Project Title | Taxonomic structure of marine and terrestrial ecosystems and the evolution of biodiversity
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Key words | Palaeobiology, Systematics, Biodiversity, Evolution
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Richard J. Twitchett, The Natural History Museum (r.twitchett@nhm.ac.uk)
Is the PhD suitable for part time study? | Yes

Project Highlights:
- Undertake research on a world-leading and historic collection of fossil specimens
- Experience of working in both a university and a large museum of natural history
- Work in multidisciplinary team of palaeobiologists and ecologists

Overview:
Understanding the patterns of diversification and extinction in the history of life relies on counting the succession of fossil genera and families through time (Benton 1995, Alroy et al. 2008). However, a genus can contain many species or it can contain just a single species (Sigwart et al. 2018), and classic work on extant organisms has shown that the frequency distribution of species among genera is right-skewed: there are lots of monotypic genera but very few speciose genera (Willis and Yule 1922). The observation that taxonomic structure can vary—not all genera are of equal size—raises a number of core issues in macroevolution.

Firstly, it highlights that an understanding of the species diversity represented by the genus rank is necessary in any field where genera or families are used to summarize patterns of diversification. Secondly, it illuminates the different processes controlling the species richness of a genus: genera containing many species can result from a single large radiation, but genera containing few species may result from a relatively unchanging evolutionary lineage or the extinction of closely related species. Thirdly, variation in the taxonomic structure of clades and regions may also reflect differences in taxonomic practice and sampling, which can influence the documentation and perception of evolution. Finally, analyses of taxonomic structure can themselves reveal diversification dynamics because the proportion of monotypic genera in a clade can provide an index of genus origination rate (Foote 2012).

In order to address these issues, this project will measure the taxonomic structure of marine and terrestrial biodiversity in three settings: (1) A latitudinal gradient from North America to the Neotropics; (2) The Middle Jurassic (~174–163 million years ago), which represents a snapshot of ecosystems during the Mesozoic Marine Revolution; (3) The ‘Big-5’ mass extinction events of the Phanerozoic, which will provide vital new data on the nature and magnitude of biodiversity loss during these critical intervals in Earth history.
Methodology:

The raw data for this PhD project will be frequency distributions of species among genera, and genera among families, for three groups of marine organisms (bivalves, gastropods and cephalopods), and three groups of terrestrial plants (pteridophytes, gymnosperms and angiosperms). These taxonomic size-frequency distributions will be based on data collected from online databases, museum specimens housed in the collections of the Natural History Museum, and taxonomic literature in specialist libraries at the Natural History Museum such as the Cox Library (benthic molluscs) and the Buckman Library (cephalopods).

Training and skills:

This project will provide specific training in the practice of systematic palaeontology, including application of the International Code of Zoological Nomenclature and the International Code of Nomenclature for algae, fungi and plants. Depending on the skills and career goals of the successful applicant, training will also be provided in the use of large databases in macroevolutionary research, time series analysis, and the algorithmic quantification of morphology from discrete characters. These skills are particularly relevant to a career in science, either in a traditional research setting in a university, or in a curatorial setting in a museum or botanical garden.

Partners and collaboration:

The project will be based partly at the Natural History Museum, London, and will involve collaboration with Prof. Richard J. Twitchett.
Possible timeline:

Year 1: Gather data on the taxonomic structure of the marine and terrestrial organisms for the modern latitudinal transect from North America to the Neotropics. Present preliminary research results as a poster at a national conference.

Year 2: Gather data on the taxonomic structure of the marine and terrestrial organisms for the Jurassic, and the 'Big-5' mass extinction events at the Natural History Museum. Prepare manuscript summarising the results of research into the taxonomic structure of modern ecosystems. Present results at an international conference.

Year 3: Prepare manuscripts reporting the results of research on the taxonomic structure of the Jurassic and the 'Big-5' mass extinction events. Present research results at an international conference. Write up PhD thesis.

Further reading:


Further details:

Students should have a strong background in geology, biology or both, and a keen interest in palaeobiology and systematics. Please contact Luke Mander (luke.mander@open.ac.uk) for further information.

Applications must include:
- a cover letter outlining why the project is of interest and how your skills are well suited to the project
- an academic CV containing contact details of three academic references
- an Open University application form.
- If you are resident in the UK or European Economic Area, please use the form downloadable here: https://tinyurl.com/y73hrfou
- If you are resident elsewhere, please use the form downloadable here: https://tinyurl.com/y836sgq4

Applications should be sent to STEM-EEES-PhD-Student-Recruitment@open.ac.uk by 12pm (noon) on 21st January 2019.