THE CRETACEOUS-PALEOGENE BOUNDARY CLAY BEDS IN THE WORLD OCEANS: EVIDENCE FOR THE GLOBAL ACIDIFICATION OF OCEAN SURFACE

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The Cretaceous-Paleogene boundary (KPB) represents one of the most dramatic turnovers in the fossil record for marine calcareous plankton (mainly coccolithophores and foraminifera) that formed calcite deposits that gave the Cretaceous name. In the world oceans more than 90 % of calcareous plankton was extinguished at that boundary; this mass extinction appears to have been sudden and inevitably led to the catastrophic collapse of the whole oceanic life.

The KPB sections of the deep- and shallow-marine settings throughout the world are characterized by a relatively thick biogenic calcite depleted/clay-rich interval, so-called the boundary clay. Various paleontological, mineralogical and geochemical data as well geological data all apparently support a genetic relationship between the deposition of this clay and the asteroidal impact at Chicxulub (Yucatan Peninsula, Mexico).

Because the impact target at Chicxulub is a predominantly carbonate-rich marine sedimentary rock combined with some minor sedimentary anhydrite (calcium sulfate), an immense amount of acid-forming gas CO_2 was instantaneously released into the atmosphere accompanied with lesser amount of another acid-forming gas SO_2. According to theory, the massive amount of impact-derived atmospheric CO_2 would accumulate globally in ocean surface, since this gas enters ocean water by air-ocean exchange. The net geochemical effect of this accumulation would be a decrease of the ocean surface pH (leading to an “acidification”) and $CaCO_3$ saturation state, causing primarily a large decline in $CaCO_3$ precipitation induced by calcareous plankton. In my opinion, the excessive impact-generated CO_2 in the atmosphere was perhaps a critical factor in forming the boundary clays at deep- and shallow-marine sites worldwide. If this is a true, then experimental data and observations would indicate that the impact-released CO_2 accompanied by the acidification of ocean surface/$CaCO_3$ undersaturation lasted only a few decades at most.

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