

Proposition de sujet de thèse 2026

(A remplir par les équipes d'accueil et à retourner à Isabelle HAMMAD : hammad@cerege.fr
*à renseigner obligatoirement pour la validation du sujet, (1) : A remplir lors de la campagne d'attribution des allocations, à l'issue de la session de juin des Masters

Sujet de doctorat proposé *: [From Surface Microbial Diversity to Deep-Ocean Carbon Sequestration: High-Resolution Insights from Innovative Autonomous Platforms](#)

Encadrant(s), nom, prénom, adresse mail *:

Sophie BONNET, Directrice de recherche IRD, sophie.bonnet@mio.osupytheas.fr

Cécile Guieu, Directrice de recherche CNRS, cecile.guieu@imev-mer.fr

Laboratoire *: Mediterranean Institute of Oceanography (MIO, UMR235), Equipe BIOGEOCHIMIE

Tableau récapitulatif du sujet

Candidat(e) ⁽¹⁾	
Nom - Prénom :	
Date de naissance :	
Licence (origine, années, mention) :	
Mention et classement au Master 1 année (Xème sur Y)	
Mention et classement au S3 du Master 2 (Xème sur Y)	
Mention et classement au S4 du Master 2 (Xème sur Y)	
Mention et classement au M2 (année) (Xème sur Y)	
MASTER (nom, université)	
Sujet de doctorat proposé*	From Surface Microbial Diversity to Deep-Ocean Carbon Sequestration: High-Resolution Insights from Innovative Autonomous Platforms
Encadrants (2 max, indiquer si HDR ou pas)*	Sophie Bonnet (HDR) Cécile Guieu (HDR)
Laboratoire*	M.I.O, Marseille
Programme finançant la recherche (indiqué si obtenu ou envisagé) (1)	Projets européens HOPE (2021-2028) et HARVEST (2026-2031) (obtenus)

Sujet de doctorat proposé*

Intitulé* : [From Surface Microbial Diversity to Deep-Ocean Carbon Sequestration: High-Resolution Insights from Innovative Autonomous Platforms](#)

Descriptif *:

Context and knowledge gaps

The deep ocean (below 200 m) represents ~98% of the ocean volume and plays a fundamental role in climate regulation through the long-term sequestration of biologically fixed carbon (C). This sequestration is partly driven by the gravitational biological carbon pump (BCP), whereby atmospheric CO₂ is fixed by surface phytoplankton and exported to depth as sinking particles ("marine snow"). Without the BCP, atmospheric CO₂ concentrations would be ~50% higher than today (1).

The efficiency of the BCP is largely controlled by nitrogen (N) availability in surface waters (2). Yet nitrate limitation constrains phytoplankton productivity in nearly half of the global ocean (3). In these oligotrophic regions, diazotrophs sustain new production by fixing atmospheric N₂ into bioavailable nitrogen, supporting phytoplankton growth and carbon export through the N₂-primed prokaryotic carbon pump (4). Although biological N₂ fixation is the largest external source of N to the ocean (5), the extent to which diazotroph-derived carbon is transferred to the deep ocean remains poorly constrained. This uncertainty is critical in a

climate-change context, as diazotrophs are expected to become increasingly important contributors to marine primary production (6), while oligotrophic gyres -currently covering ~50% of the ocean- are projected to expand, potentially amplifying their impact on the BCP (7).

Diazotrophs influence carbon export through two main pathways: **(i)** direct export of diazotroph biomass and **(ii)** indirect export, whereby diazotroph-derived nitrogen (DDN) fuels non-diazotrophic plankton that are subsequently exported as aggregates and fecal pellets (8–14). Despite their recognized importance, the relative contributions of these export pathways and the mechanisms regulating them remain poorly constrained. Cruise-based observations from the proposing team indicate that direct export can episodically account for up to ~80% of particulate carbon flux at 1000 m depth (8). However, it remains unclear whether such intense export events are short-lived anomalies or recurrent features of the system, how tightly they are coupled to surface diazotroph dynamics -particularly bloom development- and which physical or ecological conditions initiate and sustain them (**Gap 1**).

Another major knowledge gap concerns the mechanisms linking surface plankton community structure to deep-ocean carbon sequestration. It remains unclear whether sinking particles mirror the composition of surface microbial communities or whether specific taxa are preferentially exported while others are rapidly remineralized in the upper ocean (**Gap 2**). Finally, the relationships between microbial diversity, particle size spectra, particle morphology, and sinking velocities remain largely unexplored, particularly in oligotrophic, stratified regions of the ocean. Observations suggest that *Trichodesmium* blooms produce large, fluffy aggregates sinking at ~100–200 m d⁻¹, whereas nanoplankton-derived aggregates tend to be smaller but denser, sinking more rapidly (~300–500 m d⁻¹) (15). However, available data remain very scarce, limiting our mechanistic understanding and constraining our ability to predict how surface microbial community composition translates into particle characteristics and ultimately controls carbon export efficiency (**Gap 3**).

