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Cold-water coral ecosystems and anthropogenic impact in two Biscay canyons

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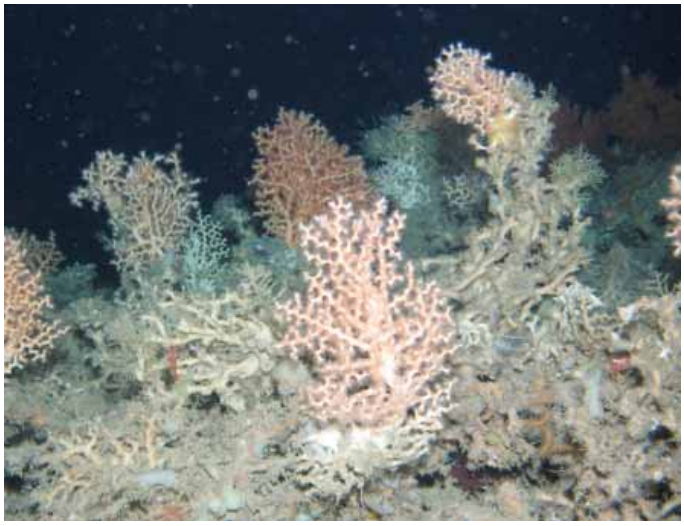

Above: Dead Lophelia pertusa with living Madrepora oculata on top (Guilvinec Canyon)

Since the start of the HERMES and the HERMIONE projects, the margin of the Bay of Biscay has received special attention with respect to benthic ecosystems and sedimentary processes. The area is also known to be the historical cradle of cold-water coral studies by Joubin (1922) and Le Danois (1948). Already at that time the relationship between cold-water corals and fisheries were being discussed (with corals being a nuisance for fisheries!). Having performed previous work in the Whittard canyon (R/V Belgica 2006) and the Guilvinec canyon (R/V Belgica 2008), a joint marine geology and biology cruise was organized by the Renard Centre of Marine Geology and the Section of Marine Biology from Ghent University from 7 to 28 June 2010. The first leg (7-16 June, Zeebrugge-La Rochelle) focused on the Guilvinec canyon, while the second leg (19-28 June, La Rochelle-Zeebrugge) revisited several sites in the central Whittard canyon. The main objectives of this cruise were to (a) map and observe cold-water coral ecosystems on the canyon flanks with ROV Genesis, (b) obtain hydrographic data from CTD casts and water samples and (c) perform seabed multicoring for biology (descriptive and experimental research), biogeochemistry and sedimentology. In total, 23 scientists participated in this cruise, representing 10 institutes, among which were IFREMER, University College Cork and IFM-GeoMAR.

Although the R/V Belgica had to undergo the legendary Biscay weather during the first leg, a total of 12 CTD (and water sample) deployments, 8 ROV dives, 29 seismic lines (417 km) and 17 MUC deployments were realized. The MUC deployments proved very successful because of the USBL-guided positioning, which allowed accurate seafloor sampling together with CTD measurements (a stand-alone CTD was attached to the MUC frame). Seabed sampling and ROV operations in the Whittard area were targeted at the middle branches between 200 and 1400 m water depth, concentrating on the flanks with sometimes steep escarpments. Fortunately, an accurate navigation was assisted through TOBI sidescan sonar imagery from the JC36 cruise in 2009. Not only does the collected dataset provide excellent information on canyon structure, morphology and ecosystems, ROV operations also yielded a spectacular "by-catch" indicating anthropogenic impact.

The Whittard Canyon sediments sampled during this cruise harbour unique meiobenthic communities. Multicore sampling performed in 2006 yielded highly diverse nematode samples, with much greater numbers of genera compared to the Portuguese canyons (Ingels, 2009). In addition, two new species have been identified with endo- and ectosymbiotic prokaryotes. For one of these species, the genus had never before been found in the deep-sea! A high organic load, moderate hydrodynamic disturbance,

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combined with relatively high temperatures and salinity due to the influence of the Mediterranean Outflow Water create a unique benthic habitat with potentially many more discoveries waiting to be made.

Above: Happy UGent biologists retrieving another successful multicore sample!

