Geophysical Research Abstracts
Vol. 16, EGU2014-12681-1, 2014
EGU General Assembly 2014

An overview of the role of planktonic foraminifera in integrated stratigraphy: case studies from the Albian/Cenomanian, Cenomanian/Turonian and Coniacian/Santonian boundaries

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Planktonic foraminifera are marine protozoans characterized by an excellent geological record and by high morphological diversification and speciation rates. For these reasons, they have been widely used in biostratigraphy and strongly contributed to the multi-disciplinary efforts to improve Cretaceous chronostratigraphy in pelagic settings.
A critical time is the Albian to Santonian interval for which a high-resolution multiple bio-, geochemical and physical integrated stratigraphy framework exportable worldwide is still needed. This is partially because a consistent correlation of the planktonic foraminifera bioevents and calibration against other stratigraphic tools often lacks in accuracy, resolution and reproducibility of the data.
At present the GSSPs for the base of the Cenomanian (Mt Risou, SE France), the base of the Turonian (Pueblo, Colorado) and the base of the Santonian (Olazagutia, N Spain) stages have been established and ratified by IUGS. Planktonic foraminifera bioevents are primary defining criteria for the Albian/Cenomanian boundary (appearance level of *Thalmanninella globotruncanoides*), and secondary defining criteria for the Cenomanian/Turonian (appearance level of *Helvetoglobotruncana helvetica*) and Coniacian/Santonian (appearance level of *Globotruncana linneiana*) boundaries.
However, the identifications of the foraminiferal index species across those boundaries have been reported to be sometimes difficult or unreliable from a number of localities worldwide either because of their rarity or uncertainty in the taxonomic identifications. Reasons rely on many factors, such as poor sampling resolution, incomplete exposure, facies differences, fossil preservation quality, diachronous taxa occurrences, and regional/provincial distribution of the index species. Often, discrepancies pertain to taxonomic inconsistencies, species misidentifications and different species concepts that accumulate over time in the literature.
Nevertheless, biostratigraphy and especially planktonic foraminifera is a primary tool in stratigraphic correlations, and sometimes it is the unique tool allowing practical correlation among sections to determine the magnitude and extent of regional and global events found in the geological record, and identification of stage boundaries when the defining criteria are not reliable or not detectable.
Three case studies are presented to test the correlation precision, accuracy and reproducibility of the planktonic foraminifera data: the Albian/Cenomanian at Blake Nose Plateau (N Atlantic), the Cenomanian/ Turonian at Eastbourne (England), and the Coniacian/Santonian sequences in Tanzania. Each case study provides an example of multidisciplinary and integrated stratigraphic approach and is compared with the equivalent stratotype section. Results highlight the validity of the planktonic foraminifera index species and provide insights into their correct taxonomic identification.