Geochemical characterization and interpretation of Khuff Reservoir Fluids, North Dome

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The North Dome structure is the largest single gas reservoir in the world. Despite the importance of these reserves several important questions regarding the reservoir fluids remain poorly addressed and unsatisfactorily answered.

The aim of this study was to geochemically characterize and interpret: (1) the acid gas (H2S, CO2); (2) the gas condensates; and (3) the organic-rich layers occurring in the Upper Khuff reservoirs of North Dome.

The study has focussed on two main questions:

(1) Are the Silurian Hot Shales the only hydrocarbon source rock for these Khuff reservoirs?

The Silurian Hot Shales have been considered the only hydrocarbon source rock for these Khuff reservoirs in the Qatar Arch. Molecular and isotope geochemistry of these condensates, and the intra-Khuff organic-rich layers, demonstrate that a single source rock is unlikely.

(2) What is the origin, or origins, of the acid gases (H2S and CO2), and methane, and why don't the condensates appear to be thermally altered?

Thermo-chemical Reduction of hydrocarbons by sulphates (TSR) can partly account for the occurrence of acid gas. The occurrence of TSR generated gas can be unequivocally demonstrated by isotopic (ƒÔ13C, ƒÔ2H, ƒÔ34S) and molecular geochemical (occurrence of the thiadiamondoid series) studies. Analysis of mass balance of condensate thermal alteration shows that secondary cracking of the condensates could not have generated all the methane in place.

GENERAL CONCLUSIONS

The studies have show that the characterization, interpretation and distributions of the Khuff hydrocarbons, and their associated gases, is highly complex - being multiphased and strongly linked to the burial history, structuration of the field, reservoir sedimentological heterogeneity and regional setting. Hence, the only way to better understand and eventually predict these fluids is by applying multiscale and pluri-disciplinary approaches.