

Hypervelocity impact experiments to simulate chondrite fragmentation on the early ocean and implication for the fate of meteoritic organics

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Unravelling the origin(s) of prebiotic organic materials that constituted protocells is important to constrain the conditions for the chemical evolution and the emergence of life in early earth and possibly in the other aqua planets. 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, it is considered that most of the meteoritic organic materials was survived from mineralization during hypervelocity impact into the early ocean. However, the fate of meteoritic 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. In particular, meteorite fragmentation during the oceanic impact is key to understand physicochemical conditions that meteoritic organics undergone. To better understand the meteorite fragmentation on the early ocean, hypervelocity impact experiments in an open system were performed by using chondrite projectiles. Experiments with stainless-steel and polycarbonate projectiles were also performed and compared the results of chondrite-water impact to identify main factors controlling the meteorite fragmentation.

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