

**Late Cretaceous Palaeoenvironments of the NE Brazil margin
and the opening of the equatorial Atlantic gateway**

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The Late Cretaceous stratigraphy of the Equatorial margin of North East Brazil holds a unique record of the final stages of the opening of the South Atlantic. During this interval the last stages of rifting between South America and Africa opened a series of basins in NE Brazil that were infilled with complex sequences of terrestrial lake and fluvial deposits punctuated by occasional marine incursions during periods of extreme eustatic high stands. One of these marine incursions occurs around the Cenomanian-Turonian boundary associated with the “super-greenhouse” climate state of extreme warmth and extensive black shale deposition in Tethyan sections during Ocean Anoxic Event 2 (OAE2). This project will analyse the pollen, spore and dinoflagellate records of three new core holes from the Pernambuco Basin on the equatorial margin of NE Brazil. This will be integrated with biomarker and organic geochemical proxy approaches to reconstruct the palaeoenvironments and palaeotemperature records of the tropics during this extreme climate state. Together these palynological and organic geochemistry data will determine 1) the nature and diversity of tropical flora and vegetation during the Late Cretaceous super-greenhouse; 2) use combined palaeo-floristic and organic proxy estimates to produce estimates of tropical temperatures at this time and their variability; 3) produce a detailed record of marine incursions into the Pernambuco Basin, constrained by new biostratigraphic data, to assist in determining the tectonic and climatic controls on the opening of the Atlantic equatorial gateway.

This project will focus on the detailed analysis of three new deep (~500m) cores in the Pernambuco Basin that recovered full sections of Late Cretaceous stratigraphy. These are curated at UFPE and detailed sedimentological data and access for sampling will be provided by project partners Haydon Mort and Mario de Lima Filho. This project aims to provide new high-resolution palynological and organic geochemistry data from all three cores, to address the three project objectives listed above. In detail the work will involve:

- palynological analyses of all three cores to provide biostratigraphic age constraints and correlations between the cores; estimates of local tropical terrestrial environments and diversity; and, document levels of marine incursions by the presence/absence of marine dinoflagellates;
- undertake organic geochemical analyses at levels with productive and well-preserved organic material (based on palynological analyses above). These will be targeted on terrestrial (MBT/CBT) and marine (GDGT) temperature estimates but will also look for fingerprints of tropical methanogenic wetlands to trace their presence and extent through this critical time of Earth history;
- integrate the stratigraphy from these three cores into a sequence stratigraphic framework and extend these correlations into an understanding of regional and off-shore stratigraphy based on open access seismic surveys in the region.

Benefits and training: This studentship will provide a detailed palynological training in the biostratigraphy, palaeoecology and diversity of Late Cretaceous tropical terrestrial and marine communities. The student will also receive training in organic geochemical extraction and analysis methods necessary for both proxy temperature estimates and palaeoenvironmental biomarker analysis. This project will also provide a solid education in Cretaceous palaeoclimate and in the integration of stratigraphic data into regional geology, sequence stratigraphy and seismic stratigraphy.

Applicants should apply via

<http://www.birmingham.ac.uk/postgraduate/courses/research/gees/earth-sciences.aspx> where they should click on ‘Apply now’ and choose the option ‘PhD in Department of Earth Sciences’ and give the PhD title in the ‘Funding details’ section of the online application.