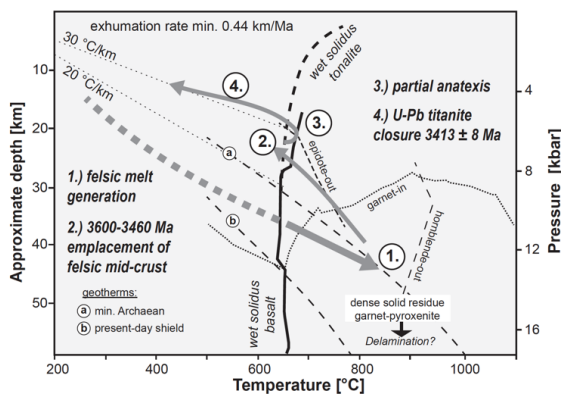


## Earth's oldest stable crust formed by cyclic gravitational overturns

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The tectonic-petrologic history of ancient rocks from a granite dome to greenstone keel transect in the East Pilbara Terrane (EPT) is unveiled. Combining previous structural field data [1] with new geochronological, geochemical, and petrological constraints, we demonstrate the presence of an early 'rock cycle'. Our data indicates the formation of ~3.60-3.46 billion-year-old (Ga) felsic proto-crust from a mafic precursor and its exhumation during gravitationally-driven overturn until ~3.41 Ga (Figure 1). These data provide insights into the geodynamics of Earth during a time when mantle potential temperatures probably reached peak values [2].



**Figure 1:** Inferred pressure-temperature-time path for felsic proto-crust formation and its exhumation during gravitational overturn.

Integrating previous data from the EPT and other Archaean terranes, a model of early crustal stabilization is proposed, in which successive gravitational overturns follow at ~0.10 Ga cycles. Progressive dome-and-keel development is linked to crustal stabilization and the onset of plate tectonic processes at ~3.20-3.00 Ga [3,4].

[1] Wiemer *et al.* (2016) *Prec. Res.* **282**, 121-138. [2] Korenaga (2013) *Annu. Rev. Earth Planet. Sci.* **41**, 117-151. [3] Van Kranendonk *et al.* (2010) *Prec. Res.* **177**, 145-161. [4] Dhuime *et al.* (2012) *Science* **335**, 1334-1336.