are present in the west and there is no evidence of active faulting during deposition. The conclusion I draw is that a rift-type western margin for the LRFT cannot be seen, despite the indirect geophysical evidence for the extent of basalt fill. The more likely explanation is that the LRFT is a half graben with a faulted eastern margin and an unfaulted western one.

The extent of the Mount Gordon Arch

The stratigraphic and sedimentological evidence for the existence of a local high in the Mammoth area is convincing (Derrick, fig. 6), but the interpretation of an arch to the north of that area is questioned. It appears to be based on (i) the presence of a trachybasalt member in the Quilalar Formation; (ii) the amount of pre-Surprise Creek Formation deformation in the vicinity of the supposed arch; and (iii) on the thickness of the Surprise Creek Formation. I would counter these arguments thus: (i) the trachybasalt flows are thin, and would not be expected to extend over a huge area. Any lava flow must stop somewhere, and the existence of tuffs beyond the point of termination is not necessarily an indication of a topographic barrier to the lavas; (ii) evidence of erosion preceding deposition of the Surprise Creek Formation may well indicate warping and uplift south of Gunpowder (near locality d, Derrick, fig. 8), but there is no evidence of any such effect to the north; (iii) preserved thicknesses of the sandstone units in the Surprise Creek Formation (BMR, 1981) vary between 270 m and 800 m, but show no systematic variation relative to the site of the Mount Gordon Arch. On the contrary, the thickness is less in the northwesternmost outcrops, away from the site of the supposed arch.

Conclusions

Derrick's usage of the term LRFT differs from that of Glikson & others (1976), and his paper presents conflicting information on the younger limit of rift-related sedimentation. The western margin of the LRFT has not yet been recognised, and in fact it may not be a rift (faulted) margin at all. There is no evidence for the existence of the Mount Gordon arch in the Mount Oxide Region (i.e. north of Gunpowder).

Acknowledgement

I thank D.H. Blake for commenting on a draft for this discussion.

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REPLY

G.M. Derrick

Definition of the Leichhardt River Fault Trough (LRFT)

The definition by Glikson & others (1976) of the LRFT reflected the limits of detailed geological mapping by the Bureau of Mineral Resources and Geological Survey of Queensland at that time. Glikson & others considered that the most characteristic feature of the fault trough was an abundance of basic volcanics, and their distribution clearly outlined a north-trending linear zone bounded by a partly faulted eastern margin; the Mount Isa–Mount Gordon Fault Zones appeared to be a satisfactory western margin because of the change in structural style across these faults, and an apparent absence of basic volcanics west of the fault system in parts of the Lawn Hill Platform.

More recently, it has been established that basic volcanics do occur in the cores of domal structures in the Lawn Hill Platform, and that they possess, everywhere, a pronounced magnetic signature. The latter appears to show a relatively linear western margin to the basalts in the subsurface. These factors were influential in my extending and redefining the LRFT from that discussed by Glikson & others. In so doing I have maintained the emphasis of earlier authors, viz. the basalt content is most characteristic. I also suggest the updated descriptions of the nature and extent of the LRFT are preferable to the introduction at this stage of yet another new name for this feature.

Sweet's comments regarding Figures 3, 4 and 5 of Derrick (1982) are pedantic. Figure 3 correctly distinguishes between 'rift fill' (Haslingden Group) and 'rift cover' (Quilalar Formation, Surprise Creek Formation, Mt. Isa and McNamara Groups). Figure 4 clearly shows Quilalar Formation as an open-ended sheet transgressing the eastern margin of the LRFT. Figure 5 likewise shows the same phenomena for Mount Isa–McNamara Group deposition. Quilalar Formation is described (p. 81) as being of 'region-wide' distribution, and as extending across 'much of the Mt. Isa Inlier' (p.85).

In discussion on evolution of the LRFT (Derrick, 1982, fig. 12) it is clearly stated that post-Haslingden Group sedimentation 'extended far beyond the limits of (Haslingden Group) rift fill'; the younger sequences are schematically shown as occupying broad basins 130 km wide, compared with stated LRFT widths of about 65 km.

I contend that these quotations are sufficient to conclude that the Mount Isa and McNamara Groups were not deposited in a rift structure — rather they were deposited *on* a rift structure and beyond. Yet the Mount Isa and McNamara Groups are inextricably linked to the earlier-formed rift fill (1800–1750 Ma) by virtue of reactivation of older rift structures, e.g. the Mount Gordon Arch, contemporaneous with early Mount Isa/McNamara Group deposition (1680–?1650 Ma). Hence, it is clear that the LRFT had a history — both depositional and tectonic — which extended from 1800 to about 1650 Ma.

Nature of the western margin of the LRFT

I agree with Sweet that the western margin of the LRFT is not satisfactorily defined. It will remain so for as long as the cover of Georgina Basin sediments remains in place. The western limit to basalt, as defined by geophysics, should be considered as a broad zone rather than a line, and it is located at depths of several hundred metres. All relevant diagrams in Derrick (1982) indicate schematic uncertainty on this matter, as do earlier papers on the topic (Plumb & others, 1980). Sweet's suggestion of a large half-graben has merit, but also remains conjectural. Analogies can be drawn with the Batten Trough, which appears to have formed as both a graben and half-graben structure at various times in its development (Plumb & others, 1980, fig. 6).

Extent of the Mount Gordon Arch

Sweet points out the difficulty in tracing the Mount Gordon Arch northwards from Gunpowder. This task is complicated by 20 kms of right lateral displacement on the Mount Gordon Fault north of gunpowder. When this displacement is allowed for, the trace of the Mount Gordon Arch is tentatively located just east of the trachybasalt flows in the Quilalar Formation — hence my suggestion that the projected arch areas may have controlled distribution of the flows.

These observations apply only to Quilalar Formation time; no such claim is made for younger units (Surprise Creek Formation, McNamara Group) in the far northern areas. It is clear from thickness variations in the Surprise Creek Formation that the northern areas of the LRFT were submergent relative to southern areas; even in areas near Gunpowder, it is clear that the influence of the Mount Gordon Arch had waned by Oxide Chert time, and the arch was increasingly submergent to the north (Derrick, 1982, p.89). In this respect Sweet and myself appear to be in broad agreement that existence of the Mount Gordon Arch north of Gunpowder is conjectural, especially in depositional periods younger than Quilalar time.

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