In South Pacific, French and Japanese scientists develop a new generation of underwater observatories

In early May, scientists from the French Research Institute for Exploitation of the Sea (IFREMER) and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) installed a new underwater observation system to study the seamounts in the Coral Sea, south of New Caledonia. It will help develop a new generation of multidisciplinary deep-sea observatories.

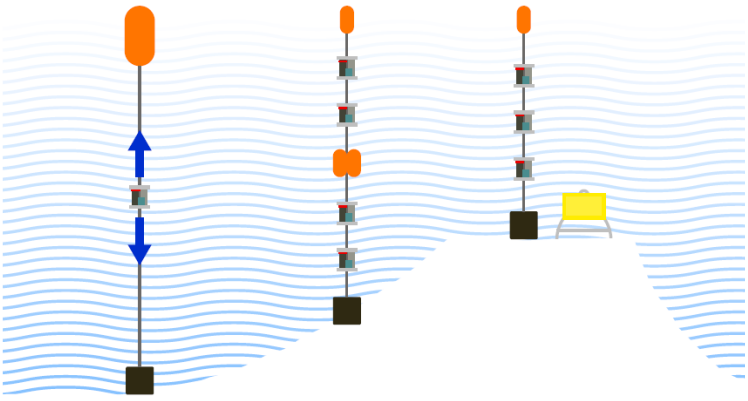
On board of the *Antéa*, scientists from Ifremer, JAMSTEC and IRD are preparing the mooring line that will be observing the seamounts of New Caledonia © Julien Legrand. Ifremer. Kaseaope (2023)

Scientists from the French Research Institute for Exploitation of the Sea (IFREMER) and the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) conducted a scientific cruise in the Coral Sea on board the research vessel *Antea* in early May, to install the first elements of a new generation of ocean observation systems. A first mooring line equipped with sensors and samplers in the whole water column, and the Edokko seafloor observation device equipped with

several HD cameras, have been set up for the next 18 months on the side and top of mount Stylaster, between 500 and 1,200 meters depth. This new observatory will allow to investigate seamount, that are biodiversity hotspots but not fully understood ecosystems of the Coral Sea natural park, one of the largest marine protected area in the world.

> "Direct observation by the Remote Operated Vehicle (ROV) Victor 6000 in 2019 highlighted a large diversity of habitats and faunal communities within seamounts and confirmed the great variability between seamounts suggested by sampling cruises over the last 30 years, **explains Karine Olu, researcher in benthic ecology at Ifremer and directing the Kaseaope cruise**. To understand the drivers of this spatial variability and the dynamics of these ecosystems, scientists developed a modular and mobile observation system more complete than most deep-sea observatories that will allow time series acquisition at high temporal rate."

It will be complemented by 2028, with a profiler mooring sliding along a line to collect data in the whole water column, several instrumented mooring lines at the base and on the sides of the seamount, and an autonomous benthic station on its top. This new generation of deep-sea observatory has been developed to allow a multidisciplinary approach and to ensure long-term study of oceanographic and biological dynamics of seamounts in the Coral Sea. Physical measures such as currents, salinity and carbon flow will help understand the role of seamounts in internal movements of the ocean, while cameras and environmental DNA sensors developed by JAMSTEC will allow to investigate and monitor associated fauna. This system will thus provide precious data for actors involved in the conservation of seamounts in New Caledonia, such as the Coral Sea natural park or the French Institute for Research and Development (IRD).



The complete South Pacific Observatory structure will be composed of several elements in order to observe seamounts from base to top. On the left: the profiler mooring will be installed in 2028. In the middle: the experimental mooring line installed during the Kaseaope-1 cruise. On the right: the autonomous benthic station will be installed in 2024. © Ifremer – Jérémy Barrault

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As part of the ScInObs (Science and Innovation for subsea Observatories) project from Ifremer, this observation system will draw on innovations to address several technological challenges encountered with existing deep-sea observatories. The facility currently experimented in New Caledonia namely aims to reduce the environmental and economic impact of observatories, by reducing the frequency maintenance operations, from once every year for most systems to once every two years. The reduction of installation and maintenance costs as well as efforts for interoperability with other structures also aims to facilitate the replication of these observatories in other insular States in the Pacific.

This project also displays strong international collaboration effort, and contribute to better understanding of the marine environment of south-west Pacific in line with the 2019-2023 roadmap for Franco-Japanese cooperation. The ScInObs project was also labelled by the United Nation Ocean Decade as part of the « One Ocean Network for Deep Observation » which encourage collaboration between the operators of scientific observatories of the deep ocean to foster technological innovation and help understand deep-sea ecosystems and how they are affected by climatic change and human activities.

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