Goldschmidt 2023 Abstract
https://doi.org/10.7185/gold2023.19749

Continent emergence hindered by suppressed topography on early Earth - *F.G. Houtermans Medal Lecture*

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Earth owes much of its dynamic surface environment to its bimodal hypsometry, manifested by continents which ride high and ocean basins which ride low. Earth's long-wavelength topography is primarily controlled by isostasy, and thus elevation variations are controlled by lateral differences in crustal thickness and density. The continental crust is much thicker than the oceanic crust, which is key to maintaining its high elevations of up to > 8 km above the seafloor. However, there is a limit to how high elevations can rise by crustal thickening. When crustal thickness exceeds 50-60 km, the mafic lower crust undergoes a phase transition to eclogite, which, because of its high density, will result in root pull and arrest further elevation gain. The root pull effect is clearly seen in the Andes and consistent with our phase equilibria modeling results. On early Earth, the oceanic crust was probably much thicker due to higher mantle melting degrees. Because of this thick oceanic crust and the formation of dense continental roots, the maximum elevation contrast between the Archean continents and seafloor may have been < 4 km, less than half that of the present-day. Unless the oceans were significantly less voluminous, the diminished elevation contrast between ocean basins and continents would inevitably lead to a water-world planet on which much of the continents existed as submerged plateaus.