



NERC Centre for Doctoral Training in Oil & Gas (2017 start)

Project Title: New Paleogene bio- and chemo-stratigraphies from key exploration areas in the equatorial Atlantic Ocean
Host institution: University of Birmingham
Supervisor 1: Kirsty Edgar
Supervisor 2: Tom Dunkley Jones
Additional Supervisor (s): Carina Hoorn (University of Amsterdam) & Farid Chemale Junior (Universidade de Brasilia)

Project description:

The Paleogene encompasses arguably the most profound climatic shift of the past 65 million years of Earth history during which Earth's climate evolves from a 'greenhouse' in the early Paleogene to an 'icehouse' in the Oligocene. This transition results in significant re-organisation of ocean circulation, the cryosphere, marine communities, and biogeochemical cycles. Drilling by Petrobras and Mobil have yielded relatively thick sedimentary sequences spanning the Eocene and Oligocene in two key areas; Mossy Grove (Gulf of Mexico) and the Foz do Amazonas Basin (Brazilian margin). They are of particular value because they are also host to rare exceptionally preserved carbonate marine microfossils as well as terrestrial markers (e.g., pollen and spores). These sediments are un-studied and thus, offer a unique opportunity to accurately reconstruct ancient palaeoenvironments and ultimately develop an integrated marine-terrestrial stratigraphy. This work is also of particular value because the Gulf of Mexico and Brazilian margin are key areas of petroleum exploration and production today. Yet, gaps remain in our understanding of how these regions have evolved throughout key intervals of geological time at high temporal resolution. This is particularly true of the Foz do Amazonas Basin, offshore northern Brazil, a high priority for current exploration by a number of companies.

Here the student will use a combination of geochemical (stable oxygen and carbon isotopes, and trace element ratios) and faunal proxies from well-preserved calcareous microfossils (foraminifera and calcareous nannofossils) to develop a highly resolved bio- and chemo-stratigraphy for cores from the Foz do Amazonas Basin and Mossy Grove. Environmental reconstruction will focus on the following parameters; ocean temperatures, productivity, oxygenation, and the paleowater depth history of the sites. These new records will provide the first high-temporal resolution Paleogene stratigraphy for the Foz do Amazonas Basin and together with records from the Gulf of Mexico will provide the most complete record of environmental changes at low latitudes from the middle Eocene through late Oligocene (~47-24 Ma). Ultimately improving our understanding of the timing and nature of the greenhouse-icehouse transition and the implications for marine and terrestrial communities.

CDT Research theme(s): This work directly addresses the theme "*Extending the life of mature basins*" by working towards a better understanding of the stratigraphic and paleoenvironmental setting throughout the Paleogene in regions of active petroleum exploration and production.

Research context: This project builds upon the expanding Micropalaeontology research centre at Birmingham with 5 staff members (specialising in foraminifera, calcareous nannofossils, ostracods, conodonts, and marine vertebrates), 6 PhD students and >18 MSc Micropalaeontology students.

Research costs: The successful candidate will be trained in micropalaeontological (incl. taxonomy) and geochemical techniques on samples that are already available in-house. Visits to work with collaborators in Amsterdam (working on the terrestrial component) and/or Brazil will complement this work. FEC costs for full analyses and visits is ~£12k. **Career routes:** This project will provide the student with skills essential for biostratigraphy, as well as expertise in palaeoenvironments within active petroleum areas.