Until recently, addressing these gaps was constrained by two major bottlenecks: **(i)** the highly transient nature of the processes involved, with blooms and export pulses occurring over hours to days and therefore poorly captured by conventional ship-based sampling, and **(ii)** the difficulty of simultaneously monitoring surface ecosystem dynamics and deep-ocean particle fluxes and carbon content at high temporal resolution over extended periods and under contrasting trophic regimes. Overcoming these limitations requires sustained, high-frequency observations combined with spatially resolved process studies. Within this framework, **HOPE** provides the continuous, high-temporal-resolution observational backbone necessary to capture short-lived events and resolve ecosystem–export coupling from the surface to depth. Complementarily, **HARVEST** introduces a spatial dimension by exploring contrasting trophic and geochemical gradients, enabling the investigation of how varying environmental contexts modulate particle formation and export. Together, these two projects create a uniquely powerful and integrated framework, ideally suited to disentangle temporal variability from spatial controls and to resolve the mechanisms governing diazotroph-driven carbon export across scales.

Objectives

The overarching goal of this PhD project is to quantify and mechanistically resolve how surface plankton community composition shapes deep-ocean carbon export across temporal and environmental gradients. The specific objectives are to:

1. **Constrain the magnitude, variability, and biogeochemical significance of diazotroph-driven carbon export (Gap 1).** Quantify the relative contributions of direct and indirect export over an annual cycle using high-frequency observations, to determine whether intense export pulses are episodic or recurrent and assess their contribution to the yearly carbon budgets.
2. **Investigate the coupling between surface and deep microbial communities (Gap 2).** Determine whether sinking particle assemblages reflect surface microbial communities or result from selective export, and evaluate how this selectivity varies from daily to seasonal timescales.
3. **Link community composition to particle morphological properties and export efficiency (Gap 3).** Establish mechanistic relationships between surface microbial diversity and particle size spectra, morphology, and sinking velocity, and quantify how these properties control carbon export efficiency across contrasting trophic regimes.

Methodology

This project adopts a multidisciplinary approach combining marine biogeochemistry, molecular ecology, and autonomous sensor technologies. It will be conducted in the subtropical South Pacific, a region recently identified as a significant sink for atmospheric CO₂ due to high primary productivity and N₂ fixation (16). The region's physical and ecological gradients, along with its seasonal variability, make it ideal for studying the drivers of carbon export. This PhD will leverage the complementary strengths of two projects: **HOPE**, providing continuous, high-frequency temporal observations to capture transient export events, and **HARVEST**, offering spatially resolved sampling across contrasting trophic and geochemical gradients. Together, these infrastructures enable a uniquely integrated assessment of carbon export dynamics across both time and space.

Objectives 1 and 2 will be addressed using the HOPE instrumented site (Fig. 1).

