

Reconstructing the Evolution of the Brooks Range Orogenic Wedge: Preliminary Structural and Stratigraphic Evidence from the Siksikpak River Area, Northern Alaska

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The Colville basin of northern Alaska is bounded on the south by the Brooks Range Orogen. The genetic link between this collisional mountain belt and the adjacent foreland basin fill has long been recognized, however, many key structural and stratigraphic relationships remain unclear. Recent field work in the greater Siksikpak River area has provided a unique view into the geometry of the orogenic wedge, particularly the relationship between the Endicott Mountains Allochthon (EMA) and other, higher thrust sheets. The tip of the mid-Cretaceous orogenic wedge is difficult to constrain, although exposures of material from higher allochthons was observed along the Desolation Creek fault (informal name), more than 30 kilometers north of the present day mountain front. It is unclear if this material is “attached” to the EMA or represents allochthonous material which overthrust Early Cretaceous synorogenic deposits. Regardless, it is clear that a significant portion of the proximal foreland basin was deposited on top of the orogenic wedge—including the entire belt marked by the Early Cretaceous Fortress Mountain Formation. This observation suggests that an extensive Early Cretaceous wedge-top depozone (*sensu* DeCelles and Giles, 1996) existed in the southern Colville foreland basin, and that the loci of maximum accommodation (foredeep depozone) lay to the north, as recorded by the extremely thick Torok Formation. Therefore, the geometry of the sedimentary basin resembles a doubly-tapered prism, rather than the commonly perceived “doorstop” geometry, monotonically deepening toward the mountain front. This more accurate model of foreland basin development partly explains anomalously low thermal maturity values observed in this and other previous studies along the Brooks Range foothills. Deformation within the wedge-top depozone often results in persistent structural highs that limit accommodation (and burial) and promote bypass. A critical component of this interpretation is that deformation of the orogenic wedge continued into the mid-Cretaceous—synchronous with the depositional filling of the Colville Basin. Oil and gas exploration in the remote foothills of the Brooks Range will benefit from a basin model which integrates the entire proximal foreland basin system.