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Integrated geophysical and petrological study of fluid expulsion features along the Moroccan Atlantic margin

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In this study we integrate a geophysical – carbonate petrological data set, collected during the TTR-14 cruise (summer 2004) along the Moroccan Atlantic margin in Gulf of Cadiz (Southern area, 400m – 1000m and El Arraiche mud volcano field). This allows us to investigate the deeper structure and its control on fluid venting, to address the nature of seafloor topographical features, fluid geochemistry and venting processes. The deeper structure of the Southern area is dominated by two NW trending anticlinal acoustic basement ridges. Their northern flank and top is cut by major present-day active, normal faults, along which four dome structures and the Meknes mud volcano (mv), are concentrated. These ridges correspond to rotated, fault-bounded blocks breaking up the top of the accretionary wedge. This indicates the southward prolongation of extensional tectonics and its structural control on mud volcanism, south of the El Arraiche field, which is also evidenced by the typical sandstone mud breccias recovered at the Meknes mv. Carbonate cemented mud breccia from the Meknes (type M) and the Kidd (type K) mv, and cemented sediment portions from Pen Duick Escarpment (type PD), all possess similar carbon isotopic (-19 to -29‰ VPDB) and carbonate geochemical signatures, indicating seepage of a geochemical similar thermogenic hydrocarbon-bearing fluid source. Slightly elevated δ^{18}O values of HMC-cemented type M crusts suggest the former presence and dissociation of gas hydrates. The brecciated fabric, intraclasts and aragonite cement morphology, typical of type K crusts testify of a relative vigorous fluid ascent. HMC-calcian dolomite cemented PD crusts were likely formed under conditions of slower fluid ascent. Their actual near-seafloor occurrence, well above the base of the SRZ, is hypothesized to relate to erosion and migration of the SRZ by variations in upward hydrocarbon fluxes.