The role of calcareous nannofossils in age model construction: a further step towards high-precision chronologic frameworks

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Calcareous nannofossils have been a powerful tool for regional and worldwide biostratigraphic correlations and dating of the entire Cenozoic. Biochronologic estimates, which have greatly improved in the last 20 years, are derived from high-resolution calibrations of biohorizons that are based upon other independent chronological scales, such as magnetostratigraphy, stable isotope stratigraphy, and orbitally tuned cyclostratigraphy. Calcareous nannofossils can play different roles in dating and correlation: (1) provide preliminary control points for astronomical tuning of cyclostratigraphic records of deep-sea sediments and (2) improve biochronology through orbitally-tuned time scales. The improvement in precision of bioevent age calibrations is obviously related to the construction of an accurate high-fidelity age model that derives from an integrated approach. This strategy can be developed only if different skills are grouped together, and implies a more difficult effort in term of data gathering, but it guarantees the quality of the final results and permits the construction of highly resolved, integrated time scales.

In a recent example of this approach for the early Eocene (ca. 56–47Ma) (Westerhold *et al*., 2017), multi-site, high-resolution proxy records (XRF core scanning iron intensity, bulk stable isotope, magnetostratigraphic, and nannofossil data) were combined. Calcareous nannofossil biostratigraphy was first used for a correct interpretation of the magnetostratigraphic reversals. Once a consistent bio-magnetostratigraphic framework was achieved, geochemical/mineralogical parameters were used to tune the entire dataset and establish a 405-kyr eccentricity cyclostratigraphic framework. The use of this multi-site timescale allows for precise calibration of calcareous nannofossil biohorizons in different geographical areas. This then makes it possible to discuss the isochrony/diachrony of individual biohorizons and to evaluate their reliability. The opportunity to have an increasingly precise calcareous nannofossil biochronology is surely a bonus, but we would stress that the quality of the final biochronology depends not only on the precision of the age model but also, and more importantly, on the quantitative, highly resolved data that must be gathered through the use of rigorous analytical techniques to recognize the biohorizons.

References

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