Updating the theories on ammonoid extinction

The extinction of the ammonoids (Class Cephalopoda, °Early Devonian – †Late Cretaceous has puzzled scientists for many decades. After being very successful for many millions of years, and having survived many crises, they disappear from the fossil record near the end of the Cretaceous. Over time, a large number of (conflicting) theories have been put forward, relating the extinction to a large number of possible causes and triggers. Of them, sea-level change, the Chicxulub impact, of which the split second nowadays officially defines the Cretaceous/Paleogene (K/Pg) boundary, and Deccan volcanism are amongst the most cited ones.

The inconsistencies between the proposed theories generally root in too narrowly geographically and geologically spread datasets. When delineating possible cause and effect, it is necessary to first properly review the timing and weight of all the happenings. This applies to most fossil groups, and especially to the ammonoids. To demonstrate, before the publication of the seminal paper of Alvarez et al. (1980), almost no ammonoid was known to occur near the K/Pg boundary, while today, due to the efforts of many workers, we know of at least 57 species and 31 genera in the ultimate half million year of the Cretaceous, occurring in 29 localities spread across the globe and documenting a wide variety of ecological settings (Landman et al 2014, 2015).

Several of these localities locate in Tunisia. 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 (Goolaerts et al. 2004, 2010).

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 triggered by the environmental perturbations in the immediate aftermath of 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. However, this does not explain how, in some areas, like the type Maastrichtian (Belgium-The Netherlands), Denmark and New Jersey, a number of ammonoids seemed able to shortly survive into the Paleogene.

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