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Evidence of compressional active tectonics in Ragged Mountain Fault (Southern Alaska)

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Ragged Mountain in southern Alaska is a N-S trending mountain range bounded on its eastern side by the west dipping Ragged Mountain Thrust. This fault is a major structure that juxtaposes Tertiary sedimentary rocks of the allochtonous Yakutat terrane beneath older Paleogene rocks of the North American plate (Prince William Terrane). The present-day tectonic regime in the area is governed by the NW-SE convergence of the North American and Pacific plates and the collision of the Yakutat microplate into southern Alaska. The 25 km long mountain range has an asymmetric topography with a convex-eastward and steep fault-line front in the eastern flank, and a digitated and gentler western side dissected by cirques and glacial troughs. Tysdale et al. (1976), based on geomorphic criteria, proposed that the upper plate of the low angle (8ž) Ragged Mountain Fault has undergone a reverse gravity-driven westward displacement of more than 180 m in Holocene times. As part of the Saint Elias Erosion and Tectonic project founded by the NSF (Continental Dynamics Program), a field paleoseismological and geomorphological investigation has been conducted in the Ragged Mountain Fault in order to gain insight into the recent activity of this structure and the origin of some of the associated geomorphic anomalies. In the surveyed area the steep slopes of the hanging wall pass abruptly into a nearly horizontal erosional surface cut across steeply dipping beds of a footwall syncline. The recent talus and rock avalanche deposits that cover the lower sector of the mountain front display conspicuous convex downhill facing scarps at the foot of the slope and a swarm of fresh uphill-facing scarps and graben structures at higher elevation. Trenches dug across a downhill-facing scarp and an antislope scarp of a graben depression have exposed contractional and extensional structures affecting recent deposits, respectively.

In both cases the structures record multiple episodes of deformation. This evidence suggests that the Ragged Mountain Fault is currently acting as a thrust fault rather than a planar gravitational slide. The origin of the extensional structures affecting the colluvial deposits may be attributed to the gravitational collapse of the hanging wall slopes oversteepened by the outward rotation induced by the propagation of the thrust. The low relief erosional surface east of the Ragged Mountain Fault is interrupted by west-facing scarps. Trenching across one of the scarps indicates that they are the surface expression of active flexural slip faults created by the eastward rotation of the steeply dipping footwall strata induced by compressional activity on Ragged Mountain Fault. The progressive deformation recorded by the assymetrical synform with cumulative wedge outs exposed in the peaty deposits dug in this trench suggests that these bedding-parallel faults have a creep-type rather than an episodic displacement regime. The absolute dating of the units sampled in the hand dug trenches will provide further information on the chronology of large paleoearthquakes, the slip rate of the analysed structures, and the seismogenic potential of Ragged Mountain Thrust.