The unique Wolverine HREE deposit, Browns Range area, Western Australia

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The Wolverine deposit is the largest of a number of REE ore bodies located in the Browns Range area of the Tanami region, Western Australia. These deposits collectively represent one of the worlds' richest sources of dysprosium and other critical HREE. The Wolverine deposit consists of xenotime [$(Y,REE)PO_4$] and minor florencite [$(REEAl_3(PO_4)_2(OH)_6$] mineralisation in hydrothermal lodes within massive arkosic sandstones. Small alkali granite and pegmatite bodies also intruded the sandstone in the region. Steeply dipping mineralisation is associated with silicification at major fault junctions, and occurs mostly as; 1) high grade, low tonnage lodes with large (>10m long and 1m wide) veins and chaotic breccias of massive, anhedral xenotime (±quartz, ±hematite, ±sericite), and; 2) low grade, probably higher tonnage disseminated mm-scale xenotime-quartz veins and crackle breccias in which xenotime grains occur in a number of morphological types, mainly blade-like and pyramidal overgrowth on pre-existing xenotime grains.

U-Pb dating and isotopic analysis of detrital zircon grains from arkose samples from across the district yielded a single age population of ~3.1 (±~0.1) Ga (corrected for lead loss), which is interpreted to be the maximum depositional age of the sandstones. This age is significantly older than the granitic rocks in the region (ca. 1.8 to 2.5 Ga), indicating that there is (previously unknown) Mesoarchean basement within the North Australian Craton. Highly unradiogenic Hf isotope data for these zircons combined with unradiogenic Nd isotope values for ore xenotime indicate that old (Early Archean or Hadean?) crustal components contributed to the formation of ~3.1 Ga basement rocks and potentially the xenotime ore bodies.

Work is ongoing to understand the temporal evolution of the deposit, the source of the REE (i.e., mantle versus old crustal) and the processes of transport and precipitation of HREE to form the deposit.