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CRIMEA'S MUD VOLCANOES : AN ONE-YEAR GEOCHEMICAL MONITORING

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Mud volcanoes are widespread geological demonstrations, which imply physico-chemical interactions between at least three elements (clay, water and hydrocarbon) and between three phases (solid, liquid and gas). They occur mainly at convergent margins, like Barbados, Japan, Indonesia, Sicily or Mediterranean ridge. They often are related to deeper hydrocarbon reservoirs, and are therefore interesting both for applied R&D, and for the academic comprehension of their nature. In this study, we worked principally on the Crimea's mud volcano of Boulganack, a two-kilometers caldera with a lot of vents, ranging in size from a few centimeters to 20 meters of diameter. Ten vents were chosen for collecting samples of gas once per week, during one year. Chemical and isotopic (δ^{13}C) analyses of hydrocarbons (C1 – C5 of this thermogenic gas), nitrogen and carbon dioxide were performed. One vent was chosen for nobles gases analyses. This system was studied according to three axes: Matter flows, thermal studies and geochemical analyses. We observed important geographic chemical and isotopic heterogeneities, at the meter scale, and smaller temporal ones at the week scale. Spatial variations are generally most important than temporal variations. All three approaches converge on the transient behavior of the volcanic system. Finally the quantification of matter flows implies that methane was forming a gas phase during a long part of the travel even if it was dissolved in water in deeper area. We suggest two conclusions: the possibility that the surface water flow is only a residue of the global water flow, and/or the possibility of a two steps system, an initial flow of methane dissolved in water, and a shallow chamber where methane would be expressed in gas form while water would be recycled. In this case, in agreement with the observations, we can explain the periodic eruptive character (explosive release of a large quantity of gas) and the irregular activity of the mud volcanoes (discontinuous

gas supply). Lastly, the application of these observations in the marine environment implies that methane would be released on the ocean floor in the shape of micro bubbles of a gas phase.

Noble gas analyses provide more information about the origin (bacterial or thermogenic), the migration, the possible water solubilization, and the residence time. They allow us to define the history of hydrocarbons, and so to understand better the activity of mud volcanoes.