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# Abstracts of other papers presented at the conference on 'Multiple Deformation and Foliation Development'

compiled by C. McA. Powell

School of Earth Sciences, Macquarie University, North Ryde, New South Wales, 2113, Australia

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### *Problems in structural correlation from low to high metamorphic grade: examples from the Halls Creek Mobile Zone, East Kimberleys, and the Adelaide Fold Belt.* R. Allen, Department of Geology and Mineralogy, The University of Adelaide, Adelaide, South Australia, Australia, 5000.

In the Halls Creek Mobile Zone, deposition, deformation and metamorphism occurred in the Proterozoic whereas orogenic activity in the Adelaide Fold Belt commenced in the Early Palaeozoic, although both fold belts have an initial history of Proterozoic rifting. In both, $D_1$ folds are the most obvious structural elements at low metamorphic grades. In areas of high-grade rocks, $D_2$ overprints $D_1$ and earlier structures and fabrics are difficult to identify. $D_1$ folds are inclined to recumbent, tight to isoclinal, with penetrative axial-plane slaty cleavage. A near-coaxial $D_2$ event modified these folds at high grade. In the Halls Creek Mobile Zone, additional crustal shortening produced 'pinched in' synclines, folds with tightly appressed limbs and a strong elongation lineation. In the Adelaide Fold Belt the major component of $D_2$ appears to be simple shear with little crustal shortening, producing discrete zones of $D_2$ crenulation, shallowing of $D_1$ fold limbs and transposition. However, while fold style can in places serve to discriminate between $D_1$ and $D_2$, the crucial observation needed is the sense of bedding/cleavage relationships around folds. This is critically dependent on the ability to distinguish $S_1$ from $S_0$ and $S_2$. This is a function of their relative development and retention (itself a function of lithology), fold geometry, and the nature of the layer-parallel fabric. Some lithologies are unsuitable (e.g. basalts and ignimbrites in the Kimberleys), and in others, prograde $S_2$ obliterates $S_1$ except in fold hinges and porphyroblasts. Thus, structural correlation from low to high grade in these two fold belts is generally problematical.

### *Structural geometry of the Chewings Range, Central Australia.* C. Amri,* B. E. Hobbs,* C. K. Mawer,† C. Teyssier* and J. C. Wilkie,‡ *Department of Earth Sciences, Monash University, Clayton, Victoria, Australia, 3168, †Department of Geology, University of New Brunswick, Fredericton, New Brunswick, Canada, E3B 5A3, ‡Box 123, Gundaroo, New South Wales, Australia, 2620.

The igneous and metamorphic basement complex of the Western Arunta Block is overlain by a sequence of quartz-rich metasediments and thin intercalated basic and acid meta-volcanic horizons which form the Chewings Range layering, $S_0$. The first recognized deformation, $D_{1-2}$, is reponsible for a flat-lying composite foliation, $S_{1-2}$, axial plane to tight to isoclinal $F_2$ folds and containing a strong $L_2$ lineation which trends N–S. This lineation is of stretching origin and commonly lies at a small angle (0–45°) to $F_2$ fold hinges. $D_{1-2}$ was associated with sillimanite-grade metamorphism. The $D_3$ deformation is characterized by a steep N-dipping axial-plane crenulation cleavage in the most schistose rocks. It is coeval with both prograde and retrograde assemblages. Large-scale $F_2$ and $F_3$ structures interfere, resulting locally in complex map patterns. Late-stage mylonite zones commonly occur at the contact between quartzites and surrounding gneisses.

A Fry-type analysis of the $D_{1-2}$ deformation responsible for the strain recorded in the quartzites was used to determine the finite strain. The results indicated a range from constriction to flattening-type ellipsoids. Quartz commonly forms up to 100% of the Chewings Range quartzites and its microscopic substructures can be readily related to the macroscopic structural features. Crystallographic preferred orientations of quartz $c$-axes have been correlated with strain at a number of localities and appear to be consistent with predicted theoretical patterns. They show a girdle at a high angle to the linear fabric of the tectonites, with maxima regularly distributed; this suggests that in each grain one of the crystallographic planes became parallel to the foliation.

### *Foliation development in the Cannibal Creek Granite and its aureole: heterogeneous shortening around a ballooning diapir.* R. Bateman, Department of Geology, James Cook University, Townsville, Queensland, Australia, 4811.

Several features indicate that the Cannibal Creek Granite was emplaced as a ballooning diapir: (1) its aureole was intensely deformed in an event, the effects of which die out within 5 km of the pluton; (2) the granitoid is less dense than the rocks of its aureole; (3) the aureole foliation is parallel to and continuous with the granitoid foliation, and forms closed, elliptical trend lines and (4) contact-metamorphic porphyroblasts grew synkinematically with regard to the aureole foliation.

The foliation in the granitoid is commonly formed by an alignment of microcline megacrysts and mica. In more gneissic rocks around the contact, feldspars have recrystallized and quartz forms intensely deformed ribbons. Where the granitoid foliation strikes obliquely to the contact, it is continuous with that of the aureole. This obliquity occurs where the contact is less regular in trend than the foliation on a scale of a few kilometres, and indicates that the rocks of the aureole and the pluton were rheologically similar during the deformation of the aureole.

The aureole foliation is penetrative within 500 m of the contact, and occurs further out as a crenulation cleavage, weakening outwards. 'Millipede' microstructures, the large-scale geometry of the aureole folds and foliation, and the absence of lineations in the foliation indicate that the deformation had a strain history of heterogeneous bulk shortening. There is no record of progressive bulk shear, indicating that this deformation took place by ballooning *in situ*, after the pluton had ascended to its present position. Kinking and stoping evidently preceded ballooning, and may have resulted from the ascent of the magma. The aureole deformation was followed by the injection of ring dykes and collapse of the central block.

### *Foliation development, porphyroblast nucleation and growth and deformation history.* T. H. Bell, Department of Geology, James Cook University, Queensland, Australia, 4811, and P. D. Fleming, Department of Geology, La Trobe University, Bundoora, Victoria, Australia, 3083.

Syntectonic porphyroblast nucleation and growth is controlled by deformation partitioning on a microscopic scale. Dissolution occurs in operating zones of high shearing strain and some of this dissolved material transfers in solution to sites of low shearing strain where reaction, precipitation and replacement sometimes generates porphyroblastic minerals. Syntectonic porphyroblasts cannot grow across operating zones of high shearing strain. However, shifting patterns of deformation partitioning causes some formerly operative zones of high shearing strain to cease operating or become dominated by shortening