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Repeated melting of Archean crust: new evidence of the progressive differentiation of the Zimbabwe Craton

LOT KOOPMANS[1], BRIAN MAPINGERE[2], RICHARD MARK PALIN[1], ANTONY MAMUSE[3], DR. NICHOLAS J GARDINER[4], KYLE LARSON[5], BRENDAN DYCK[5] AND LAURENCE J ROBB[6]

[1]University of Oxford
[2]Anglo American
[3]Midlands State University
[4]University of St Andrews
[5]University of British Columbia Okanagan
[6]University of the Witwatersrand

Presenting Author: lot.koopmans@earth.ox.ac.uk

The secular evolution of Earth's continental crust is marked by a distinct change in architecture and composition between 3.2 and 2.5 Ga, which likely reflect changes in the prevailing geological processes responsible for its formation and differentiation. Previous work has shown that the evolution of many cratons worldwide follows a consistent pattern of extended (0.2–0.5 Ga) sodic TTG magma emplacement preceding a relatively short (0.02–0.15 Ga) period of more potassic granitoid magma emplacement [1]. Perhaps unsurprisingly, the timing of this transition varies between every studied craton, and exactly how and what drives this transition is debated.

Associated with this transitional period is the dramatic increase in the abundance of lithium-caesium-tantalum (LCT) pegmatites in the geological record. LCT pegmatites require input of recycled surface material into the melting region to produce the required chemical compositions, and therefore potentially provide a unique opportunity to further resolve the mechanisms presiding over global geochemical changes.

Here we present new field, geochemical, and geochronological data from several sites within the Zimbabwe Craton. Field evidence identifies at least three melting events that affected the lower crust, which are preserved as deep-seated anatectic regions and their upper-crustal plutonic equivalents. Notably, the craton preserves an early 3.4 Ga event where more evolved granitic compositions intrude Eoarchean basement, before 'standard' sodic TTG magmatism resumes. Spread throughout the craton are several occurrences of LCT pegmatites, which have recently been dated to c. 2.7–2.6 Ga (this study), right in between the craton-wide transition from TTGs to sanukitoids and potassic granites [2]. Exactly how these intrusions fit into the cratonic framework remains to be seen. To tackle this, we assess the geochemical evolution of each melt event identified in the lower crust, tie them to the larger intrusions preserved in upper crustal regions, and provide a preliminary assessment of the mechanisms driving the different differentiation episodes in the Zimbabwe craton.

[1] Laurent, et al. (2014) *Lithos* 205, 208–35.

[2] Jelsma, et al. (2021) *South African Journal of Geology* 124 (1), 279–310.