The Farmington Canyon Complex: Geochemical and Isotopic Constraints on the Evolution of the SW Laurentian Margin

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The Farmington Canyon Complex (FCC) of northeastern Utah is located along the southwestern margin of the Archean Wyoming province and comprises quartzofeldspathic gneisses and migmatites intercalated with amphibolites and metasedimentary rocks. U-Pb geochronology by ion probe indicates the FCC is the largest exposure of Early Paleoproterozoic crust along the southwestern Laurentian margin and is one of the few exposures of ~2.4 crust in the northern hemisphere. Geochemical and isotopic data indicate the metasupracrustal rocks of the FCC represent recycling of Wyoming Province Archean crust and mantle lithosphere. Detrital zircons found within a paragneiss yield U-Pb crystallization ages of ~2.4 Ga and metamorphic ages of ~1.7 Ga. Common Pb isotope data range from ~15.5-17.5 for 207/204 and ~17.6-27.5 for 206/204. These values plot well above the Pb evolution curve for continental crust indicating the protoliths of the metasedimentary rocks were derived predominantly from an Archean continental source, namely the Wyoming craton. The mafic rocks of the complex are characterized by HFSE depletion and Archean (2.9-3.8 Ga) Nd model ages and Late Archean-Early Paleoproterozoic crystallization ages therefore indicating the Archean mantle lithosphere was remobilized during the 2.4 Ga rifting event, but retained its initial Archean arc-like signature. In addition, the mafic rocks exhibit flat HREE patterns and negative Eu anomalies that are consistent with melting of a shallow lithospheric mantle in a rift environment. We interpret the FCC to have formed as a 2.4 Ga rift margin wherein Archean crust and mantle lithosphere were remobilized, but retained their distinct Archean geochemical and isotopic signatures. The igneous rocks and metasedimentary protoliths were then deformed together during the ~1.7 -1.8 Ga metamorphic event resulting from the accretion of Proterozoic and Archean blocks now to the west and southwest.

Future work will include constraining the complete cooling history of the FCC through use of both high temperature and low temperature thermochronology. By constraining the primary depositional and crystallization ages of these rocks in conjunction with their metamorphic and cooling histories, comparisons can be made with the tectonic histories of other Paleoproterozoic belts along the southwestern margin of Laurentia, like the Great Falls Tectonic Zone. In addition to characterizing the FCC, my research will also aid in the elucidation of the western extent of the Wyoming craton. This will be done by comparing the isotopic and geochemical characteristics of rocks found in western Utah and Idaho in the Albion, Grouse Creek, and Raft River Ranges to the Wyoming craton. These constraints are necessary to test models of possible Neoproterozoic conjugates, and to establish the piercing points critical to a more accurate reconstruction of Neoproterozoic global paleogeography, and the supercontinent Rodinia.