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The Mediterranean Ridge 25 years after ODP Leg 160 drilling: New discoveries on mud volcanism and fluid-rock interactions in the Olimpi mud volcano field

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The Mediterranean Ridge (MedRidge) Accretionary Complex has been studied intensely over the past 40+ years in order to understand its formation and role within the Eurasian-African collision zone in the Eastern Mediterranean Sea. Since the early days of exploration, several fluid expulsion features, later identified as mud volcanoes (MVs), were discovered. Additionally, numerous hypersaline deep-water basins (i.e. brine pools) were found scattered across the MedRidge. Pore water geochemistry analyses from past studies showed that the majority of the MVs located south of Crete are influenced by diagenetic processes causing pore water freshening (e.g. clay mineral dehydration) and lead to a lower salinity compared to seawater. However, the pore water geochemistry of the brine pools as well as the Napoli MV, located in the Olimpi mud volcano field (OMVF), showed higher salinities than seawater pointing towards a source of evaporitic deposits.

During R/V SONNE cruise 278 in 2020, 25 years after the ODP Leg 160 drilling campaign in the OMVF with DV JOIDES Resolution, new sediment cores and pore water samples were accurately recovered from seepage structures, after mapping them with AUV micro-bathymetry. We will present the recently acquired data of two MVs (Gelendzhik and Heraklion) in the western OMVF, three in the eastern OMVF (Napoli, Milano and Bergamo MVs) and a brine pool located at the toe of the Bergamo MV. Pore water samples from MVs affected by clay mineral dehydration show decreasing chlorinity, increasing Na/Cl ratios and a constant depletion of SO_4^{2-} due to anaerobic oxidation of methane (AOM), while fluids from the MVs with an evaporitic influence show a decrease in chlorinity and Na/Cl ratios close to 1 (halite dissolution) and a downcore increase in SO_4^{2-}.Some of the most indicative fluid mobile elements in the case of deeply-rooted fluids (boron, lithium and strontium) measured from the highly saline samples suggest different fluid sources. An enrichment of boron and lithium in the pore waters of Napoli and Heraklion MVs point to a mixture of highly saline pore waters with a freshened fluid, whereas the unusually high Sr-concentration [2.2 mM] of Gelendzhik MV in comparison to Heraklion [0.3 mM] and Napoli MV [0.22 mM] hints towards a different source. The location of Gelendzhik MV along a major fault system suggests an influence from greater depth processes (e.g. stratigraphically deeper sediments) in contrast to the source depth of 1-2 km previously determined for the other MVs within the OMVF. These results are in agreement with the recent findings of Nikitas et al. (2021), which connected the sediment extruded at Gelendzhik and Heraklion MVs to sub-salt formations

or source beds of the Messinian Evaporites.

Our findings are expanding the previous assumption that the Napoli MV represents an exception in the OMVF and illustrates the complexity of mud volcanism even at small-scales along the MedRidge Accretionary Complex.

Nikitas, A.; Triantaphyllou, M.V.; Rousakis, G.; Panagiotopoulos, I.; Pasadakis, N.; Hatzianestis, I.; Gogou, A. Pre□Messinian Deposits of the Mediterranean Ridge: Biostratigraphic and Geochemical Evidence from the Olimpi Mud Volcano Field. *Water* **2021**, *13*, 1367. https://doi.org/10.3390/w13101367