University of Alaska Geochronology Facility: Ongoing collaborations on the rock record of Neogene deformation in southern Alaska.

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The planned EarthScope deployment of the USArray in Alaska provides exciting opportunities for understanding mantle-crust interactions in a complex convergent margin. An ongoing wide-spread GPS and EarthScope seismic instrument campaign will provide valuable insights into how stress from the ongoing flat-slab subduction of the Yakutat microplate at Alaska’s southern margin is distributed inboard. Far-field response to the plate boundary coupling is expressed as both vertical and horizontal tectonics along crustal-scale faults such as the Denali Fault system. Results from this study will have both regional and broad scale tectonic implications. In particular, results from this project will help define what constitutes the boundaries of blocks of Alaska crust, and whether the wide plate boundary zone between the Pacific and North American plates is best characterized by diffuse deformation, block rotation, or both. Results will also have relevance to how surface processes and seasonal hydrological changes affect vertical movement of the upper plate.

The deployments will also present an opportunity to integrate short term observations (e.g. GPS measurements) with Alaska’s million year time scale tectonic history preserved in the rock record. The University of Alaska Fairbanks geochronology facility is currently involved in numerous collaborations in southern Alaska using thermochronology and geochronology integrated with micro- and macrostructural analysis to document continental-scale fault movements, block formation, block boundaries and block history, interactions between tectonic and glacial processes, and vertical tectonics. Recent projects have concluded that flat-slab subduction has influenced the tectonics of south-central Alaska for at least ~24 Ma, which is documented in the Neogene formation of the eastern Alaska Range and strike-slip movement along the eastern Denali Fault system. A central focus of our group’s research is to investigate if particular regions of Alaska are undergoing diffuse/distributed deformation or are acting more block-like. Continuing and proposed projects along this front relevant to the EarthScope community include, but are not limited too:

a) How do near-field structural irregularities like the Denali Fault restraining bend affect vertical tectonics (e.g. Mount McKinley) and is there a rock record of southern Alaska block movement history along the Denali Fault restraining bend?
b) Why does the slip rate of the Denali fault vary along strike, and do these rates change through time?

c) Does the rock record of the western Alaska Range support the inference of a boundary between the Bering and southern Alaska blocks?

d) In the Talkeetna Mountains, is there a record of south to north Neogene progressive exhumation related to the location of the Yakutat flat slab through time?

e) Do active faults and glacial processes, through an unique feedback system, magnify the effect both processes have on the long-term erosion history of a region?

We look forward to discussing these current projects with the EarthScope community and avenues for integrating the objectives of the USArray with our work. We also look forward to discussing further collaborations integrating the modern and geological record.