Fluid movement during propagation of the Rundle thrust

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ABSTRACT

As fluid enters a thrust fault system, it seems reasonable to assume flow is focused along fractures and the thrust surface. The geometry of the thrust surface (i.e. ramp or flat zones), and size and spacing of fractures exert significant control on the path, and consequently the chemistry, of thrust fluids. Such factors are a reflection of lithology, time, and temperature. Despite the potential economic significance of syntectonic thermal and fluid regimes in thrust-faulted regions, the relationship is poorly understood. The involvement of thrust fluids in the development of petroleum resources is significant, as the movement of thrust fluids may be simultaneous with the migration of hydrocarbons. Additionally, temperatures related to thrusting may be significant with respect to hydrocarbon maturation.

The Rundle thrust, near Canmore, Alberta, provides an extensive stratigraphic and structural framework within which to conduct such a study. The effects of crustal shortening (accomplished via thrust faults, imbricate thrusts, and concentric folds), as well as transverse faulting, common in the area, are examined.

Syndeformational formation of cements is necessary to preserve fractures that open as the thrust propagates. Fractures filled by calcite and dolomite cements offer a record of temperature, fluid flow and fluid chemistry prevalent during faulting. Stable isotope geochemistry and fluid inclusion analyses, including mass spectrometry and microthermometry, are employed to interpret the system. Aqueous fluids are derived from meteoric and other (pore fluid and possibly hydrothermal) sources. Preliminary findings reveal an abundance of methane in several stratigraphic units, some of which also contain significant hydrogen sulfide. Results constrain the thermal history, fluid flow, the composition of aqueous fluids, and the generation and migration of non-aqueous fluids (including hydrocarbons) during thrust faulting.