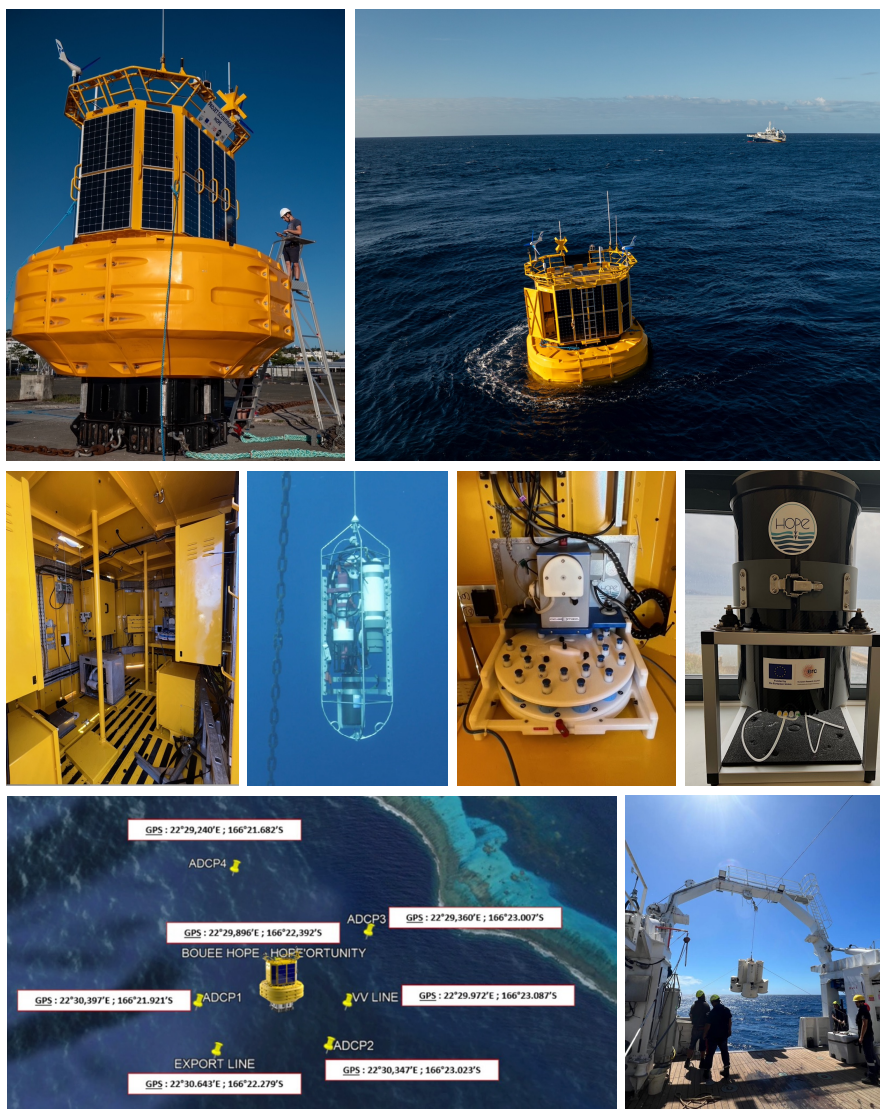


Fig. 1. The HOPE innovative instrumented system, comprising an autonomous smart buoy and a network of 6 fixed moorings. The smart buoy operates adaptively, making decisions based on environmental conditions, and is equipped with a profiling winch carrying a CTD, an Underwater Vision Profiler (UVP), nitrate and phosphate sensors, and an intelligent battery system. The lab of the buoy is equipped with a DNA/RNA autosampler and an automated flow cytometer. It is surrounded by six fixed mooring lines since March 2024 (five physical moorings and one biogeochemical mooring, the “Export-line”). The PhD student will primarily work with data from the smart buoy and the Export-line, which is equipped with approximately 30 sensors and instruments, including eight sediment traps dedicated to OMICS, biogeochemical analyses, and gel-trap imaging. The Export-line is recovered, refurbished, and redeployed every three months onboard the R/V Antea. The HOPE sampling program will conclude in early 2027.

It combines a solar- and wind-powered Smart Buoy with a network of six moorings, enabling high-frequency, long-term observations from the surface to the deep ocean. The Smart Buoy profiles the euphotic zone (0–100 m) every 4h, measuring physical, chemical, and optical parameters, including temperature, salinity, oxygen, PAR, chlorophyll-a, nutrients, and particle abundance and size spectra (UVP). It is also equipped with

an automated CytoSense flow cytometer and a DNA/RNA autosampler, enabling high-frequency monitoring of surface plankton communities, including diazotrophs. The surrounding mooring network images particles every 4h and collects sinking material every 48 h. One mooring line, dedicated to the PhD, includes a UVP and three types of sediment traps deployed at multiple depths for biogeochemical analyses, molecular biology, and gel trap/deep-learning approaches, allowing quantification of both direct and indirect export pathways.

The student will analyze 2 full annual cycles of HOPE observations (2025-2026) ; thus, most of the samples will be available from the beginning of the PhD project. For **Objective 1**, dominant diazotroph groups in sinking particles will be quantified using qPCR, converted into carbon fluxes, and compared to total particulate carbon export. These data will be interpreted alongside high-frequency surface DNA measurements and the full suite of physical and biogeochemical observations to identify the drivers of blooms and export pulses. In parallel, stable nitrogen isotope analyses, performed in collaboration with Texas A&M University (Collaboration Pr Angela Knapp), will provide an independent constraint on diazotroph-derived export, enabling reconstruction of direct and indirect pathways at high temporal resolution.

For **Objective 2**, DNA from surface plankton (buoy autosampler) and sinking particles (sediment traps) will be sequenced using prokaryotic and eukaryotic markers to compare surface and exported microbial communities. These data will be complemented by UVP-based taxonomic information from the buoy (UVP6-HF) and from the Export-line (UVP6-LP) for large particles. Particle size spectra also from UVPs will then be combined with microbial data to examine links between community composition, particle size, and export dynamics. Links with gel traps (PhD Matthieu Savarino ending Oct. 2026, data processed) will also be established for data interpretation.