Cold-water coral ecosystems

Within the Guilvinec Canyon, two ROV dives were performed: one at a small spur on the northwestern flank and one at a ridge southwest of the Penmarc'h Spur. During the first dive (750-950 m water depth), thick cold-water coral rubble graveyards with living corals that had settled on top were encountered. Madrepora oculata and Lophelia pertusa were the most common species here, and were often colonized by sponges, crinoids, antipatharians and soft corals. Also, hard substrate colonized by cold-water corals and antipatharians was observed as well as soft sediment with small boulders characterized by patchy distributions of coral rubble. During the second dive, only soft sediment was observed on the southern slope of the ridge with almost no fauna. On the top of the ridge in a water depth of 680 many trawl marks had scarred the seabed. Going down the southeastern flank of the ridge, dead coral rubble patches alternated with areas covered in boulders. At some locations in this area living cold-water corals (Lophelia pertusa and Madrepora oculata) were seen, living on top of the coral rubble.

Within the Whittard Canyon, a total of 5 successful ROV transects were performed at water depths between 450 and 1040 m. During theses dives, (rippled) soft sediment, often colonized by numerous pennatulids, was seen alternately with hard substrates in the shape of small banks, ridges and/or large cliffs with heights varying between 10 cm and 8 m (even one cliff of about 50 m high). The area was characterised by an irregular topographic relief with steep slopes and frequent evidence of downslope transport. Mostly dead cold-water coral rubble was observed with occasional living cold-water corals (Lophelia pertusa and Madrepora oculata) on top of the rubble. Several Dendrophyllia sp. and Desmophyllum species were noticed, as well as debris from the deep-water oyster Neopycnodonte zibrowii.

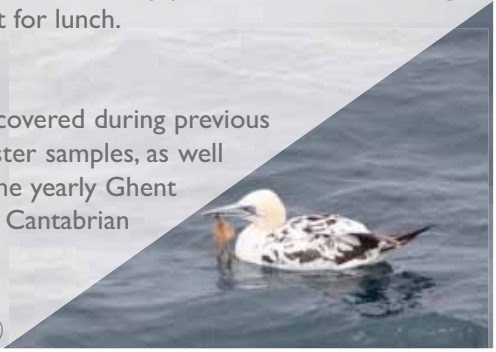
Above: Mission accomplished: time for a BBQ picnic on the afterdeck

Anthropogenic impact

During both legs of this cruise there were clear signs of anthropogenic impact affecting life in and on our seas. A prime example were the long lines that got caught in the TMS of the ROV, forcing the crew to abort the dive and assess the damage back on deck. The fishing lines had blocked the ROV thrusters and were entrained on the spindle of the ROV umbilical cable, dragging corals and oysters in its path whilst retrieving it to the surface. These fishing lines had been laying on the seabed long enough for the corals to start encrusting around it and polyps to start growing on the nylon surface. Even though submarine canyons seem a hostile place to deploy fishing gear, old trawl marks on the seabed gave evidence of destructive fishing activities. The only thing left was dead, broken corals and rubble or even nothing at all, like in the Guilvinec Canyon. There were no signs of live deep-water coral structures previously seen in more sheltered parts of the canyon. Numerous fishing vessels were operating at the Eastern branch of the Whittard Canyon during the HERMIONE JC035 cruise in 2009, presenting evidence of the intensity of fishing practices in this area. As demonstrated here and at numerous other instances, destructive fishing, and the gear left behind, affect benthic life and hamper scientific research with potentially disastrous consequences. Not only was the seabed damaged; numerous observations of seabirds with ropes, hooks and fishing lines entangled around their necks, beaks and legs presented us with a sad reality of how we are so easily capable of destroying life around us. Steaming back, we were at times surrounded by plastics and litter floating on the sea surface, hungry seabirds pecking at it as if they were expecting a treat for lunch.

Future plans

The acquired data of this cruise will be integrated with the existing datasets recovered during previous cruises (Belgica, Pelagia, James Cook, Pourquoi-Pas). The retrieved coral and oyster samples, as well as the fishing gear, are – of course – available for the HERMIONE community. The yearly Ghent University R/V Belgica cruise in 2011 will put further focus on the Armorican and Cantabrian margins.



Right: Gannet probably with fishing hook caught in its beak (courtesy of T. Jauniaux, ULg)