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First Recovery of Micrometeorites from K-Pg Boundary: Unveiling the Role of Cosmic Dust in Mass Extinction

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Extraterrestrial material has played a significant role in geological, environmental, and life-related processes since Earth's formation. Every year, Earth receives tons of extraterrestrial material, primarily in the form of micrometeorites (cosmic dust ranging from 10 μm to 2 mm), with an estimated annual contribution of ~40,000 tons [1]. The flux of cosmic dust has varied considerably throughout Earth's history and is believed to be directly proportional to extraterrestrial activity in interplanetary space. The K-Pg boundary, marking one of the largest mass extinction events, contains ~70% of the total extraterrestrial material from the Phanerozoic era, signifying a period of increased extraterrestrial activity [2]. This study reports the first discovery of micrometeorites in Deccan intertrappean sediments, ranging in age from ~67 Ma to 64 Ma [3]. These spherules exhibit remarkable preservation of both S-type (silicate-dominated) and Fe-Ni spherules, along with Fe spherules, indicating favourable conditions created by a non-marine environment, rapid deposition, and exceptional climatic conditions. Additionally, the presence of impact spherules with close resemblance to Chicxulub impact spherules suggests a K-Pg boundary within the sampled intertrappean layer. The carbonaceous chondritic nature of the discovered micrometeorites aligns with the Chicxulub impactor, implying an active collisional period for the carbonaceous chondrite family. The inherent fragility of carbonaceous chondrites could have contributed to increased dust production in interplanetary space, leading to an elevated cosmic dust flux towards Earth. The elevated cosmic dust flux, combined with an already enhanced concentration of dust from Deccan volcanism and the Chicxulub impact, could have further exacerbated the hostile conditions at the K-Pg boundary. Furthermore, the increased concentration of micrometeorites, containing significant amounts of bioavailable iron [4], might have played a significant role in the rapid recovery of life after the extinction event by providing essential nutrients.

References:

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