Objective 3 will be addressed during the HARVEST cruise (December 2027) aboard the *R/V Pourquoi Pas?* (Fig. 2), along a transect from New Caledonia to the Tonga volcanic arc. This region features numerous underwater volcanoes that release iron and promote recurrent *Trichodesmium* blooms (17, 18), contrasting with adjacent eastern waters that are ultra-oligotrophic and exhibit low diazotrophic activity. As a result, surface plankton community composition varies strongly over short spatial scales and will be characterized at high spatial resolution (approximately every nautical mile) using the CytoSense flow cytometer and DNA/RNA autosampler that were originally on the smart buoy. This approach maintains continuity with HOPE instrumentation, but here applied across a broad spatial gradient rather than high-frequency temporal sampling at a fixed station (HOPE observations will have been completed prior to HARVEST). An Underwater Vision Profiler (UVP) mounted on the rosette will measure in situ particle size spectra and morphology at each station. Combining these datasets will allow direct linkage of surface microbial community composition to particle characteristics, revealing how spatial variability in plankton communities influences particle size, morphology, and export potential.

In parallel, six stations with contrasting surface plankton communities and iron conditions will be selected for process experiments. At each station, surface seawater will be collected, preconcentrated, and incubated in rolling tanks to generate particles under controlled conditions. Particle formation and evolution will be monitored daily by imaging to quantify changes in size spectra. After five days of rotation (0.5 rpm), individual particles will be analyzed for size and shape descriptors, and their sinking velocities will be measured to establish quantitative relationships between particle size and sinking velocities as previously done by the proposing team (19). Particles will then be preserved for DNA extraction, molecular and biogeochemical analyses, following the protocols of Objective 2. The presence of ashes close to volcanoes (mineral potentially ballasting particles) in export dynamics will also be explored.

At selected stations (close to volcanoes and control sites), sediment traps will be deployed to allow direct comparison between experimentally generated particles and naturally formed particles collected in situ.

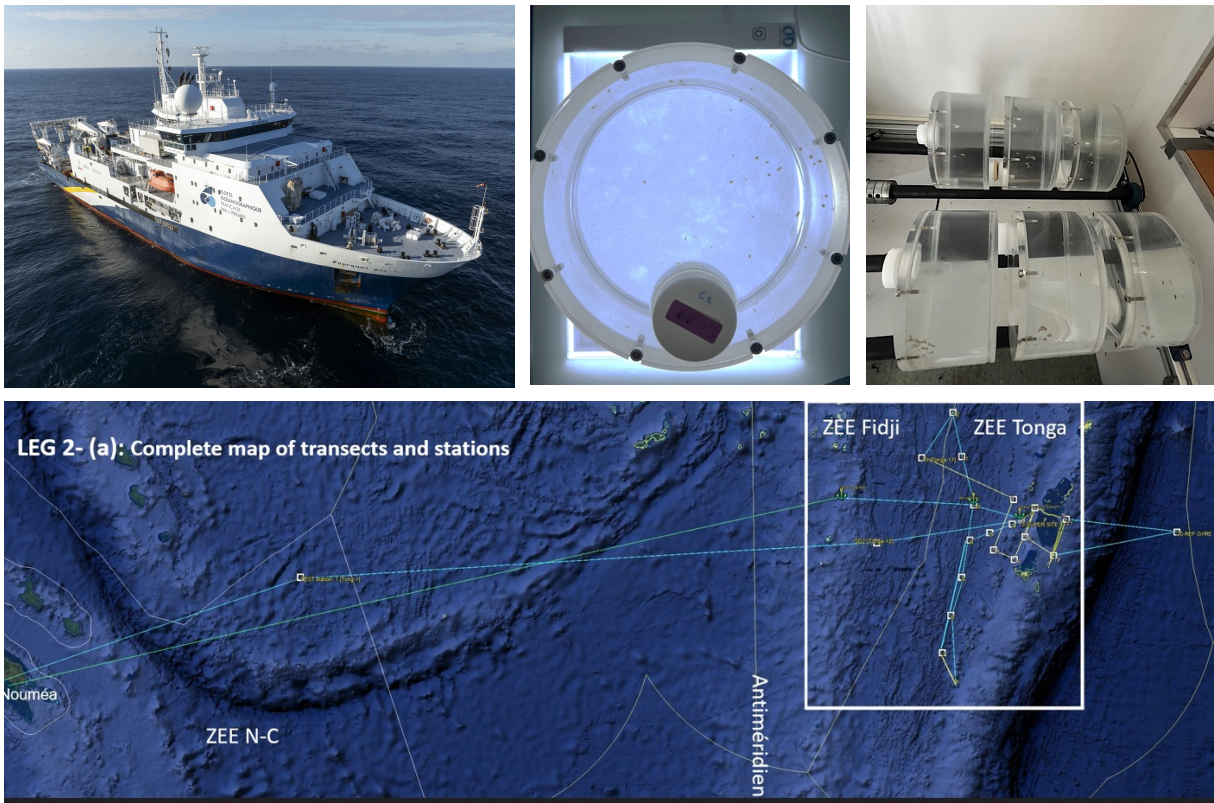


Fig. 2. The HARVEST cruise LEG2 transect planned for November–December 2027 (35 days) aboard the R/V Pourquoi pas? HARVEST aims to investigate how iron released by submarine volcanism stimulates phytoplankton growth, particularly in iron-limited regions of the ocean. Combining ship-based surveys, autonomous platforms, and long-term moorings, and different scale modelling, the project will quantify hydrothermal iron inputs from both shallow and deep submarine volcanoes, track iron transport and chemical transformation toward the sunlit surface layer and assess its impact on phytoplankton communities. Within this framework, the PhD student will focus on linking surface plankton communities to the microbial composition of sinking particles (marine snow) across contrasting geochemical gradients, and on assessing how these relationships shape carbon export dynamics in collaboration with the HARVEST team.

