Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.30932

An *n*-alkane record of a terrestrial early Eocene environment from the Rockall Trough

BRIDGET WARREN[1], JAMES A BENDLE[2], TOM DUNKLEY JONES[2], DR. OSAMU SEKI[3], GUY HARRINGTON[4] AND STEPHEN M JONES[2]

[1]The Open University
[2]University of Birmingham
[3]Institute of Low Temperature Science, Hokkaido University
[4]University of York

The Early Eocene Climatic Optimum (EECO, 53-49 MA) was the warmest and highest CO_2 interval for the last 66 million years. Ecosystems both respond to and are a proxy 'recorder' of climate, and understanding the behaviour of terrestrial ecosystems to such extreme temperature and CO_2 conditions is important for understanding their functions, past and future. Here we present *n*-alkane plant wax carbon isotopes, alongside pollen assemblages and GDGT distributions for a high mid-latitude location (Rockall Trough) through a portion of the EECO (51-49 Ma).

Pollen and *n*-alkane chain length distributions both suggest that plant assemblages remained stable across the interval, providing an exciting opportunity to examine plant response to environmental change within a stable community. Our data shows that despite early Eocene reconstructions of wet mid-to-high latitudes, along with high-CO_2 concentrations, which according to modern studies lead to increased carbon isotopic fractionation, *n*-alkane $\delta^{13}C$ suggest similar or slightly reduced fractionation compared to modern plants. Furthermore, trends vary between the different *n*-alkane homologues: the longer homologues (C_{29}+) became more negative through the interval, while shorter homologues remained stable.

We interpret this as reflecting different source plants for different homologues, potentially growing in different environments, responding to different environmental conditions. Specifically, we suggest that the longer chain lengths reflect the environment further inland, where changes in elevation associated with the cessation of the North Atlantic Igneous Province induced climatic shifts that altered plant carbon uptake and increased fractionation as the interval progressed.

Finally, we evaluate the use of *n*-alkane $\delta^{13}C$ as a palaeo-CO_2 proxy (the "C_3 plant proxy"). We find that it is unable to replicate CO_2 trends seen in other reconstructions of the same time interval, and that the choice of *n*-alkane homologue substantially alters both absolute CO_2 reconstruction and qualitative trends of CO_2 through time.