PhD Project – starting October 2019

University of Lille
Doctoral School: ED104 Sciences de la matière, du rayonnement et de l'environnement (SMRE)
Doctoral Program : Géosciences - Ecologie - Paléontologie - Océanographie
Thesis title :

The impact of global warming on oceanic plankton (radiolarian) diversity, morphological disparity and macroecology; lessons from the Paleogene

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Funding : requested at the University of Lille

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The project aims at examining patterns in radiolarian plankton diversity, morphological disparity and biogeography during the Late Paleocene–Middle Eocene; this geological time interval of the Paleogene includes two global warming events that took place at approximately 56 and 40 million years ago, known respectively as the Paleocene - Eocene Thermal Maximum (PETM) and the Middle Eocene Climatic Optimum (MECO). Both occurred before the onset of the permanent Antarctic glaciation, during a period of greenhouse climate that used to be considered until recently as climatically stable. The ambition of this project is to quantify and compare diversity and disparity metrics based on an extraordinary siliceous microfossil record preserved in oceanic sediments and during a time interval that covers both warming events mentioned above.

The main objective is (1) to quantify morphological changes of Nassellarian radiolarians and then (2) to compare patterns in their diversity (species richness) and morphological disparity, as this may result in depicting iterative patterns of morphological change, which may be quantified and lead to the discovery of general rules that shape plankton diversity. Phylogenetic and biogeographic information will be integrated and compared with established paleoclimatic proxies in order to grasp the long term macroecological impact of climate change.

During this project, cutting edge methods in geometric morphometric analyses will be applied by using measurements taken on digitised images. Quantitative measurements of radiolarian skeleton size and shape will be carried out using both traditional (e.g. length/width ratio) and modern morphometric parameters (e.g. outline and landmarks) in order to capture and model Nassellarian radiolarian skeleton morphology. These parameters will be obtained by taking measurements of the radiolarian skeleton with the help of an image processing system. Then, these parameters will be used for outline analyses, such as Fourier analyses (based on a set of equidistant points disposed along the outline) or Procrustes analyses (based on a set of landmarks).

An important advantage of these parameters is the possible quantification of morphological traits leading to a general view of evolutionary trends. Establishment of a morphologic space will allow improved understanding of morphological diversity, and, consequently, interpreting shape changes in terms of evolution and adaptation.

Candidate's desired profile

The ideal candidate holds a Master degree in Paleontology and comes from a background training in Earth Sciences, Biology/Ecology or Environmental Sciences. He/she has a great interest in quantitative analyses, good skills in scientific writing in English and enjoys team working.

Key words:
Biodiversity dynamics, morphological disparity, macroecology, radiolaria, oceanic plankton, global warming