

PhD opportunity - Graduate School ED585

Role of Rhizaria in biogeochemical Cycles in the epi- and mesopelagic ocean (*RhiCycle*)

University of the Littoral Opal Coast
Laboratoire d'Océanologie et Géosciences (LOG) - Wimereux, France

36 months

Call description: The French National Research Agency (ANR; <https://anr.fr/en/>) has selected the project *RhiCycle* to co-finance a PhD position. *RhiCycle* is a 4-years project, led by Tristan Biard. *RhiCycle* aims to characterize the contribution of siliceous rhizarians, a group of marine protists secreting mineral tests made out of biogenic silica, to global marine biogeochemical cycles, in particular the carbon biological pump and silica cycle.

The team involved in *RhiCycle* already published a number of pioneering studies about the importance of the elusive Rhizaria in modern oceans (Caron 2016). These studies highlight that Rhizaria represent a substantial fraction of living biomass in the ocean (Biard et al., 2016). Such biomass eventually fuel large fluxes of particulate organic carbon (POC; Guidi et al., 2016; Stukel et al., 2019) and biogenic silica (bSiO₂; Biard et al., 2018; Llopis Monferrer et al., 2020) exported to the deep ocean. Nevertheless, rhizarians encompass a large diversity of species, spanning a wide size range (0.04 - >4 mm) and inhabiting diverse ecological niches (epi- and meso-pelagic). Therefore, the role and significance of Rhizaria to biogeochemical cycles cannot be resumed to the study of a few taxa (which was the case for the previous studies mentioned above). Altogether, this raises the question: Considering their broad size spectra and extended range of vertical habitats, what is the significance of silicified rhizarians in biogeochemical cycles, in particular carbon and silica cycling?

We hypothesize that the significance of rhizarians to biogeochemical cycles is constrained by their vertical habitat. Epipelagic populations can contribute to the export of atmospheric CO₂ through photosymbiotic associations and eventually contribute to both POC and to bSiO₂ fluxes. Yet, their contribution is likely limited in coastal regions or during the bloom season, where their fluxes (although potentially high) are masked by those of primary producers (e.g., diatoms). Deeper, in the meso- and bathypelagic regions, thrive some rhizarians by feeding on particles sinking out of the surface layer. By consuming these carbon-rich particles, they can prevent the sequestration of carbon in deep-sea sediments. In the meantime, by growing via the consumption of these carbon-rich particles, mesopelagic rhizarians, often composed of large cells (>1 mm), may also act as a deep internal source for POC and bSiO₂ fluxes to the ocean bottom.

To investigate such diverse questions, *RhiCycle* and the PhD project are by nature interdisciplinary. Therefore, an original combination of tools and expertise encompassing marine biogeochemistry, quantitative high-throughput in situ imaging (Underwater Vision Profiler systems), sediment trap fluxes and molecular characterizations of diversity will be used. Designed to complement regional field studies (in particular in Villefranche-sur-Mer, French Riviera) and oceanographic cruises in a variety of ecosystems, laboratory experiments will generate information needed to interpret large-scale studies in different major oceanic basins (Northeastern Pacific, North Atlantic), in particular via collaborations with the CCELTERR program (led by the Scripps Institution of Oceanography - USA) that include an oceanographic cruise off the Californian coast in 2021.

PhD applicants- Required skills: We are looking for a bright and highly motivated PhD candidate should hold a MSc in a relevant topic (e.g. marine biology-ecology, biological oceanography, biochemistry), but highly motivated candidate with other MSc will be considered. He/She should be

able to perform data analysis (preferably programming in R, but Matlab or Python would work) at intermediate level.

Other ideal skills include: proficiency in written and spoken English, a high degree of independence, experience in conducting field and laboratory experiments, and ability to work in an interdisciplinary, international research group. The candidate should be willing to spend periods of time during fields trips.

The PhD candidate will have the opportunity to join (at least one) an international expedition, allowing him/her to acquire a unique field work experience and meet foreign researchers (beneficial for the period after the PhD, in particular for post-doctoral experiences). The candidate will learn from interdisciplinary discussion with strong emphasis on critical thinking and will be receive a multidisciplinary training, ranging from biological oceanography, biogeochemistry, ecology and big-data analysis.

Duration: The PhD position is for 3 years. **Start date:** October 1, 2020.

Supervision: The PhD candidate will be supervised by Dr. Tristan Biard and Pr. Urania Christaki. Dr. Tristan Biard is a recent laureate of the ANR 2019 Young Researcher Call with the project RhiCycle. He has an extensive experience in working with rhizarians using multidisciplinary approaches. U. Christaki is a renowned expert in the carbon cycle and microbial ecology, and has supervised numerous PhD so far.

Location: The position will be based at the Laboratoire d'Océanologie et Géosciences (LOG), Wimereux, France. It is a joint research unit of the University of the Littoral Opal Coast, the University of Lille and the Centre National de la Recherche Scientifique. It is renowned in the fields of zoo- and phytoplankton ecology/physiology, microbial ecology, biogeochemistry, marine optics, physical oceanography and geosciences.

Hours and Compensation: The PhD candidate will be given a fully equipped work station at the LOG, and will be expected to work full time for a duration of 36 months, starting in October 2020. The minimum gross monthly remuneration under the contract shall be ~€1,800.

Application Requirements: Interested candidates should send an email to Tristan Biard (Tristan.biard@univ-littoral.fr) until 25 June 2020 (this deadline will be extended if the suitable candidate could not be found), with the subject line: PhD-RhiCycle, and include the following:

- Cover letter of 1 or 2 pages (with a brief summary of the candidate's academic and research experiences and goals)
- CV

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