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Biogeochemistry of Carbonate mounds from the Pen Duick escarpment in the Gulf of Cadiz

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In the Gulf of Cadiz, carbonate mounds build by cold-water corals were recently discovered on the Renard Ridge, a zone of active fluid flow and mud volcanism. Their sizes vary from 25 to more than 60 m high, at a depth of 520 m and they are aligned along the ridge axis. These mounds, located in the close vicinity of fluid flow markers such as carbonate crusts and mud volcanoes, provided a novel opportunity to study a possible fluid flow control on the mound processes and distribution. Previous geochemical studies on the southernmost mound of the ridge indeed showed that this mound was located on focused fluid flow compared to surrounding sediments, and we observed typical profiles of methane migration and anoxic oxidation (AOM) at 3,8 m below the sea floor within the mound. Such AOM occurrence imprinted a characteristic δ13C signature (down to –21,9 ‰ Vs. PDB) and significantly contributes to the overall carbonate budget of the mound.

During the recent R/V Maria S. Merian cruise (April-June 2006), we sampled by mean of a gravity corer six new structures likely to be cold-water carbonate mounds, along the Pen Duick escarpment and the Renard Ridge. Our aim was to determine if the geochemical profiles observed in the first mound could be generalized to all the mounds in this area.

Each core yielded a full sequence of cold-water corals down to about 5 meters below the sea floor. Hence, the numerous knoll-like structures revealed by high-resolution bathymetry along the ridge are indeed carbonate mounds build by cold-water corals and the entire Ridge has been massively colonized by corals. No live reef-forming

coral could be recovered from the cores, nor observed by towed video instruments. Then, fluid migration seems to be a common feature all along the ridge. However, important discrepancies were observed: methane concentrations are higher and sulfate gradients steeper on both side of the ridge, whereas the central part of the ridge seems less active in term of fluid migration. In this case, the sulfate to methane transition zone could not be reached using conventional gravity corer. In order to obtain the full biogeochemical picture of these mounds, the use of a long piston corer, or drilling devices, will be required.

The reasons of the formation of massive reefs in this area are still unknown and are probably linked to locally enhanced hydrologic conditions. However, it is possible that cold-water coral could have benefited from the hard substrate and the topographic elevations provided by fluid related structures such as carbonate crusts, chimneys and clasts, as observed in several other locations in the Gulf of Cadiz.