

The K–PG boundary: how geological events lead to collapse of marine primary producers

Le Hir guillaume (1), Fluteau frederic (2), and Godd eris yves (3)

(1) Paris VII - Denis Diderot, Institut de Physique du Globe de Paris, France (lehir@ipgp.fr), (2) Institut de Physique du Globe de Paris, France, (3) G eosciences Environnement Toulouse, CNRS-Universit  Paul Sabatier, Toulouse, France

The cause(s) of Cretaceous/Paleogene (K–Pg) mass extinction event is a matter of debate since three decades. A first scenario connects the K–Pg crisis with the Chicxulub impact while the second scenario evokes the emplacement of the Deccan traps in India as the cause for the K–Pg biodiversity collapse. Pierazzo et al. (1998) estimated that the extraterrestrial bolide lead to an instantaneously CO₂ degassing ranging from 880 Gt to 2,960 Gt into the atmosphere, together with a massive release of SO₂ ranging from 150 to 460 Gt.. Self et al. (2006, 2008) and Chenet et al. (2009) suggested that the emplacement of the Deccan traps released 15,000 Gt to 35,000 Gt of CO₂ and 6,800 Gt to 17,000 Gt of SO₂ over a 250 kyr-long period (Schoene et al., 2015). To decipher and quantify the long term environmental consequences of both events, we tested different scenarios: a pulse-like magmatic degassing, a bolide impact, and a combination of both. To understand the environmental changes and quantify biodiversity responses, we improve GEOCLIM, a coupled climate-carbon numerical model, by implementing a biodiversity model in which marine species are described by specific death/born rates, sensitivity to abiotic factors (temperature, pH, dissolved O₂, calcite saturation state) and feeding relationships, each of these characteristics is assigned randomly. Preliminary simulations accounting for the eruption of the Deccan traps show that successive cooling events (S-aerosols effect) combined with a progressive acidification of surface water (caused by CO₂ and SO₂ injections) cause a major collapse of the marine biomass. Additional simulations in which Chicxulub impact, different community structures of primary producers will be discussed.