Expected outcomes/ deliverables

This PhD will provide a mechanistic understanding of how surface plankton communities, particularly diazotrophs, drive carbon export to the deep ocean. It will establish seasonal and spatial patterns of particulate carbon export and reveal how microbial composition varies with particle size and with the structure of surface plankton communities and mineral ballast. By linking these patterns to environmental parameters, the project will identify the key drivers controlling export efficiency and particle formation. Importantly, the high-resolution datasets generated, including microbial community composition, particle size spectra, sinking velocities, and direct versus indirect export fluxes, will provide critical empirical constraints for ocean biogeochemical models, such as PISCES, improving their representation of diazotroph-driven processes and particle-mediated carbon fluxes. These insights will enhance predictive capabilities of the biological carbon pump under changing ocean conditions, bridging a key gap between surface ecosystem dynamics, microbial ecology, and deep-ocean carbon sequestration.

Integration within hosts labs & Collaborations

This PhD project is embedded within the M.I.O. cross-cutting research axis “*Biological Pump*” and the Biogeochemistry team, in close collaboration with the CHOC team of LOV (Villefranche-sur-Mer). The PhD candidate will benefit from access to the M.I.O. analytical platforms (OMICS, Imaging, ISOTOP, and Cytometry) and from the dedicated technical support of experienced engineers and technicians who will contribute to the analytical components of the project (Olivier Grosso, Mercedes Camps, Sandra Nunige, and Aude Barani). The project will also rely on national-level logistical and analytical support, including the DT-INSU, the IMAGO service unit in Nouméa (IRD), and the “Cellule Pièges” of Villefranche-sur-mer (support requests already approved).

The PhD student will evolve in a stimulating scientific environment and collaborative research framework, involving leading laboratories in France and abroad. In France, the project connects several UMRs such as the Mediterranean Institute of Oceanography (MIO) affiliated with Aix-Marseille University, and lab partners such

as the Laboratoire d’Océanographie de Villefranche (LOV), LEMAR, GEOAZUR, MARBEC, AD2M and GET, bringing together complementary expertise in marine biogeochemistry, microbial ecology, particle dynamics, and autonomous ocean observing systems.

Internationally, the PhD student will work closely with Texas A&M University (USA), notably with Prof. Angela Knapp, through stable nitrogen isotope ($\delta^{15}\text{N}$) data to interpret diazotroph-driven nitrogen and carbon export fluxes. The project also lies on established collaborations with Duke University (USA) and the University of Haifa (Israel) and research stays may be organized.

Proposed Timeline for the PhD Project

Below is a diagram illustrating the planned timeline of the PhD project.

	ANNEE 1				ANNEE 2				ANNEE 3			
	Tr1	Tr2	Tr3	Tr4	Tr1	Tr2	Tr3	Tr4	Tr1	Tr2	Tr3	Tr4
OBJECTIVE 1												
Bibliographie, prise en main des techniques												
Analyse de la série de 2 ans de pièges à particules (extraction ADN, qPCR)												
Analyses des données biogéochimiques de surface et d'ADN sur périodes sélectionnées (été/hiver)												
Traitement du jeu de données et bilan biogéochimiques												
Rédaction Article 1												
OBJECTIVE 2												
Séquencage des données de surface et de pièges (ADN extrait dans Objectif 1)												
Traitement du jeu de données prokaryotes et eucaryotes et intégration des autres variables biogéochimiques												
Rédaction Article 2												
OBJECTIVE 3												
HARVEST croise												
Traitement des données issues du transect continu de surface et CTD/UVP												
Traitement des données issues des expériences de processus												
Rédaction Article 3												
GENERAL												
100h de cours												
Conferences												
Rédaction thèse sur articles												

Détail du Programme finançant la recherche* :

This PhD project is positioned at the interface of two large-scale, highly ambitious research programs funded by the European Research Council: **HOPE** (*How do diazotrophs shape the Biological Carbon Pump?*, ERC CoG 2023–2028, Bonnet) and **HARVEST** (*Hydrothermal iron from the earth’s interior as fertiliser of photosynthesis in the ocean*, ERC Synergy 2026-2031, Guieu, Sigloch, Lengaigne). It therefore offers the PhD student a unique opportunity to work within an international, cutting-edge scientific environment and to benefit from the expertise of a multidisciplinary team of leading scientists in marine biogeochemistry, microbial ecology, and ocean observing technologies, in addition to be involved with a team of many PhD scientist and post-doctoral researchers from both projects.

