

MUD VOLCANISM, GAS HYDRATES AND CARBONATE CHIMNEYS IN THE GULF OF CADIZ: RESULTS FROM FOUR YEARS OF TTR CRUISES

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A large mud volcano field, first interpreted on side-scan sonar imaging and later confirmed by coring, was discovered in the Moroccan sector of the Gulf of Cadiz in 1999, during the TTR-9 cruise (Gardner, 2001). Since then, the whole Gulf of Cadiz has been intensively investigated by single channel seismics, long range and deep-tow sidescan sonar, underwater TV, multibeam bathymetry, dredging and coring. The study area is situated close to a major plate boundary, the Açores-Gibraltar plate boundary, in a tectonically complex and active region, characterized by a combination of important strike-slip movement and compressional tectonics related to the Africa-Eurasia NW-directed convergence. Until present, 29 mud volcanoes, located at water depths between 200 and 3500 m, have been identified and confirmed by coring; many other promising targets observed on the available sidescan mosaics await confirmation by groundtruthing. The mud volcanoes vary largely in size; their diameter that can reach over 4 km and their height can attain a few hundred meters. The largest mud volcanoes occur in the Moroccan sector. Gas hydrates have already been recovered from 3 mud volcanoes (Bonjardim, Captain Arutjunov and Ginsburg). The composition of these gases indicates a thermogenic origin and may indicate the existence of oil basins at depth.

A large area covered with carbonate chimneys, related to fluid venting, was also discovered in the northern sector of the Gulf of Cadiz, associated with major NE-SW trending diapiric ridges, in an area characterized by high backscatter on the side-scan sonar mosaics. The carbonate chimneys consist essentially of dolomite and high magnesium calcite. Isotopic studies indicate that these chimneys are methane related, implying the release of a very large volume of methane through these structures.

A combined interpretation of the available side-scan sonar imaging and seismic lines (both single channel and multichannel) shows that most of the mud volcanoes area structurally controlled. In the northern sector, it is possible that the Mediterranean Outflow may have had a role in the methane release through gas hydrate destabilization.