



Deep-sea canyon fauna on the Portuguese margin

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In 2005 a number of research cruises were undertaken as part of the EU Integrated Project HERMES (Hotspot Ecosystem Research on the Margins of European Seas) to study canyon systems on the Portuguese margin. The Nazaré Canyon was chosen as the principal study area. Seabed photography, coring and trawling were taken between depths of 700 and 4300m. The Nazaré Canyon is one of Europe's most dramatic underwater landscape features. It stretches for more than 150 miles from the shores of Portugal out into the abyssal Atlantic Ocean. It is a particularly difficult area to study because of its mountainous topography, high sediment loads and episodic down-canyon flows. Consequently, very little is known of the fauna that inhabit the canyon walls and floor.

The upper part of the Nazaré Canyon (0-2700m) is an active area of sediment transport. Sediment is resuspended regularly by strong tidal currents and high rates of deposition occur (up to 800 g/m²/d). The high level of physical disturbance results in low macrobenthos abundance on the canyon floor. However, greater abundances of macrofauna and megafauna are found higher up on canyon walls including burrowing crustaceans, sessile crinoids, anemones, soft corals and holothurians.

In middle of the canyon (2700-4000m) tidal energy decreases which results in the massive settling of suspended particulate material (SPM) arriving from the upper canyon and the accumulation of organic-carbon rich mud. At about 2700m, high densities of soft corals were seen, which could be related to the higher SPM. At about 3400m on sedimented platforms lying within the main canyon, but to the side of the thalweg (the central channel within the canyon), deposit-feeding holothurians (sea cucumbers) were particularly prevalent, one a burrowing molpadiid species and the other a seden-

tary, but surface-feeding ypsilothuriid species. Molpadiid occur in shallow-water and deep sea fine-grained sediments and are believed to feed head down within the seabed. They have large guts and may incubate sediment with enteric bacteria in order to break down refractory organic matter. The very high abundances of holothurians may indicate high organic matter input, but of material that is refractory. The absence of other megafauna may indicate that the sediment is disturbed frequently by strong currents. Ypsilothuriid holothurians are essentially sedentary. Two of their ten to twelve tentacles are exceptionally long and it is believed they sweep the sediment surface for recently-deposited organic matter. In other deep-sea locations ypsilothuriids generally occur in areas where there is a regular supply of organic matter, such as the base of the continental slope.

The lower canyon (4000-5000m) is characterized by a low energy environment. Sedimentation of pelagic material occurred during most of the year coupled with episodic fluxes of refractory organic material from higher up in the canyon. There is very infrequent (century-scale) disturbance by high-speed turbidity currents. At about 4300m a new xenophyophore, a giant protozoan several centimetres in diameter, was discovered. Although xenophyophores are single-celled, they can grow to a large size using sediment particles to build a protective shell. They come in a wide variety of shapes and sizes. The Nazaré Canyon species is plate-like in form, exceedingly fragile and exhibits unusual features that suggest it represents a new type of xenophyophore. Initial results indicate that fauna directly within canyons are very different from those on the continental slope at the same depth.