W-isotope evolution of the 4.02 to 3.4 Ga Acasta Gneiss Complex

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The ^{182}Hf-^{182}W decay system, with a half-life of ~9 Ma, has been used to investigate various differentiation and accretionary processes within our solar system. In particular, recent advances in high-precision W-isotope measurements have demonstrated excesses of ^{182}W in ancient terrestrial rocks relative to the modern accessible mantle [1, 2]. These ^{182}W excesses have been attributed to either the addition of a Late Veneer of meteoritic materials [1], lowering the ^{182}W/^{184}W of the silicate Earth to present-day values, or early Earth differentiation processes [2].

The Acasta Gneiss Complex (AGC) in the Northwest Territories, Canada, contain the world's oldest rocks directly dated using U-Pb geochronology [3-4]. Gabbroic to granitic gneisses within the AGC have crystallization ages from 4.03-3.4 Ga [5], an important time interval for the studying evolution of the early Earth. The complex field relationships within the AGC coupled with the large range of ages present makes it imperative to have good geological and geochronological control on samples used for any geochemical tracer work.

We present high-precision W-isotope data from homogeneous, well-documented gabbroic to granitic gneisses within the AGC with crystallization ages ranging from ~3.4 to 4.02 Ga. Initial data suggest these rocks have ^{182}W/^{184}W ratios deviating from the modern accessible mantle ratio by up to +16 ppm (0.16 ε units). We will discuss the secular evolution of the W-isotope anomaly, as well as correlations between measured anomalies and rock type, within the Acasta Gneiss Complex and their importance for understanding crust-forming processes on the early Earth.

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