Glimpsing Hadean Earth

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The ubiquity of origin myths suggests that our species has an innate need to explain how Earth formed and came to its present state. Myth fabrication appears controlled by the technological capacity of the culture in question and the limitations of the available historical record. Despite our impressive technology and a western cultural bias to watery origins, when the scientific community encountered the limits of its historical record – there are no known rocks older than 4 Ga – it chose the paradigm of an early, desiccated, continent-free wasteland in which surface petrogenesis was largely due to bollide impact into a basaltic substrate. But the story emerging from geochemical investigations of >4 Ga Jack Hills zircons is of their formation in near-H_2O saturated meta- and peraluminous magmas under relatively low (15-30°C/km) geotherms. These data are interpreted as reflecting chemical weathering and sediment cycling in the presence of both liquid water and plate boundary interactions shortly after Earth accretion. Given that life could not have emerged until water appeared at or near the Earth's surface, a significant implication is that our planet may have been habitable as much as 500 Ma earlier than previously thought. Indeed, recent C isotopic evidence obtained from Hadean zircon inclusions is consistent with life having emerged by 4.1 Ga, or ~200 Ma earlier that the hypothesized lunar cataclysm. Perhaps the most remarkable feature of the above observations is that none were predicted from theory. Rather, generations of models, essentially innocent of observational constraints, fed the longstanding paradigm. What compelled the scientific community to develop its own origin myth of a hellish beginning in the absence of direct evidence? While science is clearly distinguished from mythology by its emphasis on verification, its practitioners may be as subject to the same existential need for explanations as any primitive society. Perhaps the most constructive act we could now undertake is to expand the search for Hadean zircons in Archean quartzites and orthogneisses. It once seemed inconceivable that we might find terrestrial fragments as old as 4.1 Ga but we now know of 5 locations on the planet with zircons this old or older. Concerns that the Jack Hills zircon record may be unrepresentative of Hadean Earth would be transcended by discovery of many geographically dispersed sites that simply await our commitment to their exploration.