PROJECT TITLE: Early Pliocene Climates in Fiji (EPiC Fiji)

Supervisors:
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Project keywords: Paleoclimate; Pliocene; sea surface temperatures; foraminifera

Global surface temperatures for the last 60 million years with the Pliocene shown by the blue arrow after refs 1 and 2.

Global Surface Temperature (°C)

Proposed start date: June 20th 2022

Project description: In this project the student will investigate ancient climates during the Pliocene epoch (5.3–2.6 million years ago) using deep-sea sediments from Fiji. The geological record contains abundant evidence about how climate has changed in the past. Such evidence is key to understanding how it will change in future. Records of past climate (paleoclimate) data help us understand changes in the Earth’s climate system that we cannot fully observe on modern timescales and they allow us to test and tune the climate models we use to predict the consequences of current warming trends. Many climate scientists have emphasised the need for more climate records from the early-middle Pliocene, which is often cited as the best past analogue for the late 21st century: global temperatures were 3–4°C higher than present, sea levels were 35 m higher, and atmospheric CO₂ levels were similar to those predicted for this century. Climate scientists need data from as many locations as possible to fully understand climate systems during the past and simulate them using climate models. However, very few records exist for the tropical Pacific, despite the Pacific playing a major role in the modern climate system. For example, changes in sea surface temperatures in the west Pacific currently drive the El Niño Southern Oscillation (ENSO) and a better understanding of how ENSO changed through time is much needed.

The student will examine sediments from the Suva peninsula, Fiji. Studies have shown that these were deposited between roughly 5.6 and 3.2 million years ago (early-middle Pliocene) and contains high concentrations of fossil foraminifera (microscopic single-celled organisms). The calcite shells of foraminifera are an excellent source of climate data as their chemistry can tell us about many oceanographic parameters such as water temperature. These sediments therefore represent a potentially excellent archive of early-middle Pliocene climate data. The student will examine the species present in the sediments and extract those typically used in sea surface temperature reconstructions. They will then use a variety of techniques (e.g. light microscopy, scanning electron microscopy, SEM) to confirm that the material is suitable for geochemical analysis. Fossil foraminifera shells will then be chemically cleaned and analysed for their Mg/Ca ratio (and potentially their ³⁶S/³⁴S ratio). This data will then be converted to temperature using established equations and considered alongside other data from this time.
**Work schedule at Cardiff University:**

2 weeks: desk work at home or in university  
5 weeks: lab work  
1 week report, presentation or poster

**Candidate requirements:** Candidates must be willing to work with chemicals in a laboratory setting.