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Banded Iron Formations – ancient proxies for the ^{182}W composition of the upper mantle and crust

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In recent years, the ^{182}Hf-^{182}W short-lived radiogenic isotope system ($t_{1/2}$=8.9 Ma) has increasingly been utilized to advance our understanding on the geodynamic evolution of planet Earth. Heterogeneities in μ^{182}W recorded in Hadean and Archean rocks have been interpreted to reflect Early Earth processes. Predominantly positive μ^{182}W anomalies in mantle-derived rocks from Archean cratons reflect the regional (mantle) source composition at the time of their emplacement. Homogenization of Earth's mantle over time, has largely resulted in the disappearance of W anomalies after the Archean. Diamictites, glacial deposits used as proxies for the upper continental crust (UCC) composition, have recently been measured to assess the average ^{182}W isotopic composition of large continental surface areas. However, diamictite samples likey reflect a regional rather than a global image of the average crustal ^{182}W isotope composition at the time of deposition.

Chemical surface weathering of continents and hydrothermal activity transports elements, including tungsten, into oceans. Assuming a conservative behavior of W in seawater, precipitates from Archean oceans, such as banded iron formations (BIF), thus, could reflect the isotope composition of the continental and hydrothermal W flux into ancient seawater. Hence, BIF may be used as proxies for the average ^{182}W composition of the W flux at the time of deposition.

Here, we have investigated samples from the 2.7 Ga old Temagami BIF of the <2.8 Ga old Abitibi Greenstone Belt. Analyses show positive μ^{182}W anomalies with μ^{182}W of up to +8 (the deviation of a sample from standards in ppm). Results from these ancient marine deposits suggest an average positive μ^{182}W composition of the W source to seawater by the end of the Archean.