porphyroblasts are completely replaced by cordierite-spinel symplectites that were isolated from the remainder of the bulk rock by cordierite moats. Garnet was also a product of prograde heating. Peak metamorphism attained conditions of ~4.7 kbar and 765°C. Associated geothermal gradients are elevated, and are estimated to be ~65°C km^{-1} during the early stages of metamorphism, and ~45°C km^{-1} during peak metamorphism.

High-temperature/low-pressure metamorphism, significantly elevated geothermal gradients and complex ~1600-1580 Ma tectonothermal evolutions are not uncommon within other mineralised Proterozoic Australian orogenic belts (e.g. Broken Hill, Mt Isa, Olympic Dam). The commonality of these geological histories, as well as the occurrence and widespread nature of mineralisation brings into question the tectonic context of such high-temperature/low-pressure metamorphic regimes.

Fluid Flow in 3D Strike-Slip Fault Systems

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This study illustrates the effect of varying fault geometry using a three-dimensional finite difference code, whereas previous studies focused on two-dimensional models. Utilizing an existing GIS fault database of the Mount Isa Inlier, the most common trend of the major structures in the Western Succession was found and set as the default fault geometry for the numerical models.

Using this default geometry, a series of fault bend and fault jog geometries were modelled and the dilation and integrated fluid flux outputs evaluated. Through variation of fault dip, fault width, bend/jog angle, bend/jog length, inclusion of a cross-cutting fault and contrasting rock types, the results were examined to determine which values for a particular parameter produced the greatest dilation and integrated fluid flux within the models.

Results demonstrate that both fault bend and fault jog models with a low fault dip or a wide fault produce greater maximum dilation and integrated fluid flux. Fault bend models generate higher maximum dilation and integrated fluid flux as the bend angle increases, whereas the fault jog models produce higher maximum values as the jog angle decreases. Maximum dilation and integrated fluid flux values are found in fault bend models with a longer bend, and in fault jog models with a shorter jog. The inclusion of a cross-cutting fault or a contrast in rock type is found to increase the maximum dilation and integrated fluid flux values in both fault bend and jog models.

Some results obtained oppose the conventional ideas relating to restraining and releasing bend and jog geometries. Using the maximum values of dilation and integrated fluid flux, the fault geometry parameters varied in this study can be ranked in order of importance. These results can be used in field campaigns to focus on areas with the most favorable fault system parameters.

Do strain-rates in deep ductile shear zones reflect seismogenesis at surficial levels of the same movement zone?

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It has become evident that large-scale ductile shear zones play a role during seismogenesis, e.g., defining the down-dip extension of seismically-active faults. Rapid movements might take place in such zones as the result of large earthquakes, including motions normally referred to as pre-slip or after-slip. Movements may be sufficiently rapid to cause temperature rises that affect the component minerals, and lead to metamorphic reactions and growth of new mineral assemblages. Importantly, such events would explain very short-lived thermal pulses we infer in orogenic belts.

There is much data that can be interpreted in terms of the effects of such short-lived thermal pulses. The survival of older mineral paragenesis suggests that the duration of any thermal pulse was not long enough to allow transformation of metamorphic minerals to new parageneses, except where deformation and fluids facilitate the process, usually within the shear zone itself. Similarly it can be supposed that the duration of any thermal pulse is not long enough to allow complete diffusional loss of argon from relict mineral grains, which therefore display anomalously older ages, except where these relicts have been substantially deformed and/or recrystallized.

These concepts can be tested using K-feldspar geospeedometry to estimate the duration of thermal events. Preliminary data suggest that the candidate shear zone operated at rates appropriate to periods of pre-slip or after-slip related to major seismic events. P-T conditions that allow growth of garnet+biotite could endure for only short periods, estimated here as not exceeding one thousand to ten thousand years during the total five million year operating life of this ductile shear zone.

Ongoing research is necessary if we are to achieve more fundamental understanding of the geodynamic context of natural hazards. Further modelling may reveal constraints on the recurrence interval of individual movements that sum to effects as mentioned above.