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AUV surveys cold seep sites on the Nile fan

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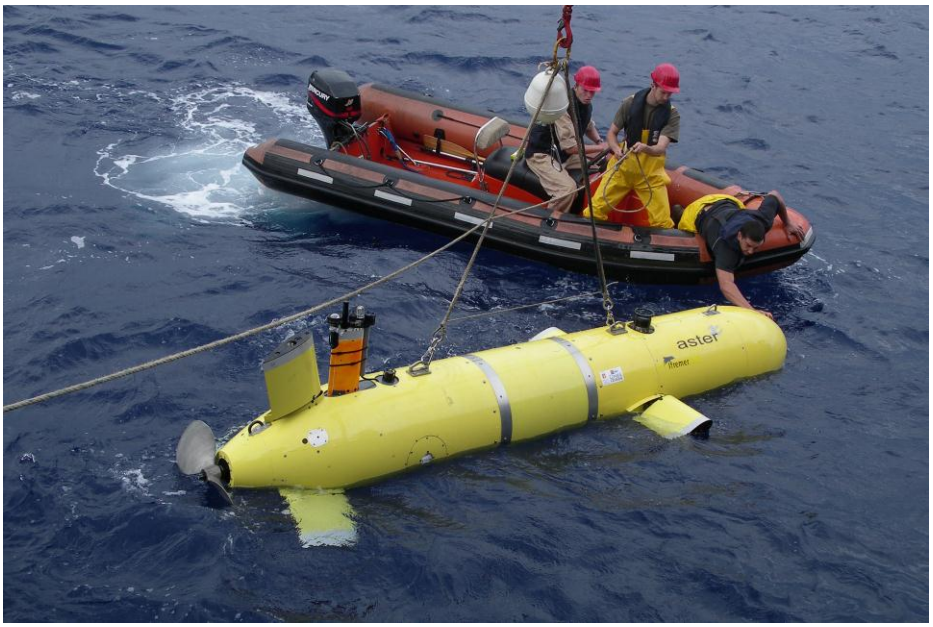
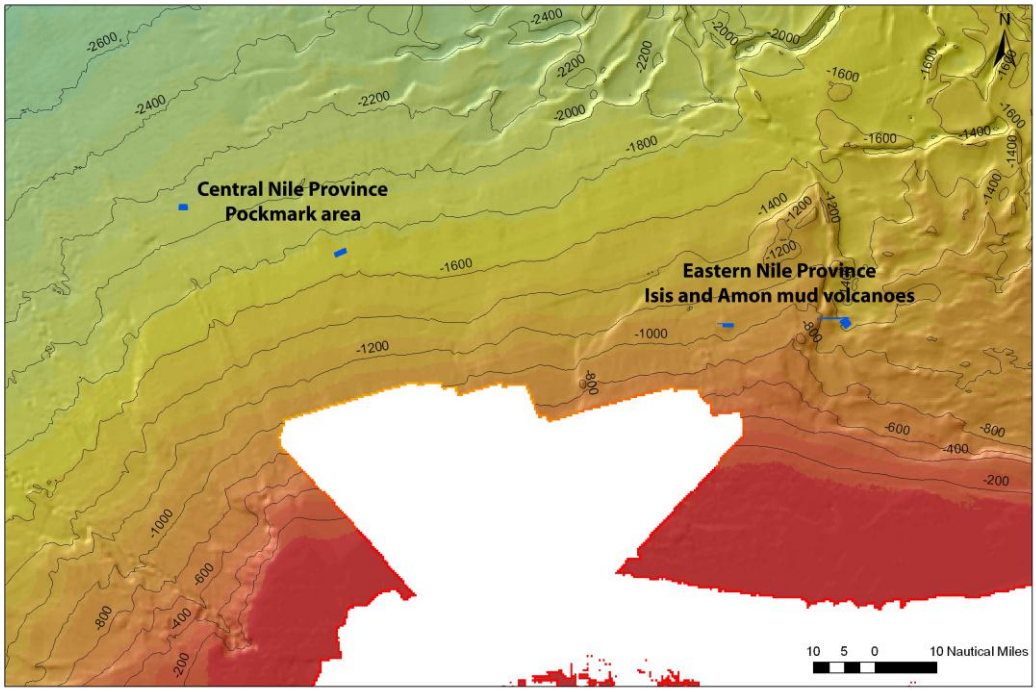
During the first BIONIL leg aboard the German reearch vessel Meteor, from 21 October to 6 November 2006 (Antje Boetius chief scientist) six dives of the Ifremer AUV (Autonomous Underwater Vehicle) Aster[X] were performed at active seep sites of the Nile deep-sea fan. One of the goals was to obtain near bottom high resolution bathymetry and backscatter images to better understand the geological setting of fluid seepage. The AUV was operated in two different configurations: high resolution swath bathymetry using a SIMRAD EM2000 multibeam echosounder (tool provided by Géosciences-Azur) and gas detection, using a SIMRAD EK60 fishery echosounder (Ifremer).

