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The competing roles of tectonic erosion and subduction accretion in controlling active margin development in Alaska

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The tectonic evolution of active continental margins is largely a function of the speed of plate convergence together with the thickness of sediment reaching the trench. As a result changes in the tectonic evolution of cordilleran mountains, in regional climate or reorganization of drainage patterns can cause switches from erosive to accretionary margin behaviour and back. The modern Earth is presumed to be more accretionary than typical for long-term history because of the enhanced continental erosion driven by Northern Hemispheric Glaciation since around 3 Ma. We present the example of the Jurassic Talkeetna volcanic arc of south-central Alaska in which the magmatic core of an Early Jurassic oceanic arc is directly juxtaposed against the dominantly Cretaceous sedimentary accretionary wedge of the Chugach Mountains across the Border Ranges Fault. Both the Talkeetna Arc and Chugach accretionary body formed above the same north-dipping subduction zone. The forearc of the Talkeetna Arc (75-100 km of crust) is missing and is interpreted to have been tectonically eroded away, synchronous with a northward migration of magmatism after 180 Ma. We suggest that after collision of the arc with a continental terrane to the north (North America or Wrangellia) the trench began to receive more sediment due to the erosion of a collisional orogen, represented by the clastic Naknek Formation. Although rapid accretion postdates 125 Ma it is the collision of the arc with the continent that first allows sufficient sediment to reach the trench and terminate tectonic erosion. Interestingly, collision of the Kohistan

Arc with Asia in the Cretaceous (ca. 85-95 Ma) did not result in a similar onset of accretion. That did not occur until that trench came into collision with the Indian passive margin in the early Eocene. Thus, although collision and orogenic uplift is important in causing flips in tectonic character this is not the sole control. Precipitation in particular is highlighted as a key control on sediment flux rates to the trench.