The University of Oxford Department of Earth Sciences

EARTHSCIENCES

UNIVERSITY OF OXFORD

Are niches smaller when there are more species? A quantitative investigation of niche partitioning over the Phanerozoic

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Key Words	**Palaeobiology, ecological modelling, macroevolution, macroecology, niche partitioning, competition**

Overview

Niche partitioning refers to the process by which competing species are driven into different patterns of resource use or different niches in ways that help them to coexist. It has been hypothesized that increasing benthic alpha diversity over the Phanerozoic may have led to increasingly finer niche partitioning in order for more and more species to coexist. This hypothesis, however, has not been tested quantitatively with regard to the coarse-scale manifestations of species' abiotic tolerances. This project will examine the response of species' niche breadths to both alpha and beta diversity, and explicitly examine how species niche breadths evolve within lineages across the Phanerozoic.

The project will represent a significant contribution to our understanding of how species evolve ecologically over geological time scales, and will allow us to test key questions proposed by Darwin that are still of interest today; for example, what is the role of biotic interactions, such as competition, in structing communities and influencing ecological and evolutionary processes?

Figure showing pectinid bivalves from Lamarck, 1819 [via Wikimedia Commons].

Methodology

The project will apply quantitative methods, including ecological modelling, to test whether species' niche occupation responds to alpha or beta diversity over geological time scales. In addition to sedimentological inferences, state-of-the-art global climate models will be used to characterise species' niches. Analyses will focus on the bivalve mollusc order Pectinidae (scallops). This group contains abundant and diverse clades of well-preserved, taphonomically-resistant shells from the Palaeozoic to Recent. By quantifying niches for pectinid species over the Phanerozoic, we will test key hypotheses regarding the role of competition in driving ecological change.

Timeline

Year 1: Training courses in statistical and ecological modelling, literature review, and sample acquisition.

Years 2 and 3: Modelling ecological niches through time and analysis of time series data.

Year 4: Data integration, thesis completion, papers for international journals/conference presentation.

Training & Skills

This interdisciplinary project will provide the successful PhD candidate with highly-valued and sought-after tools for investigating macroevolutionary and macroecological processes, including statistical and ecological modelling. The student will have the opportunity to travel abroad to collect data, and to present results

at major, international conferences (e.g. AGU, GSA, PalAss).

References & Further Reading

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Further Information

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