

Coeval stagnant- and mobile-lid tectonic regimes in the Eoarchean

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On Earth, the details of early tectonic settings have been obscured by billions of years of crustal destruction, burial, and recycling. In the Phanerozoic, covariation of trace elements (e.g. U, Nb, Sc, Yb, Gd, and Ce) in zircon has been shown to reflect tectonic setting [1] —specifically ridge, plume, and arc environments. In the Eoarchean, deciphering tectonic settings with these trace-element discriminators has been limited to the detrital zircon record [2,3]. We present zircon trace-element and oxygen isotope compositions for cogenetic populations of zircons from crystalline crustal rocks of the ~4.0-3.3 Ga Acasta Gneiss Complex and the ~3.9-2.7 Ga Saglek-Hebron Complex, Canada. When integrated with bulk-rock geochemistry and zircon U-Pb, Hf, and O isotopes [4-7], zircon trace-element trends reveal that melting of hydrated basalt was operative through the duration of magmatism in these two localities. This includes the reworking of Hadean protocrust as well as the generation of juvenile crust, potentially requiring the simultaneous operation of stagnant- and mobile-lid regimes.

[1] Grimes *et al.*, *CMP* **170**, 1–26 (2015). [2] Drabon *et al.*, *AGU Advances* **3**, e2021AV000520 (2022). [3] Valley *et al.*, *Goldschmidt 2023 Conference*. [4] Wasilewski *et al.*, *Precambrian Research*, **359**, 106092 (2021). [5] Mixon *et al.*, *EPSL*, **624**, 118443 (2023). [6] Bauer *et al.*, *EPSL*, **458**, 37-48 (2017). [7] Bauer, *Doctoral dissertation*, MIT (2017).