Public Abstract

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The location of the eastern margin of the Wyoming Archaean Province and its Proterozoic evolution are still debated. Previous studies have attributed north-south and east-west directed structures to the Proterozoic Black Hills and Central Plains orogenies, respectively, but the tectonic details of these orogenies are unclear. I have studied igneous rocks in the Laramide-age Hartville Uplift (HU), which exposed Precambrian rocks. At least part of the NNE-trending HU is bisected along its length by the Hartville Fault (HF) that juxtaposes high-grade metamorphic rocks on its eastern side against lower-grade metamorphic rocks on its western side. The objective is to use the geochemical features of the igneous rocks to infer the tectonic settings in which they formed.

The oldest dated magmatic rocks are 2.6 Ga Archaean Rawhide Buttes and Flattop Butte granites (SiO_2 > 67 wt%; K_2O /Na_2O wt% > 1; ASI > 1.05). They crop out only in the northern part of the HU and appear to be of crustal origin. The next magmatic episodes involved basaltic volcanism. They are represented by the Mother Featherlegs metabasalt on the eastern side of the HF and the Muskrat Canyon metabasalt on the western side. Compositions of these basalts are attributed to rifting and a mantle plume, respetively. The ages of the metabasalts are unknown, thus it is not certain if they are coeval. However, they may correspond to the ~2 Ga Kennedy dike swarm in the Laramie Range and amphibolites in the Black Hills that show similar extension and plume-related chemical characteristics.

In the southern HU, Proterozoic, 1.74 Ga Twin Hills diorite and Haystack Range granite crop out on the eastern side of the HF. The latter appears to be younger as its dikes cut the diorite. SiO_2 of ~55 wt % and K_2O /Na_2O ratios of < 1 suggest a lithospheric mantle origin for the Twin Hills diorite, whereas SiO_2 >69 wt %, K_2O/Na_2O > 1, and peraluminous composition indicate a crustal origin for the Haystack Range granite, specifically melting of schist that occur in the HU.

I suggest that the Archaean granitoids may be related to accretion along the Oregon Trail Structure in southern Wyoming. The region has subsequently undergone rifting, as shown by the basalt suites, possibly related to the breakup of the proto-continent Kenorland. The Twin Hills diorite and the Haystack Range granite appear to be related to westward subduction and collision (respectively) during the Black Hills-Dakotan collisional orogeny. Enigmatic migmatitic, tonalitic pods with an age of 1.715 Ga mark the latest deformation event that is attributed to the terminal collision of Wyoming and Superior cratonic provinces.