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Fluid geochemistry of two active mud volcanoes on the West Nile Delta (eastern Mediterranean Sea)

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Two mud volcanoes (MVs), Giza and North Alex MV, located on the upper domain of the western Nile deep sea fan were intensely investigated with respect to their pore fluid geochemistry. The sediments recovered from the MVs are enriched in petroleum and saturated with mostly thermogenic hydrocarbon gases, interspersed with mud clasts from deeper, compacted source strata and carbonate concretions as well as a few carbonate chimneys, a product of subsurface authigenic carbonate precipitation related to anaerobic oxidation of methane. The fluids from the centre of both MVs are conspicuously depleted in chloride and enriched in boron, which indicates that fluids are derived from mineral dewatering processes at greater depth. Decreasing K and the increasing Na/Cl ratio are known as indicators for smectite-illite transformation during which K and Cl are lost from the pore fluid by integration into illite. This interpretation is supported by positive δ^{18}O (3-6 permille) and negative δ^{37}Cl values of the fluids, which have been shown to fractionate in the respective manner during dewatering reactions. A comparison with data from other cold vent systems in different geological settings denotes that the thickness (and the type) of the sediment cover is the most decisive factor governing the geochemical signature of the fluids. Most of the sediments piled-up at the area of Giza and North Alex MV are volcanogenic sediments from the upper Nile catchment area. Their role as dominant Sr source is indicated by characteristic strontium isotope ratios of the fluids (^{87}Sr/^{86}Sr as low as 0.7066) below seawater values of the last 520 Ma.