The PhD will be embedded in the HOPE project, which has generated an exceptional, high-frequency, multi-annual dataset in the subtropical South Pacific. A large fraction of the observations will already be available at the start of the PhD, allowing the student to rapidly engage in scientific analyses while benefiting from high-quality, state-of-the-art measurements. The HOPE field operations (2.5 years) will conclude approximately six months after the beginning of the PhD, giving the student the opportunity to participate in the final 13-days cruise aboard the R/V *Antea* in New Caledonia (October 2026), as well as in the last phase of operation of an innovative autonomous smart buoy system, before the HOPE team returns to MIO (Marseille) in February 2027. Most of the PhD will therefore take place at M.I.O Marseille. Short stays at the nearby laboratory LOV will be considered for optimal collaboration within the HARVEST framework.

In addition, the student will be involved in the HARVEST 35-day oceanographic cruise in the southwest Pacific aboard the R/V *Pourquoi Pas?* (Nov.-Dec. 2027). This cruise, spanning from New Caledonia to Tonga, will provide a unique spatial perspective that complements the high-frequency HOPE time-series, allowing the student to apply the same observational and experimental approaches across contrasting oceanic regimes. Through this dual involvement, the PhD student will benefit from exceptional scientific exposure, strong international collaborations, and an outstanding research environment at the forefront of ocean science.

Directeur(s) de thèse proposé(s)*

(limiter au plus à deux personnes principales, dont au moins une titulaire de l'HDR)

Directeur HDR proposé*

Nom - Prénom : [BONNET Sophie 70%](#)

Corps : [Directrice de recherche](#)

Laboratoire (i.e. formation contractualisée de rattachement, éventuellement équipe au sein de cette formation) : [M.I.O](#)

Adresse mail : sophie.bonnet@mio.osupytheas.fr

Choix de cinq publications récentes (souligner éventuellement les étudiants dirigés co-signataires) :

[En vert : Doctorants](#)

En gras : encadrants

Bonnet, S., Guieu, C., Taillandier, V., Boulart, C., Bouruet-Aubertot, P., Gazeau, F., Bressac, M., Knapp, A. N., Cuypers, Y., González-Santana, D., Forrer, H. J., Grisoni, J.-M., Grosso, O., Habasque, J., Jardin-Camps, M., Leblond, N., Moigne, F. Le, Dhaussy, A. L., [Lory, C.](#), ... [Tilliette, C.](#) Natural iron fertilization by shallow hydrothermal sources fuels diazotroph blooms in the Ocean. *Science*, Vol 380, Issue 6647, pp. 812-817, <https://doi.org/10.1126/science.abq4654>, 2023.

[Lory, C.](#), Van Wambeke, F., Fourquez, M. Berman-Frank, I., Barani, A., [Tilliette, C.](#), Marie, D., Nunige, S., Guieu C., and **Bonnet, S.** Assessing the contribution of diazotrophs to microbial Fe uptake using a group specific approach in the Western Tropical South Pacific Ocean, *ISME Communications*, 2(1), 1-11, <https://doi.org/10.1038/s43705-022-00122-7>, 2022.

[Ababou, F.E.](#), Camps, M., Le Moigne, F., & **Bonnet, S.** A Mechanistic understanding of diazotroph aggregation and sinking: 'a rolling tank approach. *Limnology & Oceanography*, Vol. 68, Issue 3, 666-677, <https://doi.org/10.1002/lno.12301>, 2023.

[Savarino, M.](#), Le Moigne, F.A.C., Jardin-Camps, M., Ababou, F.E., Grosso, O., de Saint Leger, E., Le Ridant, A., Laurenceau-Cornec, E., Bachelier, C., Vignon, D., **Bonnet, S.** Comparable Carbon Export Fluxes but Divergent Pathways across Contrasting N₂ Fixation Regimes. Authorea, *Global Biogeochemical Cycles* (en révision).

[Chowdhury, S., Berthelot, H.](#), Baudet, C., Gonzalez-Santana, D., Reeder, C., L'Helguen, S., Maguer, JF., Loscher, C., Singh, A., Blain, S., Cassar, N., **Bonnet, S.**, Planquette, H., Benavides, M. Fronts divide diazotroph communities in the Southern Indian Ocean. *FEMS Microbiology Ecology*, <https://doi.org/10.1093/femsec/fiae095>, 2024.

Highlighted as Editor's Choice.

