PAST COLD-WATER CORAL GROWTH IN THE WEST MELILLA COLD-WATER CORAL PROVINCE, ALBORAN SEA, RELATED TO HIGH PRODUCTIVITY AND CURRENT VELOCITY

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Abstract
The West Melilla Cold-Water Coral Province (WMCP) in the Alboran Sea is characterized by coral carbonate mounds, which presently lack a living cold-water coral ecosystem. Sediment cores from the WMCP have been analyzed to unravel the palaeo-environmental conditions that controlled the growth of cold-water corals in this region in the past. Results show three periods with enhanced bottom currents, productivity and aeolian input characterized by coarser grain sizes, higher Br/Al and Ca/(Ca+Fe) ratios, and Si/(Si+Al) and Zr/Al ratios, respectively. With a stratigraphic framework still lacking, it is hypothesized that improved food supply to the corals, triggered by productivity and bottom current strength, was the dominant forcing factor controlling the vitality of cold-water corals in this region.

Keywords: Alboran Sea, Paleoceanography

Recent investigations in the eastern Alboran Sea (Western Mediterranean), found two different cold-water coral (CWC) mound provinces, with some living CWCs in the East Melilla Cold-Water Coral Province (EMCP) (e.g. Hebbeln et al., 2009) and no living CWCs observed in the West Melilla Cold-Water Coral Province (WMCP) (Lo Iacono et al., 2014). In the EMCP, productivity is thought to be the main factor controlling the thriving of CWCs (Fink et al., 2013), while little is known about the development of CWC mounds in WMCP, which at least under present-day conditions differ significantly from the EMCP by the lack of any living CWC. In order to unravel the development of CWC mounds in WMCP, on-mound and off-mound sediment cores were collected during R/V Maria S. Merian cruise MSM 36 (Fig.1). First results of XRF core scanner and grain size analyses on the off-mound core GeoB 18131, used to assess the regional paleoceanographic setting, show four core sections characterized by high Zr/Al, Br/Al, Ca/(Ca+Fe), and Si/(Si+Al) ratios in core depths of 35 ~ 70 cm, 188 ~ 223 cm, 528 ~ 610 cm and 752 ~ 812 cm (Fig.2), respectively. High values of Zr/Al and Si/(Si+Al) ratios indicate a high content of aeolian input and dry conditions in the area, while high Br/Al and Ca/(Ca+Fe) ratios suggest a high productivity which actually might be triggered by an enhanced aeolian input. The median grain size and the mean grain size curves show three peaks at the same depth levels. This sediment coarsening indicates strong bottom currents, which most likely contribute to the food supply to the filter-feeding corals and, thus, to improve their living conditions. Indeed, food availability and variables such as temperature, dissolved oxygen concentrations, etc. also earlier have been recognized as factors controlling the development of CWCs in the Mediterranean Sea (e.g. Freiwald et al., 2009; Fink et al., 2012; 2013). Although by the time of writing this abstract, the stratigraphic framework in terms of absolute age datings is still missing, we hypothesize that the periods with enhanced productivity and stronger bottom currents provided a proper environment for the growth of CWCs in the WMCP. In contrast, at present productivity appears to be high, shown by Br/Al and Ca/(Ca+Fe) ratios, but bottom current velocities are comparatively low (as shown by the grain size data). The latter fact might explain, why nowadays no living CWCs occur in the WMCP. By the time of the conference, absolute age datings will allow to put these observations into a stratigraphical framework.

References
1 - Fink, H.G., Wienberg, C., Hebbeln, D., McGregor, H.V., Schmiedl, G., Taviani, M., and Freiwald, A., 2012, Oxygen control on Holocene cold-water coral development in the eastern Mediterranean Sea. Deep-Sea Research I, 62, 89-96.
2 - Fink, H. G., Wienberg, C., De Pol-Holz, R., Wintersteller, P., and Hebbeln, D., 2013, Cold-water coral growth in the Alboran Sea related to high productivity during the Late Pleistocene and Holocene: Marine Geology, 339, 71-82.
3 - Freiwald, A., Beuck, L., Rüggeberg, A., Taviani, M., Hebbeln, D. and R/V Meteor M70-1 participants, 2009, The white coral community in the Central Mediterranean Sea - Revealed by ROV surveys. Oceanography, 22, 36-52.
4 - Hebbeln, D., C. Wienberg, L. B., A. Freiwald, P. Wintersteller, and participants, c., Report and preliminary results of RV POSEIDON Cruise POS 385 "Cold-Water Corals of the Alboran Sea (western Mediterranean Sea)", Faro - Toulon, May 29 - June 16, 2009: Berichte, Fachbereich Geowissenschaften, Universität Bremen, 273.
5 - Lo Iacono, C., Gràcia, E., Ranero, C. R., Emelianov, M., Huvenne, V. A., Bartolomé, R., Booth-Rea, G., and Prades, J., 2014, The West Melilla cold water coral mounds, Eastern Alboran Sea: Morphological characterization and environmental context: Deep Sea Research Part II: Topical Studies in Oceanography, 99, 316-326.