**Earth’s Early Evolution: A felsic crustal composition during the Hadean**

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The National Research Council identified Exploring Earth’s “Dark Ages” (the first 500 Myr) as one of the fundamental questions driving the geological and planetary sciences. Due to Earth’s constant resurfacing, any early crust presence has inevitably been recycled during the Hadean, leaving no trace of information regarding its composition or abundance. Although modern continental crust formation tends to be associated with plate tectonics, a different mechanism is required to produce an evolved crust in the absence of a plate tectonic regime. One such possible mechanism on early Earth is the processing of the surface through impact melting. Utilizing the Sudbury Igneous Complex geochemistry, we notice a clear evolution throughout the fractionated impact melt sheet in wt.% SiO₂ and Sr and Nd isotopic ratios. Using Sudbury as a proxy of how impactors process the early Earth, we model multiple impact events on a primitive mantle to illustrate how impacts can evolve crustal compositions early in Earth’s history before the likely onset of plate tectonics. The IMPaCS, or Impact Melt Partitioning and Compositional Stratification, equation (Eq. 1) defines the evolution of an impact melt as a function of impactor diameter and target composition. From applying a fractionation factor identified from the Sudbury impact and primitive mantle wt.% SiO₂ and initial ⁸⁷Sr/⁸⁶Sr ratio, we find that it is possible to create average continental crustal compositions of 60 wt.% SiO₂, and ⁸⁷Sr/⁸⁶Sr of 0.72 after just a few impacts (Fig. 1). This model illustrates the creation of a relatively thin (~few km’s) layer of evolved crust, but not the crystallization of Hadean zircon, which suggest deeper depths of formation. Employing a dynamic geospatial model of IMPaCS, using the size-frequency distribution of impacts scaled from the lunar surface, we estimate the volume and abundance of this enriched crust on Earth’s surface during the Hadean to determine how rapidly it evolved. Our results suggest the inevitable presence of evolved crustal compositions near Earth’s surface early in the Hadean and possibly a contributing factor into the eventual onset of plate tectonics and possibly providing the ingredients necessary for the origin of life.