Evolution of fractures in a fold-and-thrust belt and the associated deformed foreland basin: An example from the northeastern Brooks Range and the eastern Colville Basin, Alaska

Andrea Loveland
University of Alaska Fairbanks, Department of Geology & Geophysics
Fairbanks, Alaska
ftaml@uaf.edu

Rocks exposed at the surface of a fold-and-thrust belt record a complex fracture history that reflects a wide range of structural environments. These rocks record fracture formation during several stages of advancement of the fold-and-thrust belt into the basin: while flat-lying in the foreland, during fold-and-thrust deformation, and during late- to post-deformational uplift and unroofing. The proposed study focuses on Pre-Mississippian to Lower Cretaceous sedimentary rocks exposed along a transect across the northeastern Brooks Range fold-and-thrust belt into the Colville Basin. This project has important implications for basin evolution because it will provide information about how fractures vary as a result of changing stratigraphic and structural position.

Several data sets will be used to characterize fractures and constrain the timing and conditions under which they formed. Folds, faults, and other map-scale features will be mapped (1:25,000) and attitudes measured. Outcrop data will be combined with seismic reflection and well data from the basin to provide a picture of structure across the fold-and-thrust belt. A combination of apatite and zircon fission-track data, thermal data, as well as fluid inclusion and petrographic analyses will constrain deformation conditions and the timing of uplift and fracturing. All data will be integrated on balanced cross sections to constrain conditions at different structural levels.

By integrating these data sets, this study will provide knowledge of the timing and conditions of fracturing in sediments as they are incorporated into this fold-and-thrust belt. The quantitative model will be a useful tool for predicting fracture evolution in similar settings.