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The Peters Hills Basin, a Neogene Piggyback Basin on the Broad Pass Thrust Fault, South-Central Alaska

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ABSTRACT

The Neogene Peters Hills basin formed along the south flank of the Alaska Range and lies northwest of the Susitna basin and south of Denali. Northeast of these basins, a long-hypothesized-but-never-observed fault has been inferred to lie along the linear trend of Broad Pass. If this hypothetical fault were to extend to the southwest, it would lie between the two basins. Here, we infer this fault is a large southwest-vergent thrust fault that is inextricably linked to the development of the Peters Hills basin. The sedimentary fill of the Peters Hills basin consists of weakly lithified, middle Miocene to Pliocene terrestrial sedimentary rocks deposited by braided and meandering streams. The basin is no longer a depocenter, and it was incised by the major glaciers of the Alaska Range. Gravity modeling indicates a 2,200-m maximum thickness of sediments in the basin. There were several pulses of deposition and deformation of the basin strata, and now the mean dip is 10Â° to the southeast. The basin formed during a time in which there was regional shortening as evidenced by the exhumation of Denali, but it also has a northeast-striking active normal fault within it. These seemingly contradictory observations of the formation of a basin concurrently with regional contraction and normal faulting are most consistent with the formation of the Peters Hills basin as a piggyback basin, which formed on top of a Neogene, southwest vergent, Broad Pass thrust fault. Movement along this thrust raised a ridge of Jurassic and Cretaceous rocks, which then trapped Miocene and Pliocene fluvial sediments behind it that were derived from the growing Alaska Range. The presence of a Broad Pass thrust fault is consistent with regional structural, stratigraphic, seismicity, gravity, and aeromagnetic data. Activity on the Broad Pass thrust would help explain the westward decrease in Quaternary slip rate along the Denali fault system, and if so, it would constitute a seismic hazard that could produce earthquakes in the M[sub]w[/sub]7.6-7.8 range.