Thèses encadrées ou co-encadrées au cours des quatre dernières années*

Nom : [Caroline LORY](#)

Intitulé : [Rôle des métaux traces dans le contrôle de la fixation d'azote atmosphérique dans l'Océan Pacifique tropical Sud-ouest \(Projet TONGA\)](#)

Type d'allocation : [Contrat de thèse sur projet ANR TONGA](#)

Date de début de l'allocation de doctorat : [01/12/2018](#)

Date de soutenance (si la thèse est soutenue) : [21/06/2022](#)

Programme finançant la recherche : [TONGA \(ANR, AMIDEX, LEFE-CYBER\)](#)

Situation actuelle du docteur (si la thèse est soutenue) : [Post-doctorante dans le cadre d'un projet ADEME dans notre équipe](#)

Pourcentage de participation du directeur à l'encadrement en cas de co-direction : [....70.....%](#)

[3 articles publiés pendant la thèse dont 1 en 1ere auteure + 2 soumis prochainement en 1^{er} auteure.](#)

Nom : [Ababou Fatima-Ezharra](#)

Intitulé : [Rôle des diazotrophes dans la pompe biologique à carbone : Etude des processus d'agrégation, d'export et de reminéralisation.](#)

Type d'allocation : [Bourse ARTS IRD](#)

Date de début de l'allocation de doctorat : 01/03/2020
Date de soutenance (si la thèse est soutenue) : 25/07/2023
Programme finançant la recherche : DOGMA (LEFE-CYBER), TONGA (ANR, AMIDEX, LEFE-CYBER)
Situation actuelle du docteur (si la thèse est soutenue) :
Pourcentage de participation du directeur à l'encadrement en cas de co-direction :60.....%
3 articles publiés durant la thèse, dont 2 en premier auteur et 1 en second auteure + 1 soumis en co-auteur

Nom : Subhadeep Chowdhury
Intitulé : Dinitrogen Fixation in the Indian Ocean: An Inter-basin and Seasonal Comparison
Type d'allocation : Campus France
Date de début de l'allocation de doctorat : 11/01/2021
Date de soutenance (si la thèse est soutenue) : 24/06/2024
Programme finançant la recherche : DINDE (CEFIPRA) et IDEFIX (Pure Ocean Foundation)
Situation actuelle du docteur (si la thèse est soutenue) : Postdoctoral Associate, Bioinformatics Program, Boston University (D. Segré Lab)
Pourcentage de participation du directeur à l'encadrement en cas de co-direction :50.....%
3 articles publiés durant la thèse, dont 2 en premier auteur + 1 en préparation en 1^{er} auteur

Nom : Savarino Matthieu
Intitulé : Rôle des diazotrophs dans la pompe biologique à carbone : voies d'export et déterminisme environnemental.
Type d'allocation : ED251
Date de début de l'allocation de doctorat : 1/10/2023
Date de soutenance (si la thèse est soutenue) : en 3^{ème} année
Programme finançant la recherche : HOPE (UE)
Situation actuelle du docteur (si la thèse est soutenue) : non soutenue
Pourcentage de participation du directeur à l'encadrement en cas de co-direction :50.....%
1 article en révision (mineures) en 1^{er} auteur, 1 second en 1^{er} auteur soumis prochainement et 2 autres à venir.

Nom : Delisée Ambroise
Intitulé : Rôle des diazotrophs dans la pompe biologique à carbone : déchiffrement des voies d'export biologiques (pompe gravitationnelle) et physiques (vitesses verticales) grâce à un couplage de méthodes/capteurs innovants opérant à haute fréquence
Type d'allocation : PPR Oceans & Climat
Date de début de l'allocation de doctorat : 01/10/2024
Date de soutenance (si la thèse est soutenue) : en cours (bientôt en 3^{ème} année)
Programme finançant la recherche : HOPE (UE) et HOPE-VV (AMIDEX)
Situation actuelle du docteur (si la thèse est soutenue) : non soutenue
Pourcentage de participation du directeur à l'encadrement en cas de co-direction :50.....%
1 article en 1^{er} auteur soumis, 1 en révision (en co-auteur), 1 second en rédaction en 1^{er} auteur, 2 autres à venir.

Autre directeur proposé (éventuellement)*

Nom - Prénom : GUIEU Cécile
Corps : Directrice de recherche
Adresse mail : cecile.guieu@imev-mer.fr
Laboratoire (i.e. formation contractualisée de rattachement, éventuellement équipe au sein de cette formation) : Laboratoire d'Océanographie de Villefranche (LOV)

Choix de cinq publications récentes (souligner éventuellement les étudiants dirigés co-signataires) :

En vert : Doctorants

En gras : encadrants

Tilliette, C., Gazeau, F. Portlock, G., **Bonnet, S.**, Guigue, C., Leblond, N., Lory, C., Marie, D., Montanes, M., Pulido-Villena, E., Sarthou, G., Tedetti, M., Vorrath, M.E., Whitby, H. and **Guieu, C.** Influence of shallow hydrothermal fluids release on the functioning of phytoplankton communities. *Frontiers in Microbiology*, 10, 1082077, <https://doi.org/10.3389/fmars.2023.1082077>, 2023.

