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Tracing Early Earth's Mafic Crust: Preliminary Insights from Detrital Chromites in Kaapvaal and North Atlantic Craton Metasedimentary Rocks.

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Understanding the formation and evolution of Earth's earliest crust remains a fundamental challenge in geology. Current models suggest that Earth's first crust was predominantly mafic, but direct evidence for this mafic protocrust remains elusive. We attempt to identify remnants of this protocrust through detrital chromites in Archaean sedimentary rocks. Unlike other mafic minerals, chromite, a robust and refractory mineral, may retain geochemical signatures indicative of its origins, even after sedimentary transport and metamorphism.

We study chromite grains separated from the ~3.3 Ga Green Sandstone Bed of the Barberton Greenstone Belt, Kaapvaal Craton, and from ~3.8 Ga rare detrital quartzite metasedimentary rocks of the Isua Supracrustal Belt, North Atlantic Craton. The Green Sandstone Bed represents a prime location to search for chromite derived from ancient mafic crust, as it hosts >4.0 Ga zircons[1] and abundant chromite. Likewise, the Isua detrital metasedimentary rocks, among the oldest known on Earth, contain detrital zircons up to 3.9 Ga[3].

We report major, trace, and preliminary platinum group element abundances, along with initial Re-Os isotopic data, for detrital chromites from the Barberton Greenstone Belt and Isua Supracrustal Belt. Preliminary analyses yield modal data with average Cr# of 0.65, 0.75 and 0.82 from the Barberton Greenstone Belt, with compositional groups aligning with those identified by Lowe et al[2]. These compositions do not match that of chromite in the surrounding komatiites, suggesting a distal origin[2], potentially outside the Barberton greenstone belt. We assess the effects of metamorphism on chromite compositions, identify distinct compositional groups, and discuss possible mafic protocrust-derived chromite in our samples.

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