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Oligocene-Miocene sea surface temperatures from North Atlantic sediments

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Major changes in the carbon cycle and atmospheric CO_2 along the Cenozoic have been suggested to be a determining cause of the climatic evolution from a ''green-house Earth' to an 'ice Earth', driving the global temperature and limiting the polar ice sheet growth. During the Oligocene-Miocene time interval, $p\mathrm{CO}_2$ atmospheric concentrations are estimated to be higher than pre-industrial levels with a long-term decline. Therefore it is a period of interest for understanding the feedback between greenhouse gases and climate system. However, direct sea surface temperatures estimations for cited period are lacking especially for the west North Atlantic, and the low resolution and uncertainties of the carbon dioxide existing records, make difficult to relate them with the climatic history. Coccolithophores, unicellular calcifying phytoplankton, are susceptible to atmospheric CO_2 variations. Hence, the organic compounds (long-chain unsaturated alkenones) produced by a specific family of coccolithophores (*Reticulofenestra spp*.) can be used for reconstruct both sea surface temperatures and past atmospheric CO_2 estimations.

Here, a Sea Surface Temperature record has been produced from the $U_{37}^{k'}$ ratio in alkenones present in North Atlantic sediments, site 1406A (IODP Exp. 342) for the time interval 30 Ma to 17 Ma with a resolution of ∼250 Kyr. The record shows temperatures from 24˚C to 27˚C and exhibits three characteristic intervals potentially correlated with three marked Cenozoic excursions: the late Oligocene warming, Oligocene-Miocene transient cooling of 3.5˚C, and temperature increasing heading the middle Miocene warming. Since accurate temperatures are necessary to apply into the alkenone phytoplankton proxy to reconstruct $p\mathrm{CO}_2$, this might be an important contribution in temperature reconstruction for the Cenozoic ocean.

In this study we also produce a new record of phytoplankton carbon isotopic fractionation (ε_p) derived from δ^{13}C on alkenones which allow to generate $p\mathrm{CO}_2$ estimations. First tests, where we have implemented required coccolithophore cell physiological factors (as cell size or growth rate) show three marked decreasing steps along a long drop trend which correlates with previously published research, but differs in amplitude.