Environmental- and sea-level change revealed by dinoflagellate cysts during the Eocene-Oligocene transition at St. Stephens Quarry, Alabama, USA.

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The Eocene-Oligocene transition (EOT, ~34 Myr ago) represents the final transition from the early Paleogene "Greenhouse" into the present "Icehouse" by the initiation of Antarctic glaciation. The EOT is recorded in deep-sea benthic foraminiferal oxygen isotope ($\delta^{18}O$) records as two increasing steps, ~200 kyr apart. However, the relative contribution of cooling and increasing ice-volume cannot be separated from such $\delta^{18}O$ records. Independent temperature- and sea-level reconstructions are crucial for understanding the order of events enveloping the onset of Antarctic glaciation.

The classic reference section for the EOT, St Stephens Quarry (SSQ) in Alabama, USA, contains a relatively expanded and complete shelf succession. Previous studies at SSQ have already provided benthic foraminiferal stable isotope- and Mg/Ca based temperature information. Sea surface temperatures were reconstructed using TEX_{86} and planktonic Mg/Ca analyses. Altogether, these data show that the first step of the EOT (precursor or EOT-1) primarily reflects cooling, whereas the second step (or Oi-1) primarily reflects increasing ice-volume.

Here, we report on biotic change revealed by evaluating assemblages of fossil remains of organic walled dinoflagellates (dinocysts). Dinoflagellates are a group of unicellular surface dwelling algae and are often used to sensitively record environmental changes. We have inferred sea level change by evaluating dinocyst assemblages in the relatively shallow section of SSQ. This led us to revise the sequence stratigraphy and age model for SSQ. We document a minor sea-level fall associated with the EOT-1 and a more substantial sea-level fall at the Oi-1. At the EOT-1 we furthermore recorded the occurrence of a taxon typically associated with cold water. This is in accordance with the geochemically reconstructed temperature drop of 4 – 6°C. Early Oligocene assemblages above the Oi-1 are indicative of more productive and shallower lagoonal settings. Our records show that the EOT was a period of profound environmental change, also in the (sub)tropics.