The AUV's main characteristics are the following: a weight of 800kg, an autonomy with payload of 35 km, a working depth max of 2500 m and a survey speed between 1 to 3.5 knots.



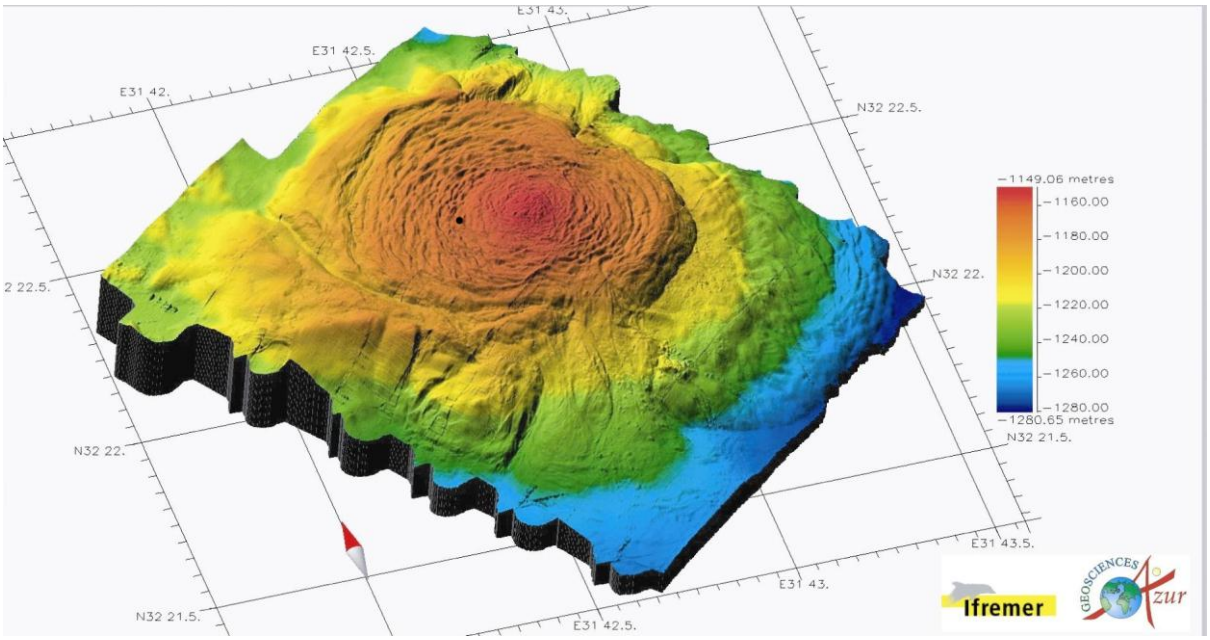
Recovery of the AUV after one of the Bionil dives.

The AUV back section integrates all the equipments of the basic vehicle (thruster, doppler velocity loch, two localization beacons, GPS, and radio antenna for surface telemetry). The middle section (the main hull) contains all the electronic systems together with eight lithium Ion batteries and one safety lead battery. The front section (right side of the picture) is mainly dedicated to external payloads systems such as transducers.
The SIMRAD EM2000 multi-beam echo-sounder which was operated on the AUV at 200 kHz includes 3 components: a processor unit (integrated into the AUV main hull and linked to the payload control computer through the vehicle network), an emitter and a receiver (both installed in the frontal section). The receiver is composed of 111 individual receivers dispatched in a 120° angle. With an ability of the AUV to fly at a fixed distance above the seafloor, the mapping coverage is function of the selected altitude (50 to 70 m altitude on BIONILallowing for a swath of 150-200 m).
During BIONIL five AUV dives were performed using the swath bathymetry configuration and one was using the gas detection sensor.

