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Global-scale emergence of continental crust during Mesoarchean - early Neoarchean

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The timing of the emergence of subaerial landmasses is equivocally constrained as post-Archean, and continues to be a much-debated issue. In this study, we document exceptionally ^{18}O depleted ($\delta^{18}O$ < 4.7 ‰) Meso- to early Neoarchean magmatism in India that shows a similarity with coeval low $\delta^{18}O$ magmatism reported from Australia, South America, and North China. Such global-scale generation of low $\delta^{18}O$ magmas would require high-temperature meteoric water-rock interaction in the uppermost crust, synchronous with magma generation, and necessitating the emergence of a substantial volume of the continental crust. The timing of this low $\delta^{18}O$ magmatism coincides with the development of extensive, subaerial, Large Igneous Provinces, a downward shift in $\delta^{18}O$ and $\delta^{17}O$ values in shales, the rise of normalized $^{87}Sr/^{86}Sr$ in seawater, and an intermittent upsurge in the quantum of atmospheric oxygen. We propose that the initial emergence of substantial volumes of continental crust occurred at ~3.2 Ga and peaked at 2.8-2.6 Ga, facilitating the generation of globally distributed, low $\delta^{18}O$ magmas, and the event can be linked to the first appearance of atmospheric oxygen.