Fission track, and compositional analysis of detrital apatite in terms of tectonic history and sedimentary provenance: Sawtooth Range, Sverdrup Basin, Canadian Arctic Islands

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The Sverdrup Basin is the largest sedimentary basin in the Canadian Arctic. Its sediments were deposited in two sequences: Proterozoic to mid-Palaeozoic and late Palaeozoic to early Cenozoic, and affected by both the Ellesmerian and Eurekan orogenies. Detrital apatite samples have been obtained from two measured sections in the Northern Sawtooth Range. The first measured section transects the East Cape Thrust with Permian rocks in the hangingwall and Triassic to Miocene rocks in the footwall. The second measured section traverses up-section from the Permian rocks in the hangingwall of the East Cape Thrust into Triassic-Jurassic rocks. Together the two sections form a continuous lithological record from the Permian to the Miocene.

The apatite samples are analyzed for fission track histories and compositional variation. The analyses of fission tracks in apatite grains yield information on burial, cooling and exhumation events in sedimentary rocks. By contrasting fission track cooling histories of samples offset by the East Cape Thrust it is possible to constrain the timing of thrusting and exhumation in the north central Sverdrup Basin.

The chemical composition of detrital apatite determined in the electron microprobe is studied in terms of two major applications: (1) The concentration of F, Cl, OH, CO_2 controls both the thermal annealing of fission tracks and their etching behaviour, therefore affecting the time-temperature models for cooling and exhumation that can be computed from them; and (2) the composition of detrital apatite grains reflects the primary composition of the melt from which it crystallized. In this study apatite samples are classified in terms of major and rare earth element composition. Chondrite normalized plots reflect the enrichment or depletion of these elements in the source melt. Thus a shift in type of sediment source rocks may be reflected in the composition of the resulting detrital apatite grains. This study defines discrete populations of apatite and relates shifts in the presence of discrete populations to shifts in sediment sources through time.