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Changing mafic sources of Archean clastic sediment in the Red Lake Greenstone belt, Superior craton? Insights from detrital chromites

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The scarcity of Hadean and early Archaean rocks limits our understanding of early Earth geodynamics. Zircons, being the sole representative of the oldest rocks on Earth, retain durable records of their chemical and isotopic characteristics, providing valuable insights into the history of their parent rocks' formation. However, they cannot directly detect the addition or presence of mafic crust, unless this crust is reworked into zircon-bearing felsic compositions. By contrast, chromite is a ubiquitous early crystallizing mineral phase in mafic and ultramafic magmas, which records essential petrogenetic information about the composition of its parental magma. Therefore, detrital chromites may serve as valuable indicators for examining the petrogenesis of eroded Archaean mafic and ultramafic crust. Dating these detrital chromites using Re-Os isotope systematics can potentially identify juvenile crust formation events that are not preserved in bedrock exposures or the zircon records.

We present preliminary petrographic and geochemical studies of detrital chromites from a 270 m core section of fuchsitic quartzite from the Red Lake Greenstone Belt, Uchi Subprovince, western Superior Craton [1]. We aim to trace chromite chemistry at different stratigraphic levels within the core to investigate changes in provenance over time. Detrital chromites are distributed mostly in bands, but also as disseminated grains, with both rounded and subhedral morphologies. Preliminary data yield moderate ZnO (up to 1.4 wt%) and high MnO (up to 2.5 wt%) coupled with low Mg# (typically $\leq$ 25). Most analyses show TiO_2 > 0.3 wt%. The Cr# of the chromites ranges from 59-84, suggesting a range of mafic or ultramafic protoliths.

[1] Afroz et al., 2023. PR, 388, 106996.