BathyBot – the deep-sea crawler to see the unseen of the NW Mediterranean Sea

Christian Tamburini[1*], Carl Gojak[2], Séverine Martini[3], Jacopo Aguzzi[4], Aurélien Arnaubec[5], Laury Barnes-Davin[6], Karim Bernardet[2], Cyrille Blanpain[7], Olivier Bocquet[8], Vincent Bertin[9], Pierre Chevaldonné[10], Paschal Coyle[9], Viorel Ciausu[5], Philippe Cuny1, Xavier Durrieu de Madron[11], Marc Garel[1], Laurence Le Direach[11], Elodie Rouanet[11], Christian Grenz[1], Zouhir Hafidi[2], Didier Mallarino[7], Patrick Lamare[9], Céline Laus[2], Julien Lecubin[7], Dominique Lefèvre[1], Nadine Lebris[13], Karim Mahiouz[2], Simone Marini[14], Marjolaine Matabos[15], Cécile Militon1, David Nerini[1], Thierry Perez[10], Laura Picheral[3], Marc Picheral[3], Romain Piasco[5], Christophe Rabouille[16], Jozée Sarrazin[15], Delphine Thibault[1], Laurenz Thomsen[17]

(1) Aix Marseille Univ, Univ Toulon, CNRS, IRD, MIO, Marseille, France; (2) DT INSU, La Seyne-sur-Mer, France; (3) LOV, Villefranche-sur-Mer, France; (4) ICM-CSIC, Barcelone, Spain; (5) Ifremer, La Seyne-sur-Mer, France; (6) Vicat, L'Isle d'Abeau, France; (7) OSU Pytheas, Marseille, France; (8) Tangram Architectes, Marseille, France; (9) Aix Marseille Univ, CNRS/IN2P3, CPPM, Marseille, France; (10) IMBE, Marseille, France; (11) CEFREM, Perpignan, France; (12) GIS Posidonie, Marseille, France; (13) LECOB, Banyuls-sur-Mer, France; (14) ISMAR, Napoli, Italy; (15) LEP, IFREMER, Plouzané, France; (16) LSCE/IPSL, Gif-sur-Yvette, France; (17) Jacob University, Bremen, Germany

* christian.tamburini@univ-amu.fr

Context. Increasing exploration and industrial exploitation of the vast and fragile deep-ocean environment for a wide range of resources (e.g., oil, gas, fisheries, new molecules, and soon, minerals) raises global concerns about potential ecological impacts (Danovaro et al. 2017). Understanding the distribution, the abundance and dynamics of particulate organic matter and living organisms in the pelagic environment, both in time and space, is therefore crucial to describe and predict the export and sequestration of biogenic carbon in the deep-ocean environment. In fact, this organic matter will partially be sequestered on millenary time scales in the deep ocean, with a strong impact on global change effects.

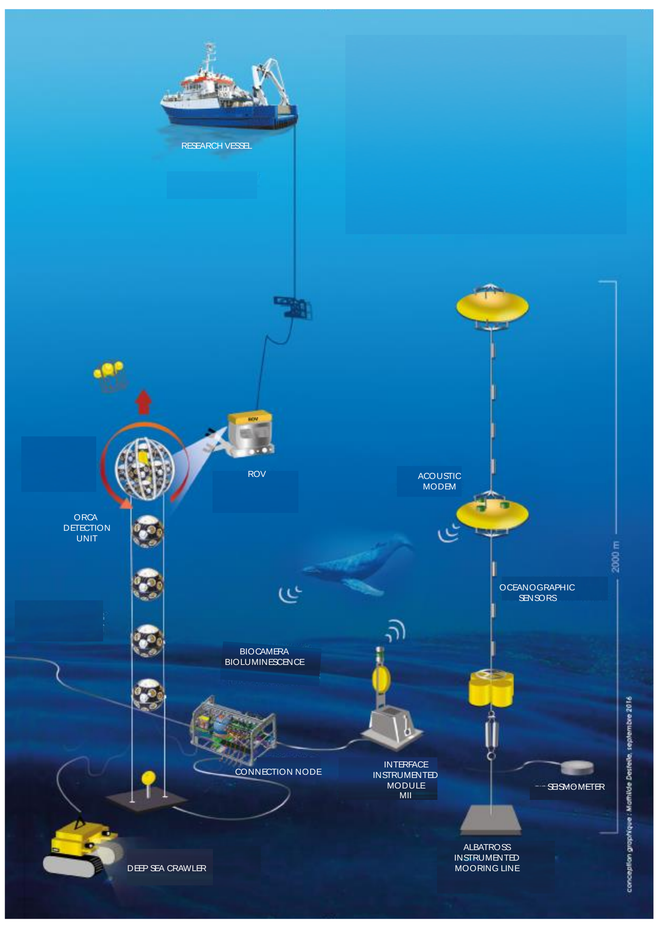
BathyBot will be deployed at 2500m depth, at 40 km off Toulon, near the MOOSE / ANTARES station in the framework of EMSO ERIC infrastructural initiatives. The deployment of a benthic crawler will complement the ALBATROSS-MII pelagic instrumented line, instrumented with oceanographic sensors. This crawler robot will allow acquisitions in real-time to observe the deep marine environment.

