ALASKA GEOLOGY

September Luncheon Abstract.

Timing of Brooks Range and North Slope Uplift and Denudation:

A Summary of Fission Track Results Completed During the Last 20 Years

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Note: AGS meetings will be at the BP Energy Center for 2009-2010.
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This newsletter promotes the September luncheon talk of the Alaska Geological Society, to be held Thursday, September 17th, at the BP Energy Center.

The elevated Brooks Range mountain belt we see today has long been interpreted as a component of a major Jurassic-Late Cretaceous convergent margin orogen; the Brookian orogeny. The Brookian, originally considered to be solely responsible for the formation of structures and relief within the Brooks Range, has been previously divided into two major episodes of compression: an early episode during the Late Jurassic to Early Cretaceous and a late episode during the Late Cretaceous to possibly earliest Tertiary (?), separated by an episode of extension during mid-Cretaceous times. The early Brookian orogenic phase was characterized by extensive emplacement of allochthons across the length of the Brooks Range, with estimated crustal shortening of 400-600 km. Deformation at this time has historically been interpreted to be a consequence of north-directed arc-continent collision in the Jurassic and Neocomian. The late Brookian orogenic phase was characterized by gentle, long-wavelength folding of Lower Cretaceous and younger strata within the adjoining North Slope foreland basin, and development of poorly dated thrust faults displaying significantly less structuring than those formed during the early Brookian orogenic phase. However, the timing (and therefore, the cause) of this proposed late Brookian phase proved difficult to determine, as the youngest strata crosscut by late Brookian thrust faults were Middle-Upper Cretaceous in age (Colville Group).

Alaska Geological Society Luncheon

Date & Time: **Thursday, Sept. 17th, 11:30 am – 1:00 pm**

Program: **Brooks Range / N. Slope Uplift**

Speaker: ***Paul O'Sullivan, Apatite to Zircon, Inc.***

Place: **BP Energy Center**

Reservations: **Please make your reservation before noon Tuesday, Sept. 15th, 2009.**

Cost:

Seminar only, no meal:	**Free**
Reserve a box lunch:	**$13**
Nonmember:	**$15**
Reserve a hot lunch:	**$20**
Nonmember:	**$22**

No reservation: add $5 to the above (on an "as-available" basis only)

E-mail reservations: **vp@alaskageology.org**
Or phone (907) 269-8673
(Ken Helmold, AGS VP)

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Over the last 20 years, the application of zircon and apatite fission track results from Devonian through Cretaceous granitic and sedimentary rocks helped us resolve the timing of uplift and denudation across the northern Brooks Range orogen and the adjoining North Slope foreland basin during the Cretaceous and Tertiary. Zircon results from outcrop samples within the orogen recorded cooling below paleotemperatures >240°C at ~140 Ma, ~120 Ma, ~60 Ma, and ~45 Ma, whereas apatite results recorded rapid cooling below paleotemperatures >110-130°C during discrete episodes at ~100 Ma, ~60 Ma, ~45 Ma, ~35 Ma, and ~25 Ma. Within the foothills and

adjoining foreland basin, zircon results recorded provenance cooling ages with distinct grain-age populations at ~160 Ma, ~140 Ma, and 120 Ma, whereas apatite results recorded rapid cooling below paleotemperatures >110-130°C at ~100 Ma, ~60 Ma, ~45 Ma, ~35 Ma, and ~25 Ma. Within the basin, apatite results from subsurface samples indicated exposure to maximum paleotemperatures in the Late Cretaceous to early Paleocene, due to subsidence and burial by Jurassic and Cretaceous sedimentary rocks. Rapid cooling from these elevated paleotemperatures subsequently occurred at ~60 Ma, ~45 Ma, and ~25 Ma. The episodes of rapid cooling recorded by the fission track results were interpreted as indicating absolute timing of tectonic events within the Brooks Range and its foreland basin.

Recently, the integration of the fission-track results with detailed structural analysis has suggested that the Brooks Range was formed as a consequence of four distinct orogenic events. These included: 1) north-directed arc-continent collision in the Jurassic and Neocomian that produced thin-skinned deformation and emplacement of far-traveled allochthons, followed by 2) regional extension and down-to-the-south normal faulting in the hinterland during the mid-Cretaceous and coeval deposition of voluminous clastic strata in the foreland and hinterland. From the mid-Cretaceous to the beginning of the Cenozoic, denudation and deformation within the Brooks Range and foreland basin greatly diminished, probably marking the end of the Brookian orogeny, as we know it. The last two orogenic events, during the Cenozoic, comprised: 3) thin- to thick-skinned deformation due to retro-arc thrusting emanating from southern Alaska in the Paleocene and Eocene, and 4) thrusting in the northeastern Brooks Range as a consequence of terrane accretion in the Oligocene to Recent. Furthermore, integrated analyses show that while the amount of deformation responsible for the development of the Brooks Range during the Jurassic to mid-Cretaceous was significantly greater than occurred subsequently, the elevated Brooks Range mountain belt seen today is primarily a Cenozoic feature, and its relief is largely unrelated to the Late Jurassic to mid-Cretaceous Brookian deformation.

About the Author:

Paul O'Sullivan received his B.S. and M.S. degrees from the University of Alaska-Fairbanks in 1986 and 1989, respectively, and his PhD from LaTrobe University in Melbourne Australia in 1994. The primary focus for both his M.S. and PhD research was the generation of apatite fission-track results to better constrain the post-depositional thermal history of sedimentary rocks throughout the northern Brooks Range and North Slope foreland basin. He continues his Alaskan fission-track studies today in cooperation with many colleagues from the USGS, ADGGS, and academia. Since 2002, he has held the position of Vice President for Apatite To Zircon, Inc., based out of Viola, Idaho.

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