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Origin and driving mechanisms of hydrocarbons-enriched mud expulsions at mud volcanoes in the Nile deep sea fan.

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In the Nile deep sea fan (NDSF, African plate), above all mud volcanoes located between 500 and 3000 m water depth, enhanced fluxes of methane and heavier hydrocarbons are encountered in the water column, with up to several tens of μmol/L. These gas plumes can extend to several hundreds of meter up in the water column and, for the shallowest mud structures, can even reach the sea surface.

Salinity of the fluid within the sediment ranges from 10‰ in the eastern NDSF to 150‰ in the western NDSF where brine lakes have been discovered on top of the mud domes. Despite this variability, stable oxygen and hydrogen isotope of H_2O indicate that at all mud volcanoes, fluids originate from deep-seated clay mineral dehydration. Moreover, the stable carbon and hydrogen isotopic composition of the hydrocarbons together with their C1/(C2+C3) ratios indicates a deep source for the gases, mainly thermogenic.

At Isis and Amon mud volcanoes (eastern NDSF), subsequent to each gas expulsion, downward advection of bottom water occurs, as indicated by the compositional and isotopic signature of the pore water indicating a pure seawater signature. This process remains more shallow at the centre of the structure than at the peripheral zone, most likely due to a higher frequency of gas outbursts at the centre. Furthermore, the uprising gases fuel not only the process of anaerobic oxidation of methane, nut also of heavier hydrocarbons.

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