Updating the theories on ammonoid extinction

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Since Alvarez *et al.* (1980) found new evidence for the impact of catastrophic events on earth's biota, hypothesis and theories explaining the fossil record (re)gained a lot of attention. The extraterrestrial origin of the anomalous iridium concentrations seemed highly controversial at first, but nowadays the Chicxulub 'accident' has become the marker for the start/base of the Paleogene. Its pivotal role in the Mesozoic-Cenozoic faunal turnover cannot be refuted (Schulte et al 2010). However, alternative theories remain being published. Of these, the Deccan volcanism with its widespread flood basalts stepped prominently forward as one of the main triggers, especially when trying to explain the gradual diversity decline within the fossil record.

The inconsistencies between the proposed theories generally root in too narrowly geographically and geologically spread datasets. This applies to most fossil groups, and especially to the ammonoids (Class Cephalopoda, °Early Devonian – †Late Cretaceous). A compilation of ammonoid occurrences of Late Maastrichtian age published by Kiessling & Claeys (2002) evidenced the lack of a globally well distributed dataset. In this compilation, North Africa was left as a blind spot, while Tunisia had been the centre of the K/Pg mass extinction debate for almost three decades, e.g. with the definition of the GSSP for the base of the Paleogene at El Kef.

Both at the GSSP and several other sections in the Tunisian Trough Basin, ammonoids were found within the topmost meters of the Maastrichtian, until very close to the K/Pg boundary level. About 900 uppermost Maastrichtian ammonoids were collected, all from within the last 420.000 years of the Cretaceous. With 22 species on record, belonging to 18 genera and 10 families, and with representatives of each of the four large ammonoid suborders (Phylloceratina, Lytoceratina, Ammonitina and Ancyloceratina), the Tunisian fauna demonstrates that ammonoids were both taxonomically and morphologically diverse until their very end. An updated version of the compilation of latest Maastrichtian ammonoid occurrences documents at least 53 species, 29 genera and 13 families in the ultimate half million year of the Cretaceous, in many more localities and occurring in a wide variety of settings.

When the Tunisian ammonoid species richness data are plotted next to all time constraints of the possible causes, the possibility of Deccan flood basalt volcanism negatively influencing ammonoid diversity must be refuted. A major extinction caused by the Chicxulub impact seems the most plausible theory at present. Through inducing a mass kill of the marine plankton, the juvenile ammonoids lost their primary food source leading to their final extinction.

Alvarez L.W., Alvarez W., Asaro F., Michel H.V. (1980). *Extraterrestrial cause for the Cretaceous-Tertiary extinction*. Science, Volume 208, n°4448, pp 1095-1108.

Kiessling W., Claeys P. (2002). *A geographic database approach to the KT Boundary. In:* Buffetaut E., Koeberl C. (eds). *Geological and Biological Effects of Impact Events*, Springer-Verlag Berlin, pp 83-140.

Schulte P. & 40 authors (2010). *The Chicxulub Asteroid Impact and Mass Extinction at the Cretaceous-Paleogene Boundary*. Science, Volume 327, n°5970, pp 1214-1218.