

Experimental study of hypervelocity impact of meteoritic material into liquid water in an open system for better understanding of the fate of extraterrestrial organics in the Hadean ocean

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Unravelling the origin(s) of prebiotic organic materials that constituted protocells on the early earth is important to constrain the conditions for the emergence of life and the chemical diversity of life in the universe. One proposes that biologically relevant organic materials were mostly produced through atmospheric chemistry and mineral-water interactions from simple compounds (N_2 , CO_2 , CO , CH_4) available in the early earth, whereas the other proposes that a significant amount of extraterrestrial organic materials, that were produced in the early solar system, protoplanetary disk, and molecular clouds, were delivered to the early earth and served as key components of protocells. If the latter hypothesis is correct, most of the extraterrestrial organic materials in meteorite should have been survived from thermal decomposition during hypervelocity impact into the Hadean ocean (>3 km/s), because geological evidences suggest that the ocean was already present but the continent was almost absent in the Hadean earth. However, the fate of extraterrestrial organic materials during oceanic impact is poorly understood due to the lack of experimental knowledge about the physicochemical processes associated with the hypervelocity impact of meteorite into liquid water. For better understanding of the physicochemical processes associated with the hypervelocity impact of meteorite into liquid water and the fate of impactor, we have newly establish a methodology of experimental impact in an open system that can simulate the Pressure-Temperature path of oceanic impact most faithfully. In this meeting, we report experimental results that polycarbonate and stainless steel projectiles impacted into liquid water at a velocity of 4-6 km/sec.

Keywords: hypervelocity impact, hadean ocean, meteorite