A SENSITIVE VORTICITY GAUGE USING ROTATED PORPHYROBLASTS, AND ITS APPLICATION TO ROCKS ADJACENT TO THE ALPINE FAULT, NEW ZEALAND

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ABSTRACT

Variable aspect ratio porphyroblasts deformed in non-coaxial flow, and internally containing rotated relicts of an external foliation, can be used to characterise plane strain flow regimes. The distribution obtained by plotting the orientation of the long axis of such grains, classified by aspect ratio, against the orientation of the internal foliation is potentially a sensitive gauge of both the bulk shear strain (as previously suggested) and kinematic vorticity number.

We illustrate the method using rotated biotite porphyroblasts in the Alpine Schist, a sequence of mid-crustal rocks that has been ramped to the surface along the Alpine Fault, a major transpressional plate boundary. Results indicate that, at distances >~1km from the fault, the rocks have undergone a combination of irrotational flattening and dextral-oblique, normal-sense shear, with a bulk shear strain of ~0.6 and kinematic vorticity number of ~2. The vorticity analysis is compatible with estimates of strongly oblate bulk strain of ~75% maximum shortening. Dextral-reverse transpressional flow characterise higher strain S-tectonite mylonite within~1km of the Alpine Fault. These relationships provide insight into the kinematics of flow and distribution of strain in the hangingwall of the Alpine fault and place constraints on numerical mechanical models for the exhumation of these mid-crustal rocks.