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Chemical and Isotopic evidences for thermochemical Sulfate Reduction Occurrence in Permo-Triassic Carbonate reservoirs: SW Iran

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Hydrogen sulfide is generally an undesirable component of natural gas, which can economically affect the process of field development [3]. In recent years, an increasing trend of hydrogen sulfide content from several Permo-Triassic gas reserves has been encountered in southwest Iran. Despite the limited produced volume of H2S, its stable upward production trend has become worrisome, as it may lead to significant facilities damage in the near future. Thus, a meticulous study is required to be conducted to detect the mechanism of H2S generation in the study area. In this study, laboratory results of the molecular and isotopic composition of gas samples, molecular data on associated condensate, and isotopic analyses of sulfur in rocks were utilized to determine the origin of the souring process. Anhydrite δ34S changes from +8.95 ‰ to +32.14 from the Permian to Triassic, respectively, confirming the curves of Claypool [2] and hydrogen sulfides δ34S varies from -7.3 to -11.8 ‰ in all reservoir units [1]. The difference in values verifies the kinetic sulfur isotope fractionation during abiological S-O bond rapture. Moreover, relatively high reported temperatures (â ‘‘100°C) deny any feasibility of bacterial activities in the given reservoirs. Biomarker analysis implies a suboxic to oxic depositional environment for the source rock, at which condition the source may not contain organic sulfur compounds. Consequently, thermochemical sulfate reduction (TSR) has been proposed as the driving factor for the souring phenomenon in the study area. Gas chemistry and isotope data demonstrate that as TSR procced a direct relationship between gas dryness and produced H2S, an increase in δ13C value of remaining methane occurred.

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