Geophysical Research Abstracts
Vol. 15, EGU2013-1473, 2013
EGU General Assembly 2013

Isotopic and palynological evidence for a new Early Jurassic environmental perturbation

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The Early Jurassic Epoch was a predominantly greenhouse phase of Earth history, but a comprehensive understanding of its climate dynamics is hampered by a lack of high resolution multi-proxy environmental records. Here we report a geologically brief (approximately several hundred thousand years) negative carbon isotope excursion (CIE) of 2-3‰ in both marine and terrestrial materials, recognised for the first time for the Late Sinemurian Substage (Early Jurassic, ∼194 Ma) of eastern England. The Late Sinemurian carbon isotope excursion, which is termed the S-CIE herein, is accompanied by peaks in the abundance of the pollen grain Classopollis classoides and the dinoflagellate cyst Liasidium variabile. Classopollis classoides was thermophilic and is a reliable proxy for hot/warm climatic conditions. Liasidium variabile is interpreted as thermophilic and eutrophic using multivariate statistics, its fluorescence properties being similar to living heterotrophic dinoflagellate cysts, and its association with Classopollis classoides. Moreover, the morphological and ecological similarities of Liasidium variabile to the Cenozoic genus Apectodinium are noteworthy. The co-occurrence of the acmes of Classopollis classoides and Liasidium variabile with a negative CIE is interpreted here as having wide geographical significance due to the marine and terrestrial carbon isotope signals being precisely in phase within an open marine setting. This is consistent with an oceanic-atmospheric injection of isotopically-light carbon, coupled with global warming and increased marginal marine nutrient supply, possibly the result of increased precipitation due to an enhanced hydrological cycle or a seasonally-stratified water column. A probable sea level rise of at least regional extent has been identified at the Liasidium variabile event in other records, which supports this putative phase of global warming. All these features are common to the Paleocene/Eocene thermal maximum (PETM, ∼56 Ma), and there are also similarities with the Early Toarcian oceanic anoxic event (T-OAE, ∼182 Ma).