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The Chicxulub impact at the K-Pg boundary – search for traces of the projectile

A. Deutsch
Institut für Planetologie, Münster, Germany (deutsca@uni-muenster.de, 0251-833 6031)

One of the most interesting problems in the context of the end-Cretaceous Chicxulub impact is the question after the whererabouts of the main mass of the projectile. The nature of this >10 km-sized Chicxulub projectile was constrained by an anomaly in the chromium isotope 54 in the K-Pg deposit at Stevens Klint, Denmark, to a carbonaceous chondrite of type CM2 [1]. About 1.5 % of the estimated mass of the projectile has been detected world-wide in the K-Pg boundary layer; mainly in the form of platinum group elements (PGE) as well as other siderophile elements (Ni, Co ...). A contamination by or even a major contribution of other "projectile" elements to the K-Pg event bed was rarely proposed. The few examples in the literature (cf. compilation in [2, 3]) used rare earth elements (REE) distribution patterns that are slightly inconsistent with REE patterns typical for the upper continental crust (UCC). Ejecta consisting of UCC target rocks is expected to form the overwhelming mass of the ejecta. In most K-Pg layers, however, the ejecta is diluted or even totally masked by a component of more local origin and with features of high-energy deposition mechanisms. Numerical models [4] indicate a deposition of >500km^3 projectile material, corresponding to >2 x 10exp9 tons of mainly silica, iron, and magnesium in the K-Pg event bed. Detecting the "meteoritic" origin of these major elements, however, in a matrix of siliceous detritus, is practically impossible.
Recent LA-ICP-MS analyses show that siliceous impact spherules – hydrated glass or altered to chlorite – in the Chicxulub event bed at various locations (e.g., Shell Creek, La Lajilla, La Popa) have REE patterns that are flat and un-fractionated, corresponding quite well to a typical CI-pattern. The REE abundances are chondritic to sub-chondritic. Mixing calculations indicate that the maximum REE contribution of UCC material to the REE budget of these spherules is on the order of 2 %, but usually much less. These flat REE patterns cannot originate from any known alteration process; they truly reflect a "meteoritic" component in the spherules. Accepting this fact, a certain amount of the siliceous host material (i.e. the spherules) must consist also of projectile material. Depending on the sampling site, the spherules with the flat REE distribution patterns amount to between 10 and ∼70 vol% of the Chicxulub event bed. The widespread occurrence of this projectile matter in the K-Pg event bed reconciles observations with impact models [4].

Ref.
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[4] Artemieva N. and Morgan J. (2009) Icarus 201, 768-780.