The thermal history and uplift of the Alaska Range from $^{40}Ar/^{39}Ar$ thermochronology

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$^{40}Ar/^{39}Ar$ laser step-heating of single mineral crystals of hornblende, biotite and potassium feldspar (K-spar) has proven useful in determining detailed thermal histories of igneous and metamorphic terranes, Individual crystals of the same mineral within a single sample can record different perspectives of that history and can record different 'events' (either thermal or chemical) that might otherwise go undetected or be blurred by 'bulk' step-heating methods. For K-spar, individual crystals can show variations in their complex, multi-domain age spectra due to variations in composition (as seen by Ca/K ratios and densities), grain size, and/or crystal structure. When this single crystal dating is combined with more 'traditional' resistance-furnace K-spar multidiffusional domain modeling, different portions of the cooling history of a unit can be identified. Because the minerals have mid-crust closure temperatures, they can provide insights into faulting and exhumation that are not seen by lower temperature thermochronometers.

We have employed this multi-mineral $^{40}Ar/^{39}Ar$ thermochronologic approach to vertical sampling studies of granitic plutons throughout the Central and Eastern segments of the Alaska Range. The Alaska Range is a ~650 km long topographic barrier that is believed to be related to the active transpressive Denali Fault system as well as to the collision and subsequent underplating of the Yakutat microplate with southern Alaska. Our results show differential episodic exhumation and uplift along the Range. Biotite age spectra from the McKinley Pluton (Denali) in the Central Alaska Range are undisturbed and reflect pluton emplacement cooling starting at 60 Ma, while K-spar data suggest episodic cooling at ~43 Ma, ~25 Ma and ~11 Ma. in addition to uplift at ~5-6 Ma (apatite fission track ages). In contrast, in the Eastern Alaska Range, biotite, K-spar, and in some cases hornblende, show evidence of post-emplacement open-system behavior or slow cooling. For example, Mt. Nenana (167 km east of Denali) has a 37 Ma biotite closure age, while K-spar ages range from 9 to 35 Ma with youngest ages at lower elevations and nearest to the Denali Fault, where ~25 Ma and ~12 Ma cooling events are identified. These cooling ages are also reflected in changes in subsidence and sedimentation rates in basins north of the Alaska Range.

PAH concentration and $\delta^{13}C$ trends in sediments receiving long-range atmospheric deposition

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PAH deposition in North America had been declining from a maximum in the 1950's due to emission controls. However, recent research has documented either stable or increasing PAH deposition in urban/sub-urban areas in the last 20 years. In contrast to pyrogenic PAHs, perylene concentrations have been found to increase with depth in many environments, suggesting *in situ* production.

PAH fluxes and $\delta^{13}C$ values were used to investigate the recent trends in PAH deposition to Siskiwit lake over the last hundred years. Despite increasing trends in some urban/sub-urban areas, over the last 20 years PAH deposition to Siskiwit Lake declined at approximately the same rate from 1952 to 2004. This supports the hypothesis that recent increases in urban environments are a local effect rather than due to long–range transport. Moreover, PAH fluxes in 2004 were 8.5 ng/cm^2 yr, comparable to near-background fluxes of 6.4 in 1908 indicating that PAH deposition from long-range transport is approaching background conditions.

$\delta^{13}C$ values of PAHs did not systematically relate to concentration profiles. The $\delta^{13}C$ of fluoranthene and pyrene (four ring PAHs) were independent of concentration changes with depth and had values of ca. -26‰. In contrast, the $\delta^{13}C$ of napthalene (two ring) and phenanthrene (three ring) showed a trend of increasing enrichment with increasing depth over a range from -28 ‰ to -25 ‰.

Perylene concentrations followed the same profile as observed by McVeety and Hites [1] in 1988. However, concentrations were greater at all depths, supporting the hypothesis of *in situ* production. The difference in perylene concentration between the two cores allowed estimation of production rates and showed that this production rate decreased over time. $\delta^{13}C$ analysis of perylene is ongoing in order to further constrain this process.

[1] McVeety, B. D. & Hites, R. A. (1988) *Atmospheric Environment* **22**(3) 511-536.