

HADEAN EVOLUTIONAL HISTORY OF ROCKY PLANET IN SOLAR SYSTEM

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Planetary formation theory based on meteorites and numerical simulation model is now entering a phase of major change, due to the discovery of hot Jupiter and super-Earth through exploration of exo-solar planets. The problem is typically seen in two extremes that is classic Kyoto model and Grand Tack Model. The key to advance from current level of debates to next stage is to conduct systematic material science including sample return missions from asteroid belt. To proceed it, I review previous researches for asteroid belt, and summarize the origin of the Earth, early evolution, and whole Earth history. Based on those reviews, I define next targets of the research as follows. 1) To confirm the chemical zoning of asteroid belt (2-5AU) from most inner part to outer part, and reveal the cause of chemical zoning. 2) To reveal the material differentiation to form a parental body of meteorite and the time to spend for it. 3) Surface geology and chronology of Moon and Mars, particularly the age of solidification and late heavy bombardment. 4) Early evolution of the Earth and its surface environment based on above three, particularly the reconstruction of Hadean Earth.

For next step, I suggest to verify currently provided formation theory of proto-solar system during Hadean time, based on above 4 researches. Details are as follows. 1) Earth-Moon system was formed from enstatite chondrite-like materials at 4,567Ma, which did not have atmospheric nor oceanic component. 2) Giant Impact event occurred around 4.4Ga, but inner core of the Earth did not melt. Moon was solidified by 4.3Ga. 3) Magma ocean of Moon and Earth was solidified by approximately 4.34Ga. At around 4.3Ga, the late heavy bombardment reached a peak. This event gave both atmosphere and ocean on the Earth. 4km thick ocean triggered the operation of plate tectonics since 4.266Ga and tectonic erosion to carry primordial continent into deep mantle. By 4.1Ga, first life was born through 3 steps.

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