The ISTerre laboratory invite applications for a three-year PhD programme focusing on the

Chemical and physical characterization of Nannoconus, the main planktonic producer of carbonates in the Cretaceous oceans

This thesis project focuses on the mineralogical and chemical characterization of calcareous nannofossils of micrometric size. It is an exploratory project at the crossroads between paleontology, mineralogy and geochemistry, integrated in the transverse theme "Biomineralization and Paleoenvironment" of the ISTerre laboratory.

In oceanic environments, marine carbonate production is largely carried out by calcareous nannoplankton represented mainly by unicellular algae, which produce tiny calcitic units (< 20 µm). The calcification of these algae results from a complex interaction of chemical, physical and biological mechanisms, which can be partly controlled by a wide variety of environmental factors (temperature, seawater chemistry). The fossil remainings (exoskeleton) of these algae are called calcareous nannofossils, and are part of a continuous sedimentary record dating back 210 million years. Measurements of elemental ratios, isotopic, trace elements of the calcareous nannofossils can be used as proxies to trace paleo-environmental conditions, but due to their very small size and very low mass (< 100 picograms), their chemical composition and biomineralization processes remain technically difficult to determine.

The main objective of this project will be to get a better understanding of the paleobiology (mode of calcification), paleoecology (depth of habitat, trophic position within the water column), and the factors controlling the massive production of **Nannoconus, which were the main planktonic producer of carbonates in the oceans at the beginning of the Cretaceous (~152 Ma and ~120 Ma).** The transfer of these massive productions of carbonates to the oceanic sedimentary archives, during this long time interval, has certainly significantly changed the chemistry of the oceans (in terms of carbonate saturation state), with consequences on the marine biosphere which will know at the end of the apogee of the Nannoconus, an important period of planktonic diversification. The link with the chemistry of the Cretaceous oceans and the emergence of new planktonic groups will be explored.

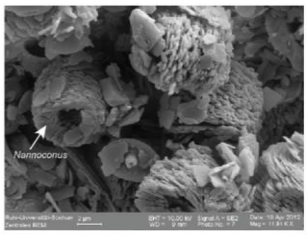

Fig. 1. Vue au MEB d'une boue calcaire à *Nannoconus* (Mer du Nord, 125 Ma ; © J. Mutterlose)

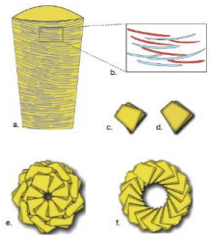

Fig. 2. Schémas de différentes coupes de *Nannoconus montrant la structure de l'exosquelette et la forme des plaques* (© M.P. Aubry)

To this end, a series of **physico-chemical characterization tools** will be employed to characterize individual microfossils, mainly using laboratory (SEM, TEM, microprobe, tomography) and **synchotron X-ray scattering** techniques, including coherent X-ray imaging, phase-contrast tomography or X-ray absorption spectroscopy.

Applicants should have a degree in a field related to paleontology, mineralogy, environmental physical-chemistry or similar. Academic knowledge of physico-chemical characterization methods will be appreciated. The application file should contain a detailed CV, copies of the university marks (Master level), a motivation letter and the names and contact information of at least two referees. **Deadline for application is May 14th, 2021.**

Keywords: paleontology, geochemistry, biomineralization, paleo-environments, diagenesis

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