Understanding Continental Freeboard in the Phanerozoic

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The average elevation of the continents relative to sea level, known as continental freeboard, is tied to a wide range of geophysical and geochemical parameters of interest – including the temperature of the mantle. Estimates of continental inundation derived from the proportion of continental area covered by marine sediments provide a remarkably direct and apparently reproducible proxy for continental freeboard throughout the Phanerozoic. However, if taken at face value, such inundation-derived records would appear to conflict with the relatively slow secular cooling of the mantle suggested by geochemical estimates of mantle potential temperature. Further difficulties for a primarily mantle-driven model are presented by the conflict between hyposmetric evidence for erosionally-limited freeboard today and the sedimentary evidence for dramatic continental inundation (i.e., substantially negative freeboard relative to the present) only several hundred million years ago. Here we consider a model that would avoid the difficulties of driving Phanerozoic freeboard trends by mantle cooling alone, and unite the Phanerozoic inundation curve with emerging physical, geochemical, and thermochronometric evidence for widespread Neoproterozoic continental erosion and exhumation.