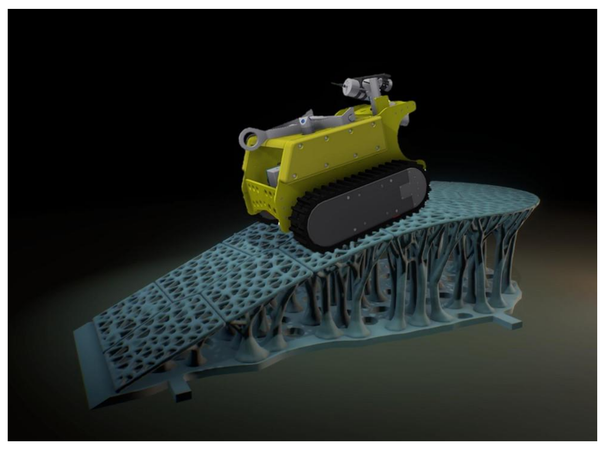
Working area. Over an area of about 15 000 m2, in which a mimetic-inspired deep colonizer will be deposited (**Fig. 2**), BathyBot will be devoted to:

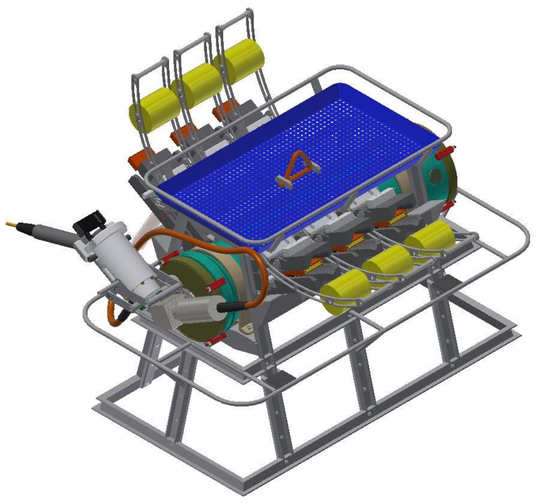
1) Explore relationships between deep-sea organisms, biogeochemical (carbon, oxygen) and environmental variables (temperature, salinity, current) in the context of global changes and their effects on the deep ocean,

2) Better define the role of bioluminescence *in situ* – (Martini and Haddock 2017), increasing the dataset of bioluminescence records,

3) Observe and monitor deep-sea pelagic and benthic organisms.







