ACCRETIONARY TECTONICS OF SOUTHERN ALASKA CONSTRAINED BY GPS

Elliott, Julie[1*]; Freymueller, Jeff[1]; and Larsen, Chris[1]

[1]Geophysical Institute, University of Alaska, Fairbanks, PO Box 757320, Fairbanks, AK 99775, *Corresponding author: julie@gi.alaska.edu

Present-day tectonics in southeast and southcentral Alaska is dominated by the on-going collision of the Yakutat block, an allochthonous terrane, with the southern Alaska margin. The Yakutat block is bounded on the east by the dextral Fairweather-Queen Charlotte transform system, to the west by the offshore Transition fault, and to the north by the St. Elias orogen, which hosts over half of North America's 25 highest peaks. Previous studies established high rates of motion for the Yakutat block, but insufficient data prevented the development of a detailed, comprehensive regional tectonic model. We present a GPS dataset that spans the region and use that data to constrain relative block motions and fault slip rates in southern Alaska.

In southeast Alaska, extremely large, northwest-directed GPS velocities are observed along the coast west of the Fairweather fault. Inboard of the Fairweather fault, GPS velocities have smaller magnitudes and display a clockwise rotation. Further east, within the Canadian Cordillera, GPS velocities have a small but distinct motion relative to North America. The Yakutat block moves to the northwest at a rate of over 45 mm/yr relative to North America, resulting in nearly 40 mm/yr of NW-SE-directed convergence between the block and southern Alaska. Compared with the Pacific plate, the velocity of the Yakutat block is slower and more westerly.

The highest strain rates in the region occur across Icy Bay and the western edge of the Malaspina Glacier. Rates there approach -1 microstrain/yr, a value higher than that observed in the Himalaya. Lower, but still significant, strain rates of about -0.2 microstrain/yr extend north from Icy Bay to the region surrounding Mount St. Elias. These strain rates suggest that the current deformation front between the Yaktuat block and southern Alaska is located within the Icy Bay area. Our preliminary modeling indicates that multiple NW- and N- directed thrust faults in Icy Bay, along the western edge of the Malaspina Glacier, and between Icy Bay and Mount St. Elias are required to explain the GPS observations. Over 50% of the relative convergence between the Yakutat block and southern Alaska may be accommodated by slip on these faults.

The second major focus of compressive strain in the St. Elias orogen is centered over the Yakataga fold-and-thrust belt. Strain rates there are in the range of -0.40 to -.50 microstrain/yr. Little significant strain is seen across the Bagley icefield or to the north of that feature. These results suggest that most of the convergence between the Yakutat block and southern Alaska is currently accommodated on structures located south of the Bagley icefield, specifically in the Icy Bay, upper Malaspina/Mount St. Elias, and Yakataga fold-and-thrust belt regions.

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