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Early Archean chromitites from West Greenland: a combined Re-Os and Pt-Os study of ancient mantle melting events

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During partial melting in the mantle osmium behaves compatibly while rhenium is moderately incompatible, hence large melt depletion events in the mantle are recorded by the ^{187}Re-^{187}Os isotope system as rhenium-depletion model ages (T_{RD}) in refractory phases and lithologies. The peaked distribution of these ages has been shown to coincide with crustal U-Pb zircon ages, providing a record of periodic episodes of significant crustal growth over the last ~3 Ga. However, the frequency of T_{RD} ages preserved decreases with time. In order to detect older events it is necessary to analyse samples that were extracted from the mantle before younger events caused dilution or overprinting of these more ancient signals.

A chromitite-ultramafic layered body from the Ujaragssuit nunât area of western Greenland with a minimum age of 3.81 Ga (U-Pb zircon date from a cross-cutting tonalite dyke) provides an ideal target for this study. Peridotites (0.303 – 4.02 ppb Os) display PGE patterns typical of partial melt depletion, with low chondrite normalized PPGE and Re concentrations relative to the IPGE. Chromitites exhibit a gentle decrease in chondrite normalised PGE concentration with increasing incompatibility. Both lithologies show positive Ru anomalies combined with systematic Os/Ir ratios, likely suggesting the presence of laurite in the source region. T_{RD} ages for whole-rock peridotites and chromitites are artificially low (483 – 2926 Ma and 2666 – 3250 Ma respectively) and whole-rock model ages are unreliable. We will present a comparison of data from whole-rock samples, leached chromite separates and single grains of Os-bearing minerals. This combined approach will allow us to further constrain the history of the earliest Archean genesis of continental crust, providing information that has so far been inaccessible when considering only whole-rock Re-Os analyses. In addition to Re-Os and PGE data, we will present Pt-Os isotope data for the chromitites, providing the first direct dating of this ultramafic layered body, which hosts the oldest known chromitites in the world.