



# INTERNATIONAL OCEAN DRILLING PROGRAMME

**PROPOSAL 1112-S**

**Going Beyond 'Beyond Epica' (Be<sup>2</sup>EPIC)**

# IODP<sup>3</sup> Proposal Cover Sheet

## Proposal Title:

Going Beyond ‘Beyond EPICA’

## Project Abstract

Going Beyond ‘Beyond Epica’ (Be<sup>2</sup>EPIC) seeks to create an unparalleled record of the ocean-atmosphere-climate system over the past 5.3 million years, and lay out a scalable framework for the entire Neogene (23 million years). Continuous tropical–subtropical ocean sediments will be used to generate geochemical records of atmospheric carbon dioxide levels and temperature from all three major ocean basins. Leveraging the unique connection of greenhouse gas proxies to the ice cores, an extensive training and validation study will be undertaken from which new understanding can be taken from, in and beyond the Pleistocene. In this SPARC we aim to align a set of primary and alternate cores, with the potential for CO<sub>2</sub> reconstructions onto a common and well constrained age model. In particular, we will aim to facilitate a multi-proxy intercomparison for shared environmental variables, interrogating their similarities and differences in a controlled setting. We will then integrate the proxies, alongside modelling efforts to create a continuous splice of climate sensitivity across the Plio-Pleistocene, complemented by temporally limited ‘snapshots’ that extend into the Miocene.

## Scientific Objectives

Going Beyond ‘Beyond Epica’ (Be<sup>2</sup>EPIC) aims to build in the spirit of the continuous ice core records and explore the Earth’s climate in unprecedented resolution. There are many proxy records which recover the same type of data as can be found within the high-quality archives of the continuous ice. We aim to provide both a stratigraphic framework for these proxy-data intercomparisons, but also multiple investigations into past global CO<sub>2</sub> trajectories and temperatures. Together these data will be used to constrain climate sensitivity and to search for tipping points in the geological record. The comparison with ice core data is integral, as a calibration/training period, but also to augment the ice core records with variables which are out of their reach such as ocean heat storage, and ocean-CO<sub>2</sub> flux.

## Science Communication Plain Language Summary

For the last ~1.5 million years of Earth’s natural history, the ice cores have provided an unprecedented window into its past, via bubbles of ancient air trapped in the ice structure, and the chemical composition of the snow which fell in ancient times. Sediment cores form in a similar fashion, with a snow of particles falling from the ocean surface to the deep seafloor. These particles also take with them chemical measures and biological compounds which represent the environment of their formation. As sediments have a much longer history than ice, we aim to explore Earth history ten times further than the ice cores can go. This project seeks to synergise, replicate, and expand the data types gained from ice cores, including atmospheric carbon dioxide, global temperature and the pacing of their interactions, leading to a picture of Earth’s full climate response to greenhouse gas forcing. Exploring deeper in time allows us to explore the Earth in times warmer than the present and potentially glimpse our near future, a key objective of IODP 2050.