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Methane venting at the Carlos Ribeiro Mud Volcano, Gulf of Cadiz

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Large quantities of organic matter reach the seafloor along many continental margins and, over time, burial of this carbon results in the formation of biogenic methane in the shallow sub-surface and thermogenic methane at depth. In tectonically active areas, such as the Gulf of Cadiz, a complex network of faults provide a pathway for rising fluids and gases to escape into the overlying water column. Given that new mud volcanoes are continually being discovered, right across the globe, it is crucial to understand the contribution of these features to the methane budget of the oceans.
A high resolution geochemical data set has been collected from the Carlos Ribeiro mud volcano on the Portugese margin to study methane emissions both today and in the past. Piston, gravity and mega cores were obtained from five sites located on a 380 m long transect that extends from the apex of the mud volcano to mudflow pathways to the southeast of the crater. Headspace methane concentrations vary from 2 mM at 2 m depth to 0.002 mM at the sediment-seawater interface, indicating that the majority of the methane is consumed within the sediment column and does not reach the seafloor. Results of a 1-D transport-reaction model applied to these methane profiles to estimate methane production and consumption rates will be presented. In addition, past methane fluxes have been assessed by analysis of authigenic barite. As gas-charged fluids in deep-marine settings generally lack dissolved sulfate, but contain elevated concentrations of dissolved barium, barite precipitates when these fluids come in to contact with sulfate in bottom seawater or sediment pore waters in the shallow sub-surface. Consequently, the chemical composition of authigenic barite is likely to record the history of gas venting from the seafloor and acts as a tracer of hydrocarbon oxidation in shallow sediments.