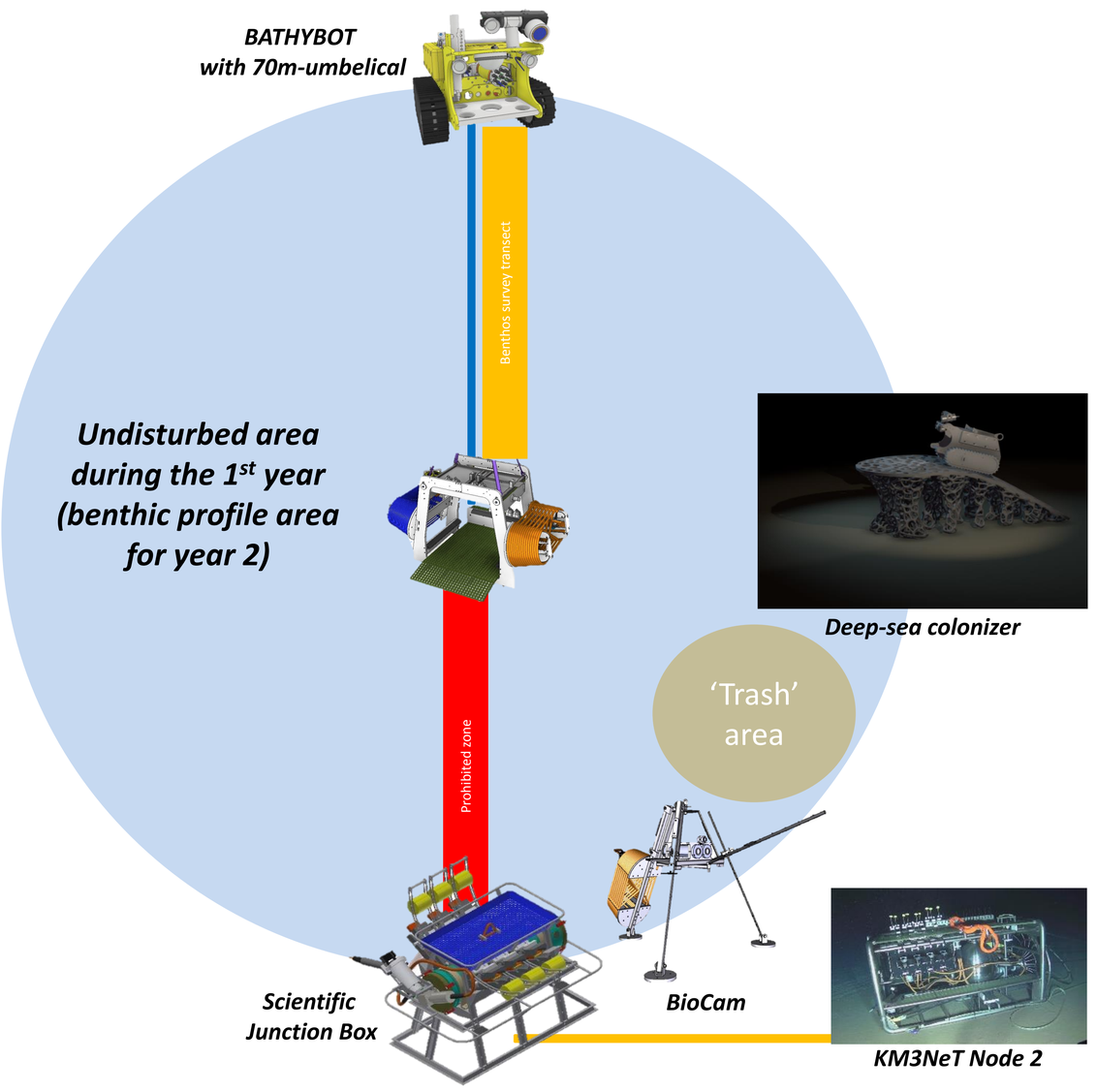


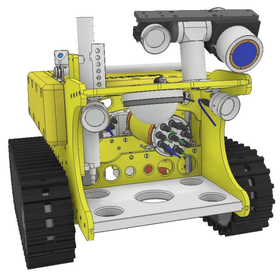
Fig. 1: KM3Net / EMSO West Ligure Node, the mimetic-inspired deep colonizer and the IFREMER Scientific Junction Box (SJB).

Fig. 2: Schematic map of the working zone of the BathyBot at the EMSO/KM3NeT ANTARES site

Instrumentation implemented on BathyBot and its docking station

On BathyBot:

- Microcat SBE37 SMP
- AQUADOPP 2MHz
- Seapoint turbidity meter
- Seapoint chlorophyll sensor
- Sony SNC-VB770 HD camera (Sony SEL24F18 lens)



Other sensors implemented on the BathyBot's docking station (DT INSU concept) are:

- ADCP
- UVP6-LP (new underwater vision profiler) provided by LOV (M. & L. Picheral)

Futur developments (2020-2021):

- Inclusion of an oxygen benthic microprofiler - LSCE

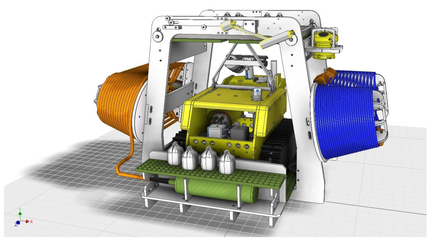


Fig. 3: BathyBot crawler frontview (above) and the BathyBot's dock station.

Scientific aspect. BathyBot is a multi-instrumented Internet Operated Vehicle (IOV). Sensors and analyzers allow sampling the benthic ecosystem in the deep Mediterranean sea. New sensors such as a low light camera are tested (**Fig. 3**). BathyBot will be the benthic infrastructure added to the pelagic line ALBATROSS-MII (**Fig. 1**). This line has been deployed during the initial phase of the project. Such complementarity between the pelagic line and the benthic crawler will be dedicated to the study of organic matter and carbon fluxes with a pelagos-benthos point of view. The goal is to survey continuously environmental and biological variables in order to study the dynamic of exchanges at the interface water column-sediment and the physicochemical processes in the sediment ecosystem (oxygen benthic microprofiler - LSCE); the processes of acidification; the evolution of temperature and the oxygenation of the Mediterranean deep waters; the impact of deep convections on the functioning of deep ocean ecosystems (particles abundance, biodiversity) and the deep-sea bioluminescence.

Thanks to this robot, biodegradation experiments (petroleum hydrocarbons, plastics) will be investigated for a long term survey dedicated to benthic communities changes (micro-, meio-, and macroorganisms) (**Fig. 3**).

A structure open to new collaborations. The deployment and connexion of BathyBot is scheduled for 2019-2020 as part of the FEDER NUMerEnv project. Once a year, it will be recovered for maintenance, instruments calibration, implementation of new instruments and provide future opportunities for new innovative scientific experiments.

Martini, S., & Haddock, S. H. (2017). Quantification of bioluminescence from the surface to the deep sea demonstrates its predominance as an ecological trait. *Scientific reports*, *7*, 45750.

Danovaro, R., Aguzzi, J., Fanelli, E., Billett, D., Gjerde, K., Jamieson, A., ... & Van Dover, C. L. (2017). An ecosystem-based deep-ocean strategy. *Science*, *355*(6324), 452-454.

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