Geophysical Research Abstracts
Vol. 16, EGU2014-2311, 2014
EGU General Assembly 2014

Nappe-Bounding Shear Zones Initiated On Syn-Tectonic, Pegmatite-Filled Extensional Shear Fractures During Deep-Crustal Nappe Flow In A Large Hot Orogen

Nicholas Culshaw (1), Christopher Gerbi (2), Jeffrey Marsh (3), and Peter Regan (1)

(1) Dalhousie University, Department of Earth Sciences, Halifax, NS, Canada , (2) School of Earth and Climate Sciences, University of Maine, Orono, ME 04469, (3) School of Earth and Environmental Sciences, Queens College, 65-30 Kissena Blvd., Flushing, NY 11367

The Central Gneiss Belt (CGB) of the Proterozoic western Grenville Province is an extensive exposure of the mid-crustal levels (upper amphibolite facies, lesser granulites) of a large hot orogen. Numerical models give a credible prediction of structure and metamorphism accompanying CGB deep-crustal nappe flow and define a temporal framework based on four developmental phases: thickening, heating, nappe-flow and post convergence extensional spreading. These phases are diachronous in direction of orogen propagation and imply a spatial framework: externides (close to orogen-craton boundary) containing moderately inclined thickening and/or extensional structures, and internides containing thickening structures overprinted by sub-horizontal nappe flow structures, which may be locally overprinted by those due to extensional spreading.

Although on average of granitoid composition, CGB nappes differ in rheology, varying from fertile and weak (unmetamorphosed before Grenville, meltable) to infertile and strong (metamorphosed at high grade before Grenville, unmeltable) or mixed fertile-infertile protoliths. Deformation style varies from diffuse in fertile nappes, weakened by pervasive melting, to localised in shear zones on boundaries or interiors of infertile nappes. Specifically, in terms of deformation phase and location within the orogen, shear zones occur as: thickening structures of externides, early thickening- and later overprinting nappe-flow structures of infertile internide nappes, and extension-related shear zones in externides and internides.

Many of the nappe-flow shear zones of the internides are associated with pegmatites. One example has been recognized of a preserved progression from small-scale fracture arrays to regional shear zone. The sequence is present on a km-scale and initiates in the interior of a nappe of layered granulite with arrays of pegmatite filled extensional-shear fractures (mm to cm width) displaying amphibolized margins. The fracture arrays develop into systems of pegmatite cored amphibolite facies shear zones (cm to dm width) lying within metre-scale corridors of variably retrogressed unsheared layered granulite. The sequence culminates with transposition of the layered protolith within the kilometre-scale amphibolite facies shear zone that forms the base of the granulite nappe. The pegmatitic hydrous magma clearly plays a role in initial crack formation, progressive retrogression and weakening of the granulite but its source remains obscure.