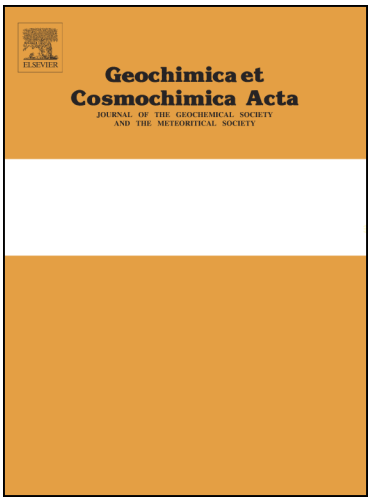

Genesis of mud volcano fluids in the Gulf of Cadiz using a novel basin-scale model approach

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Genesis of mud volcano fluids in the Gulf of Cadiz using a novel basin-scale model approach

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Abstract

Mud Volcanism and fluid seepage are widespread phenomena in the Gulf of Cadiz (SW Iberian Margin). In this seismically active region located at the boundary between the African and Eurasian plates, fluid flow is typically focused on deeply rooted active strike-slip faults. The geochemical signature of emanating fluids from various mud volcanoes (MVs) has been interpreted as being largely affected by clay mineral dehydration and recrystallization of Upper Jurassic carbonates. Here we present the results of a novel, fully-coupled 1D basin-scale reactive-transport model capable of simulating major fluid forming processes and related geochemical signatures by considering the growth of the sediment column over time, compaction of sediments, diffusion and advection of fluids, as well as convective and conductive heat flow. The outcome of the model is a realistic approximation to the development of the sediment pore water system over geological time scales in the Gulf of Cadiz. Combined with a geochemical reaction transport model for clay mineral dehydration and calcium carbonate recrystallization, we were able to reproduce measured concentrations of Cl, strontium and $^{87}Sr/^{86}Sr$ of emanating mud volcano fluids. These results support previously made qualitative interpretations and add further constraints on fluid forming processes, reaction rates and source depths. The geochemical signature at Porto MV posed a specific problem, because of insufficient constraints on non-radiogenic $^{87}Sr/^{86}Sr$ sources at this location. We favour a scenario of basement-derived fluid injection into basal Upper Jurassic carbonate deposits (Hensen et al., 2015). Although the mechanism behind such basement-derived flow, e.g. along permeable faults, remains