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Application of medical X-ray computed tomography in the study of cold-water carbonate mounds

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During the R/V Marion Dufresne 169 'MiCROSYSTEMS' cruise (July 2008) to the El Arraiche mud volcano field in the Gulf of Cadiz cold-water coral mounds were targeted. Four on-mound gravity cores, with a total length of 17.5 m, were obtained for sedimentological and palaeoceanographic analyses in order to unveil the history of the uppermost meters of these cold-water coral build-ups. In parallel, four on-mound cores were taken on approximately the same location for microbiological and biogeochemical analyses. By comparing and correlating both results, more information can be revealed about the processes acting in the dead coral rubble fields which cover these mounds.

Computed X-ray tomography (CT) was used for the identification and quantification of the corals inside the gravity cores. Furthermore, this technique is also useful for the investigation of sedimentological features, i.e. bioturbation, porosity, laminations... In this study, cores were scanned using a medical CT scanner on a relative high resolution which allows the three-dimensional visualization of the corals and sedimentological features. Slices were taken every 3 mm with an overlap of 1 mm.

Based on these data it was possible to delineate different "CT" facies within the cores. On one hand there are intervals with a high amount of corals and on the other hand zones with a very low amount of corals or even no corals at all. In the first case two different facies can be distinguished: one facies with clearly recognizable, well preserved corals, and the second facies with crushed coral fragments. In both facies the corals are embedded in a homogenous matrix. Different facies could also be defined in the intervals containing little or no corals. For example, a homogenous facies with bioturbations and/or cracks. Also an important observation is the presence of pyrite which appears in all cores at a certain depth. Sometimes the pyrite could be observed in bioturbations or inside the corals.

Besides that also the percentage of corals in these gravity cores were quantified using the "Morpho+" software, which was developed at the UGCT (Centre for X-ray Tomography, Ghent University, Belgium). Based on these results, a clear difference can be noticed between the four mounds. On Conger cliff, corals were only observed in the upper 34 cm while in the other locations corals can be found throughout the entire core with significant variations in the amount of corals.

Finally, it was possible to identify different species of cold-water corals, namely *Lophelia pertusa*, *Madrepora oculata*, *Desmophyllum cristagalli* and *Dendrophyllia*. In conjunction with dating and palaeoenvironmental analyses of the corals and the sediment matrix, this can yield valuable information about the build-up of these cold-water coral mounds in the El Arraiche mud volcano field and the palaeoenvironmental characteristics at the time the corals were living.