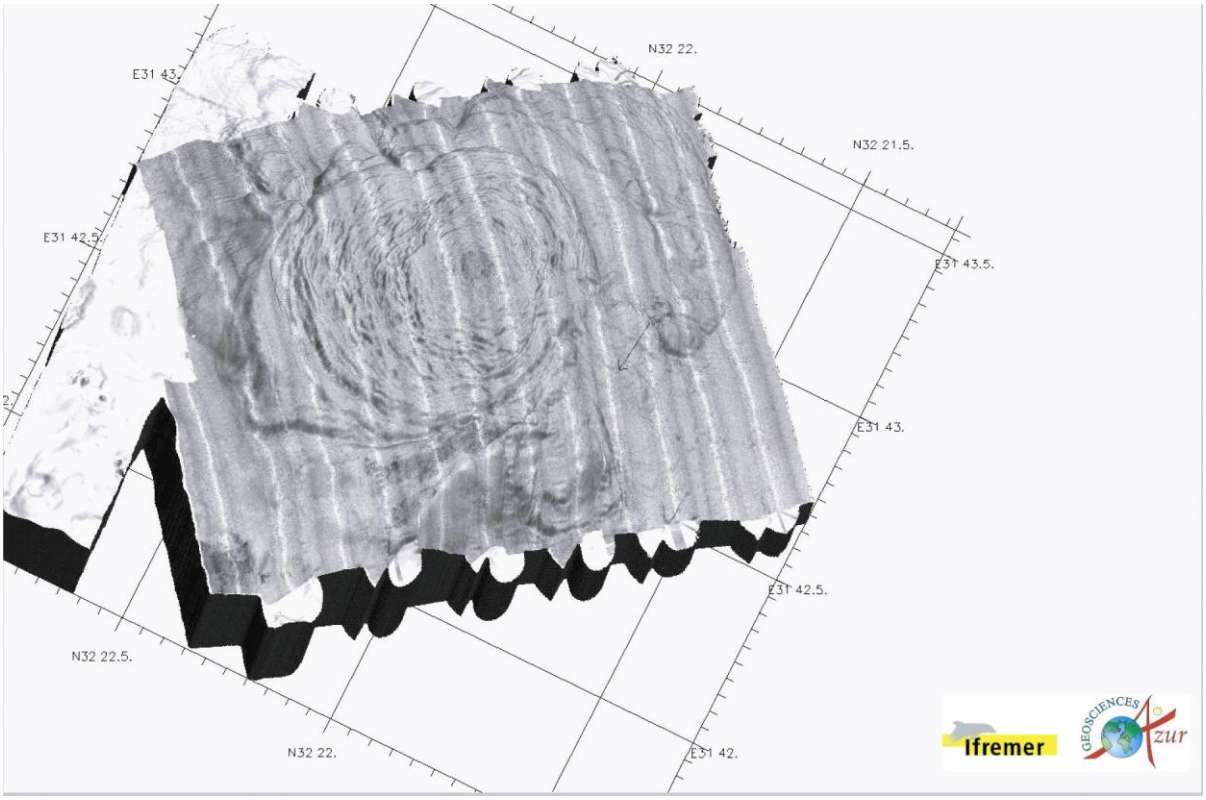


Bionil Leg 1. Blue patches indicate areas where the 6 AUV dives were performed (3 on Amon and Isis gas chimneys from the eastern Nile continental slope, at water depths between 1200 and 1000 m;and 3 others on the so-called pockmark central province at water depths between 1600 and 2150 m). Image : shaded morpho- bathymetric map from MediMap Group, Loubrieu, B. & Mascle, J., 2005. Morpho-bathymetry of the Mediterranean Sea, CIESM/Ifremer special publication, Atlases and Maps, 2 maps at 1 / 2 000 000.

Bathymetric and backscatter data were processed using the Ifremer CARAIBES software ©Ifremer. Amazingly, in less than 2h after the recovery on deck of the AUV, a rough grid was available with a 2 m spacing and could be immediately used for the ROV dives.The backscatter maps could also be displayed.



3 D view of Amon mud volcaoe on the eastern Nile continental slope (data processing by Georges Buffet/Geosciences Azur)



Backscatter imagery of Amon mud volcanoe surimposed on bathymetry (processing Georges Buffet)

During BIONIL cruise the ASTER^{x} AUV traveled for 138.880 m during 40h55min and demonstrates its capacity to dive regularly, and to deliver excellent scientific data, including

gas detection.
We feel that near bottom AUV bathymetric surveys allow to fill the difficult gap of observations between data recorded from surface (swath data) and in situ visual or video observations from submersibles and/or ROV.
The different high resolution data obtained with the AUV are now being reprocessed and relocated to obtain DTMs at 1 meter and even if needed at 50 cm spacing. These maps collected over three targets areas on the Nile continental margin will be available to plan further ROV dives and sampling operations for the HERMES expedition MEDECO scheduled in September-October r onboard the RV “Pourquoi pas?”.