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# Crustal growth and UHT metamorphism during Precambrian collision orogeny: results of petrothermomechanical modeling

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The restricted geological record on the crust-forming processes during Earth's early history provides a controversy on how and when continental crust was formed. Geological and geochronological records indicate that considerable volumes of juvenile continental crust were produced (or preserved) episodically in the Paleoproterozoic (~1.9 Gyrs) and Neoachean (~2.7 Gyrs) that coincides in time with amalgamation of oldest supercontinents [1]. If so, subduction (closure of oceans between the continents) followed by collision are supposed to set up mechanism(s) for efficient crustal growth.

Using a 2D coupled petrothermomechanical numerical model [1] with mantle temperatures 150°C higher than the modern temperature we show that collision between two crustal lithospheric blocks during forced convergence creates orogenic scale thick continental crust with temperatures 700-1100°C at the bottom within a timescale of tens of millions of years. We show that the ultra-hot orogen extends with plate tectonic rates towards the incoming lithospheric block owing to delamination of lithospheric mantle with attached lower crust, retreat of the delaminated subducting slab, and invasion of the hot asthenospheric front. Flood basalts/komatiites at the crust surface mimic the lateral motion of the asthenospheric front. The modeled Precambrian collisional orogeny provides net crustal growth and creates new continental crust with a large variety of rock types, including newly formed metabasic and metasedimentary rock, disintegrated blocks of the earlier crust, and products of partial melting.

The proposed delamination-driven model for a Precambrian collisional orogeny can accurately be applied to explain generation of a thick crust with strong granite-greenstone terranes affinities, ultrahigh temperature (UHT) granulites and formation of tonalite-trondjemite-granodiorite (TTG) series.

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