Tilliette, C., Gazeau, F., Chavagnac, V., Leblond, N., Montanes, M., Leblanc, K., Schmidt S., Charrière B., Bhairy N. & **Guieu, C.** Significant impact of hydrothermalism on the biogeochemical signature of sinking and sedimented particles in the Lau Basin. *Journal of Geophysical Research: Oceans*, 128(12), DOI: 10.1029/2023JC019828, 2023

Tilliette, C., Taillandier, V., Bouruet-Aubertot, P., Grima, N., Maes, C., Montanes, M., Sarthou, G., Vorrath, M.-E., Arnone, V., Bressac, M., González-Santana, D., Gazeau, F., **Guieu, C.** Dissolved Iron Patterns Impacted by Shallow Hydrothermal Sources Along a Transect Through the Tonga-Kermadec Arc. *Global Biogeochemical Cycles*, 36 (7), art. no. e2022GB007363, . DOI: 10.1029/2022GB007363, 2022.

Bonnet, S., Guieu, C., Taillandier, V., Boulart, C., Bouruet-Aubertot, P., Gazeau, F., Bressac, M., Knapp, A. N., Cuypers, Y., González-Santana, D., Forrer, H. J., Grisoni, J.-M., Grosso, O., Habasque, J., Jardin-Camps, M., Leblond, N., Moigne, F. Le, Dhaussy, A. L., **Lory, C.**, ... **Tilliette, C.** Natural iron fertilization by shallow hydrothermal sources fuels diazotroph blooms in the Ocean. *Science*, Vol 380, Issue 6647, pp. 812-817, <https://doi.org/10.1126/science.abq4654>, 2023.

Guieu, C., Bonnet, S., Petrenko, A., Menkes, C., Chavagnac, V., Desboeufs, K., Maes, C., Moutin, T. Iron from a submarine source impacts the productive layer of the Western Tropical South Pacific (WTSP) *Scientific Reports*, 8 (1), art. no. 9075, DOI: 10.1038/s41598-018-27407-z, 2018.

Thèses encadrées ou co-encadrées au cours des quatre dernières années*

Nom : **Louis Petiteau**

Intitulé : **In situ observations of microbial remineralization in the mesopelagic ocean at spatial and temporal scales: towards a better mechanistic understanding**

Type d'allocation : **Allocation ministérielle, ED129, Sorbonne Université**

Date de début de l'allocation de doctorat : **1^{er} octobre 2021**

Date de soutenance (si la thèse est soutenue) : **28 février 2025**

Programme finançant la recherche : **ANR (projet adhoC et APERO) ; LEFE-CYBER projet SEAMER)**

Situation actuelle du docteur (si la thèse est soutenue) : **post-doc Météo-France**

Pourcentage de participation du directeur à l'encadrement en cas de co-direction : **30%**

2 articles publiés dont 1 en 1^{er} auteur + 1 soumis prochainement en 1^{er} auteur

Nom : **Caroline LORY**

Intitulé : **Rôle des métaux traces dans le contrôle de la fixation d'azote atmosphérique dans l'Océan Pacifique tropical Sud-ouest (Projet TONGA)**

Type d'allocation : **Contrat de thèse sur projet ANR TONGA**

Date de début de l'allocation de doctorat : **01/12/2018**

Date de soutenance (si la thèse est soutenue) : **21/06/2022**

Programme finançant la recherche : **TONGA (ANR, AMIDEX, LEFE-CYBER)**

Situation actuelle du docteur (si la thèse est soutenue) : **Post-doctorante dans le cadre d'un projet ADEME dans notre équipe**

Pourcentage de participation du directeur à l'encadrement en cas de co-direction : **30%**

3 articles publiés pendant la thèse dont 1 en 1^{ere} auteure + 2 soumis prochainement en 1^{er} auteure.

Nom : **Chloé Tilliette**

Intitulé : **Influence du fer et autres éléments traces issus des sources hydrothermales peu profondes sur la biogéochimie marine dans le Pacifique du Sud-Ouest**

Type d'allocation : **Allocation ministérielle, ED129, Sorbonne Université**

Date de début de l'allocation de doctorat : **1^{er} octobre 2019**

Date de soutenance (si la thèse est soutenue) : **31 mars 2023**

Programme finançant la recherche : **projet TONGA (ANR, AMIDEX, LEFE-CYBER)**

Situation actuelle du docteur (si la thèse est soutenue) : **IR au LOG (Wimereux)**

Pourcentage de participation du directeur à l'encadrement en cas de co-direction : **50%**

3 articles publiés durant la thèse en 1^{er} auteur, 6 articles en co-auteur

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