Geophysical Research Abstracts
Vol. 17, EGU2015-8160, 2015
EGU General Assembly 2015

3D inclusion trail geometry determination within individual porphyroblasts using reflected light optical microscopy of oriented blocks

Mark Munro (1), Douglas Bowden (1), Alison Ord (1), and Bruce Hobbs (2)

(1) Centre for Exploration Targeting, The University of Western Australia, M006, 35 Stirling Highway, Crawley, WA 6009, Australia, (2) CSIRO Earth and Resource Engineering, Bentley, WA, Australia

It is vital to interpret porphyroblast microstructures accurately relative to both one another and to external matrix structures when using them to reconstruct the tectono-metamorphic evolution of orogenic terranes. Misinterpretation may have profound implications for either the deformation component or the inferred metamorphic reactions resulting in erroneous Pressure-Temperature-time-Deformation (P-T-t-D) trajectories. A number of well-established approaches have been devised for measuring porphyroblast inclusion trails including pitch and strike measurement, 'FitPitch' best-fit plane assignment, and the radial asymmetry method. A long-standing limitation of these methods is that they generally permit only a single measurement to be extracted from each individual porphyroblast, and therefore provide mean 3D orientation data for an entire population. Alternatively, High-Resolution X-ray Computed Tomography (HRXCT) facilitates the imaging of 3D internal geometries within individuals. However, at present significant operating costs render it unviable for routine application to large numbers of samples required for extracting meaningful tectonic interpretations. Here, a new method is presented for the determination of 3D geometries within porphyroblasts using reflected light examination of polished schist material. Reflected light microscopy yields good quality representation of inclusion trails preserved within porphyroblasts. Sectioning oriented samples into small, oriented blocks allows multiple intersections through porphyroblasts (generally >5mm) to be measured via mechanical stage and amalgamated to reconstruct the plane in 3D. The method represents an accessible alternative to HRXCT, which is applicable to any porphyroblastic phase of adequate size to permit at least two intersections. The technique is demonstrated on garnets from the Mesoproterozoic Mount Barren Group, southern Albany-Fraser orogen of S. W. Australia. Porphyroblasts within a structural domain of the Kybalup Schist member of the Mount Barren Group preserve two generations of foliation that have been largely overprinted in the matrix during the effects of subsequent deformation. The earliest generation (S1) was associated with approximately East-West oriented horizontal bulk shortening.