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Micropalaeontological Response to Cretaceous Oceanic Anoxic Events (Jean Baptiste Lamarck Medal Lecture)

Malcolm B. Hart

chool of Geography, Earth & Environmental Sciences, University of Plymouth, Drake Circus, Plymouth PL4 8AA, United Kingdom (mhart@plymouth.ac.uk)

The micropalaeontological changes across events such as the Cenomanian–Turonian Boundary Event (CTBE) and the Cretaceous–Paleogene Boundary (K/Pg) are relatively well known and the extinctions documented at many locations around the world. That many of these changes are synchronous is also well known, especially when calibrated by stable isotope data. However, there are many changes in the biota that are little understood in terms of their cause and the variations between localities. In attempting to explain these changes a complete terminology has been developed (e.g., stepwise extinctions, disaster taxa, refugia, recovery taxa, Lilliput Effect, etc.) but the biological control on these different responses is constantly being researched and – hopefully – refined.

Some of these "bioevents" are so distinctive (e.g., the calcisphere flood at the CTBE) as to be indicative of the event even when other indicators are absent. In some CTBE locations (e.g., the Rehkogelgraben section in Upper Austria) the calcisphere event appears to be replaced by a flood of radiolarians and there are suggestions that water depth may be the controlling influence. In a number of locations (e.g., Stevns Klint, Denmark) a flood of calcispheres is also recorded at the K/Pg boundary, including the highly distinctive *Orthopithonella colaris* (with its unusual preservation of the initial dinoflagellate tabulation). The unanswered question concerns the ecospace that these disaster taxa are invading or occupying and what has been displaced to allow them entry.

With some well known groups (e.g., foraminifera) there are abrupt changes that are widespread (e.g., the *Heterohelix* shift). There are a range of views as to what may be controlling such changes in the oceanic plankton (e.g., nutrients, changes on O_2 levels, water column anoxia/dysoxia, etc.).

With events such as the CTBE lasting only a relatively short period of time ($\sim$ 500–750 kyrs) the synchroneity of these global bioevents is an issue for those that study the Cretaceous world. Recent models of the Cretaceous oceanic circulation are suggestive of a relatively slow (sluggish?), saline–driven system that may be more fragmented than the present "conveyor" system. In that scenario the presence of such synchronous events becomes more difficult to both understand and explain.