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Postdoctoral position in biogeochemical coupled modelling at Center for Advanced Studies in Arid Zones (CEAZA)

The Center for Advanced Studies in Arid Zones (La Serena, Chile) is hiring a postdoctoral researcher with a Ph.D. in either microbiology, molecular genetics, ocean biogeochemistry or related fields.

Current evidence indicates that the coastal and open ocean has been losing oxygen (O_2) since the middle of the last century, with consequences for living organisms and biogeochemical cycles that are not yet fully understood (e.g., Breitburg et al., 2018). Although observations and model simulations document a net decline of the global ocean O_2 inventory, there is disagreement among analyses resulting in inconsistent regional estimates of the rate of O_2 loss (i.e., deoxygenation) (e.g., Oschlies, 2018). Uncertainties and differences between estimates could be attributable to the scarcity of accessible data, the use of different datasets (Grégoire et al., 2021), and the inadequacy of biogeochemical models to accurately describe key metabolic pathways in oxygen-depleted waters such as in the Oxygen Minimum Zones (OMZs).

Building a stronger capacity to understand the causes of these discrepancies and predict the impacts of low oxygen on marine ecosystems has become critical in order to identify strategies for ensuring ecosystem services sustainability, socio-economic adaptation and climate change (CC) mitigation.

Microbial communities dominate numerically and in biomass in the ocean, exerting a great influence on the biogeochemistry of the oceans. Despite their relevance, they are rarely included in marine biogeochemical models, such as those used to predict the response of the oceans to climate change. Within the framework of the CLAP project (Research Program for Climate Action Planning, <https://oceandecade.org/actions/research-program-for-climate-action-planning>), we will develop state-of-the-art simulations to evaluate the oceanic response to CC in the coastal region of Central Chile. To achieve this goal, we seek to incorporate "multi-omics" information from our regional ecosystem into a regional Earth System Model fitted with locally collected biogeochemical data.

In a novel approach, the postdoctoral researcher will have to integrate "metaomics" and biogeochemical measurements on microbial dynamics into an existing biogeochemical model (BioEBUS) (see Montes et al., 2014) to assess their contribution to biogeochemical processes in a coastal upwelling ecosystem with low-oxygen waters off Central Chile. Although genetic data serve as a potent and sensitive tracer of biogeochemistry, they remain under-exploited. Yet, omics data can uncover processes and functions that may have been





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previously overlooked, which is invaluable for creating a more realistic scheme of the primary biogeochemical processes and identifying similarities and differences between sites in terms of microbial diversity, activity, and biogeochemical functions (Louca et al., 2016). The work will consist in tuning a 1D biogeochemical model that describes metabolic coupling along the redox gradient at sites along the coast of Central Chile where data exists (Coquimbo, Iquique). The model will be then integrated in the parametrizations to an NPZD-type model driven by the 3D general circulation as simulated by a regional hydrodynamical model.

The ideal candidate should have a solid background in molecular microbiology techniques (PCR, DNA/cDNA library preparation) and in the handling of omics data, with bioinformatics experience in massive sequencing data analysis (metagenomics/metatranscriptomics and taxonomic markers) and multivariate microbial ecology. Experience in global or regional hydrodynamical modeling would be considered a plus.

Requirements:

Doctorate in either Molecular Biology, Microbiology, Oceanic Biogeochemistry or equivalent. Solid experience in microbial genomics, transcriptomics.

A solid background in at least one programming language/environment (Matlab, Python, R, FORTRAN, PHP, or other.) would be highly appreciated.

Desired Qualifications:

Knowledge of marine biogeochemical processes, preferably in Eastern Boundary Upwelling Systems.

Ability to work independently and as a team, interacting cooperatively with people of diverse backgrounds and academic levels.

Excellent communication skills (spoken/written English), be highly motivated, and have demonstrated experience with writing and publishing in international peer-reviewed journals. The initial contract is a one-year position. The appointment could be extended up to 18 months based on satisfactory performance. We will provide competitive salaries/benefits depending on the candidate's qualifications based on center guidelines. The position is available from the first of July 2023. The Postdoctoral Researcher will be co-supervised by C. Henríquez (CEAZA) and V. Garçon (CNRS, France) and will work in a multidisciplinary team that includes specialists in microbial oceanography, physical oceanography, and





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marine biogeochemistry. The project will in particular rely on the collaboration with LOMIC (France), COPAS Coastal at University of Concepción (Chile) and CERFACS (France), and visits to these institutions will be favored during the course of the project. Candidates may apply by submitting a single PDF file, including i) a cover letter outlining the research interests/strengths, ii) CV iii) contact information for at least two references, to Dr. Carlos Henríquez (carlos.henriquez@ceaza.cl) and Dr. Véronique Garçon (veronique.garcon.legos@gmail.com).

References

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- Louca, S. et al., 2016, Integrating biogeochemistry with multi omic sequence information in a model oxygen minimum zone. *PNAS*, E5925–E5933, doi/10.1073/pnas.1602897113
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