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# Linking exhumation, paleo-relief, and rift formation to magmatic processes in the Western Snake River Plain, Idaho

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Southwest Idaho has experienced substantial topographic changes over the Cenozoic that are reflections of complex tectonic and mantle processes. The western Snake River Plain (WSRP) in southwest Idaho has been characterized as an intracontinental rift basin but differs markedly in topography and style from other western Cordilleran extensional structures. It also differs in orientation and structural style from the down warped lava plain of the eastern Snake River Plain that follows the path of the Yellowstone hotspot (YHS). Potential magmatic drivers for WSRP formation include the ~12-10 Ma Bruneau-Jarbidge eruptive center of the YHS or the ~17-16 Ma Columbia River Basalt (CRB) large igneous province. To better constrain the timing and style of rifting in the region we sampled granitoid bedrock from Cretaceous and Eocene-aged plutons from the flanks of the WSRP to detail their exhumation history with apatite (U-Th)/He (AHe) thermochronometry. We present new AHe dates from seventeen samples, with cooling dates ranging range from 7 Ma to 55 Ma. The majority of cooling dates for the Cretaceous plutons are Eocene, and the Eocene intrusions yield Miocene dates. The AHe dates provide thermochronological evidence of rapid cooling and exhumation of the Idaho batholith during the Eocene. This supports the presence a high relief landscape in Idaho associated with regional uplift due to Farallon slab rollback and Challis magmatism. We also find evidence for a post-Eocene decrease in relief, seen in the negative slope on date-elevation relationships in the southwest flank of the WSRP. Our AHe dates indicate limited exhumation on the flanks of the WSRP during Miocene rift formation. We interpret this to be evidence of extension dominated by magmatic intrusions and intrabasin faults rather than basin-bounding faults. Miocene AHe dates show rapid exhumation along the Middle Fork Boise River that had begun by ~17 Ma. We take this to indicate focused incision along the river due to base level fall in the WSRP and the timing suggests that CRB activity was responsible for initiation of WSRP formation