

Lunar Impact History as Control on the Hadean Eon

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The Moon records impact activity during the Hadean Eon on Earth after a lunar crust formed ~4.52 billion years ago, after which 300 million years of saturation cratering (60-70 km diameter) of the lunar crust occurred. On Earth, the effects of this intense cratering dominated the early Hadean. Development of a terrestrial mega-regolith, rich in glass and pulverized mineral debris, made clays the dominant mineral species in water-rich environments, ideal environments for the development of complex organic precursors. During that same period, a few very large basins formed on the Moon. The far-side basin South Pole-Aitken (~2500 km in diameter) constitutes the youngest, but evidence exists for at least four other older basins of comparable or greater size, including the ~3200km diameter Procellarum Basin. The age of South Pole-Aitken is estimated to be about 4.2 billion years. That age separates two, inner solar system eras of great importance and contrast. Prior to that time, in addition to saturation cratering and clay dominated sedimentary environments, seeds of the first continents may have formed by fractional crystallization of thick, water-rich impact-melt sheets. Crystallization dates for detrital zircon from ancient basin sediments in Australia at 4.4 billion years of age, and evidence of their formation in the presence of water, strongly support this conclusion. After ~4.2 billion years, saturation cratering and formation of very large basins ceased and a second period of large basin impacts began, forming >50 large basins (300-1000 km diameter) before lunar mare basalts began erupting 3.85 billion years ago.