SEISMOTECTONICS AND STRUCTURE OF THE BROOKS RANGE, ALASKA

C. H. Estabrook, J. N. Davis, and D. B. Stone
Geophysical Institute
University of Alaska
Fairbanks, AK 99708
907-474-7997

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

J. A. Helwig*
ARCO Exploration and Production Research
Dallas, TX 75221

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 Permo-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.

*Present address: Schlumberger-Doll Research, Old Quarry Road, Ridgefield, CT 06877-4108; 203-431-5000.