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Biotic change revealed by dinoflagellate cysts and a revised sequence stratigraphy for the Eocene-Oligocene transition at St. Stephens Quarry, Alabama, USA.

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The Eocene-Oligocene transition (EOT, $\sim$34 Myr ago) reflects the final transition from the early Paleogene Greenhouse into the present Icehouse World and represents the establishment of a permanent ice sheet on Antarctica. This climatic shift is primarily recorded in benthic foraminiferal oxygen isotope (δ^{18}O) records as two steps to higher values that are 200 kyrs apart. Unfortunately, the relative contribution of cooling and cryosphere expansion cannot be separated in such records. Therefore, independent records of proxy data for temperature and sea level are required.

The St Stephens Quarry (SSQ) in Alabama, USA, contains a relatively expanded and presumably complete shelf succession spanning the EOT and is one of the global reference sections. SSQ sediments bear well preserved foraminifera, suitable for stable isotope- and Mg/Ca ratios. Moreover, organic matter, notably well-preserved organic walled dinoflagellate cyst (dinocyst) assemblages and crenarcheotal membrane lipids are present to reconstruct parameters such as sea level, productivity and paleotemperature.

Dinoflagellates are algae generally dwelling in surface waters and dinocysts have appeared to sensitively record environmental changes. We infer sea level changes by distinguishing dinocyst taxa typically associated with respectively lagoonal, high energetic inner neritic and open oceanic environments. This led us to revise the previously published sequence stratigraphy and age model for SSQ. Our data reveal a prominent sequence boundary associated with the second oxygen isotope step. This illustrates the non-linear relation between temperature and ice-volume, with the first oxygen isotope step primarily reflecting cooling and the second primarily reflecting increasing ice-volume.

Our dinocyst record may appear useful for future regional correlation between sites. Two new dinocyst species have been discovered that may function as biostratigraphic markers for the American Gulf Region.