The significance of the Medicine Hat Block (southern Alberta, northern Montana) in the assembly of Laurentia: New interpretations from single grain zircon U-Pb and Lu-Hf data.

B. LADOUCEUR[1], J. GIFFORD[1], S. MALONE[2], B. DAVIS[3]

[1]Univeristy of Mississippi: boladouc@go.olemiss.edu
[2]Ball State University: sjmalone@bsu.edu
[3]Geological Survey of Canada: bill.davis@NRCan-RNCan.gc.ca

The Medicine Hat Block (MHB) is one of the core cratonic elements that amalgamated in the Paleoproterozoic to form Laurenia. However, unlike the other cratons, the role of the MHB in the formation of Laurentia is poorly constrained. Virtually all of the MHB is concealed by Proterozoic and younger supracrustal sequences, limiting data collection. The primary source of samples from the MHB comes from two sources: 1) xenoliths of variably metamorphoses gneisses, amphibolites, and meta-plutonic rocks collected from Eocene volcanic rock, and 2) similar lithologies recovered from boreholes that penetrate to the MHB basement. Recent zircon single-grain LA-ICPMS U-Pb ages revealed a range of Archean ages, 2.63 Ga to 3.27 Ga, and two samples yielding Paleoproterozoic ages at 1.78 and 1.82 Ga. In-situ zircon Hf isotopic results revealed that Archean-aged zircons are generally suprachondritic, with εHf_t values between 8.3 and -8.7. However, the Paleoproterozoic grains yielded negative εHf_t values ranging from -6.8 to -21.2, suggestive of a reworked Archean crustal component in their genesis. In particular, the Sweetgrass Hill xenolith suite is characterized solely by Paleoproterozoic ages, with evolved εHf_t suggesting that older U-Pb ages were reset by granulite facies metamorphism and zircon recrystallization. The combined U-Pb and Hf isotopic data from these samples helps illuminate the character of the MHB and its relationships to the Wyoming and Hearne cratons, as well as the Great Falls Tectonic Zone (GFTZ). The ages overlap between cratonic elements; however, the abundance of positive εHf_t values of the ~2.8 Ga ages suggests the MHB is distinct from the Wyoming Craton, and that the GFTZ must indeed be a collisional zone as proposed by others. Paleoproterozoic ages observed in the granulite xenolith samples supports this distinctness as well and supports models of a Paleoproterozoic underplating event observed in other xenoliths and in seismic sections.