

SEISMOTECTONICS AND STRUCTURE OF THE BROOKS RANGE, ALASKA

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ABSTRACT

Data collected by seismic networks operated by the Geophysical Institute of the University of Alaska-Fairbanks are used to study the seismicity and tectonics of northern Alaska. Microearthquake activity (less than 4.7 M_L) is seen as a diffuse band trending north-northeast from Fairbanks to Barter Island, and as an easterly trend roughly parallel to, but south of, the crest of the Brooks Range. Depths of the events range from 5 to 15 miles (10-25 km). Some clustering occurs, with the most clearly defined feature being a north-south trend of epicenters from 66 to 67°N and 157 to 158°W.

A crustal velocity structure of the eastern Brooks Range is constrained using refracted phases from earthquakes local to the Barter Island, Fort Yukon, and Fairbanks networks respectively. Focal mechanism solutions from the Brooks Range show normal, thrust, and strike-slip faulting. Common to all of them, however, is an east-striking nodal plane that parallels the regional structural grain, suggesting that the fault planes are on reactivated faults. This is in contrast to the earthquakes in interior Alaska which show mainly strike-slip focal mechanisms. The orientation of the pressure axes in both areas is consistent with the convergence of the Pacific and North American plates.

THE BROOKS RANGE AND THE EASTERN ALPS: A TECTONIC COMPARISON

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ABSTRACT

A comparison of the tectonic evolution of the Brooks Range (BR) and the Eastern Alps (EA) reveals a remarkable parallelism. Both of these Mesozoic-Cenozoic orogenic belts are underlain by sialic crust formed in an earlier Paleozoic orogenic cycle. The old basement is revealed in major tectonic windows—the Tauern Fenster (EA) and the Doonerak Window-Schwatka Mountains (BR)—which are unconformably overlapped by transgressive neritic marine clastic to carbonate successions—the Permian-Triassic through Hochstegenkalk sequence (EA) and the Kekiktuk-Kayak-Lisburne sequence (BR). These successions are passive-margin sequences that pass southward, in palinspastically restored cross-sections, to synchronous deep-water facies deposited on ophiolitic basement—Bunderschiefer on Triassic-Jurassic ophiolites (EA), and Kuna facies or Etivluk sequence on Upper Paleozoic ophiolites (BR). Onset of subduction-collision is marked by olistostromal facies—Cretaceous wildflysch (EA) and Jura-Cretaceous Okpikruak Formation (BR)—and the development of major flysch-molasse successions in the foreland basins of the collisional fold and thrust belts.

Important major contrasts between these two mountain ranges reside in their colliding blocks and their post-orogenic histories. Alpine orogenesis was driven by continent-continent collision, closing out a young narrow ocean, whereas Brooks Range deformation appears to have originated by arc-continent collision, closing out an older broad (?) ocean. Younger Cenozoic deformation is extensional and strike-slip in the Eastern Alps, producing disjunctive basins, but Cenozoic deformation in the Brooks Range is diverse and includes compression in the east and extension in the far west.

By means of numerous stratigraphic and structural analogs in the better known Eastern Alps, the comparison of these two mountain belts provides interpretive insight into the Brooks Range.

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Bed of conglomerate exposed at crest of ridge, exposed again 1/4 mile south of low pass. A great overthrust occurs at crest of ridge between lake and camp. New formation of dark colored sedimentary exposed from lake valley to crest of overthrust. Explanation of the geology in front of book.

Mts. very irregular and pretty, climate much warmer on south side of mountains. Like dropping out of northern Alaska into California.

Sept. 10th Cold + Frosty

Packed another portion of camp across pass. Cashed transit - alidade - undershirt - towels - all leather shoes - ~~binoculars~~ large binoculars - 15 pound cooking utensils - rock hammers - cache cover - fossils - rock samples - side boots - Celluloid etc.

Broke camp ^{11th Cold + Frosty} and moved important part of camp 15 miles down Nimiuktuk to good wood supply - large cotton wood and willows. Had large fire and celebrated arrival on Noatak water shed. River still freezes during night, water getting scarcer in Nimiuktuk as river is descended.

Cold 12th Snow + Cloudy

Packed part of camp left at pass to camp, packed canoe half way to camp. Wix took load 6 miles south of camp to see how close we were to Noatak. Can't see Noatak.

13th

Broke camp - moved about 6 miles down river to large fork to west. Water ordinarily would increase in quantity but the weather in the mountains getting colder day by day diminishes the flow of water in the streams. Too late in season for canoe transportation on subordinate streams. Food nearly played out again. No game to be had. Camped at forks.

14 Cold + Cloudy

Moved camp 6 miles. Can work only 4 hours on small food rations - last pot of beers. Tomorrow

will eat peas + rice - have had no coffee, butter - sugar - milk for week.

Morale of party very low. Belgard (cook) would have vacation except for back packing.

15th Cold + Cloudy

Had peas + rice for breakfast, steero soup for lunch - peas and rice for supper - no more food except steero and bacon rhinds.

Moved camp 4 miles - Belgard Hughes and I each packed large load, Wix and Bronseth put rest of camp in canoe and moved on water. (6.6)

16th Cold + Rainy

Bacon rhind is, and will be the menu until our arrival at Mission on Noatak. Broke camp below main forks of Nimiuktuk put entire camp in canoe and moved to Noatak. Men so thrilled that absence of food is only secondary matter. Stomachs in first class shape but we cannot work over 3 hours per day, no staming. Camped at old cabin at mouth of Nimiuktuk.

17th Cold + Rainy

Had an early start, made old trapper cabin at spruce timber at upper end of canyon. Could have gone thru canyon but rocks and swift water did not look inviting to men of our condition. Too weak to move quickly on emergency. A wandering seagull flew too close to the boat, I took about 5 minutes aim at it and when it got within ten feet of the boat I shot it. This was a life saver - tasted like chicken. Boys had words with Belgard as to the mysterious disappearance of the seagull's gizzard. (Every morsel counted heavily at this time) Belgard explained that gizzard was put on Wix plate, but Wix accused Belgard of wolfing gizzard - while cooking the gull. Wix giving Belgard extremely vitriolic purge. Words about hot lead to assist digestion of gizzard. Argument more serious than Dan Magrew's