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Science Atlantic Lecture Tour 2015

From grain scale to mountain scale: timing and timescales of evolving orogenic processes

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For ca. 50 years since the establishment of a modern plate tectonic paradigm, the process of orogenesis and evolution of mountain belts has been the focus of a literal mountain of research (well...at least a small hill!). The processes of accretion and burial, development of thermal anomalies in the crust and lithosphere, followed by differential exhumation of rocks back to the surface are well established. Furthermore, the last decade has seen the proliferation of rigorous thermo-mechanical numerical models that can reproduce many of the salient crustal geometries observed in Phanerozoic and even Archean orogenic belts. The first part of the talk will highlight some of the historical conceptual development of orogenic processes.

Questions remain however. For example, despite their complexity, contemporary thermo-mechanical numerical models are typically confined to two dimensions and are therefore ill-suited to capturing the effects of oblique collision and transpression. In addition, geochronological techniques refined in the 1970's continue to be used to establish timescales for orogenesis based on cross-cutting intrusive relationships despite access to sophisticated in-situ methods. The latter can be used to directly date deformation fabrics, establish timing of porphyroblasts vs. matrix development, and constrain exhumation rates using accessory minerals with low Pb-diffusion closure temperatures. Combined with increasingly sophisticated thermodynamic modelling software to reconstruct pressure-temperature paths, this in-situ geochronology data has helped to push the study of orogenic belts into a new era.

The talk will finish with a couple of examples of how we build up a picture of orogenesis from the rocks we map in the field. In both cases, the style of metamorphism and reconstructed P - T paths help constrain the tectonic setting during and after collision.

All are welcome.

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12:15 -1:05

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