GEOCHEMICAL CHARACTERIZATION AND ORIGIN OF NATURAL GASES OF RESERVOIR ROCKS IN DEZFUL EMBAYMENT, IRAN

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Introduction

More than ninety oilfields have been discovered since oil was first discovered in Dezful Embayment. However, the majority of these oilfields contain intermediate °API gravity oils with limit associated gas but a few oilfields contain a huge amount of gaseous and condensate hydrocarbons. Previous geochemical works indicated that there are five petroleum systems in the basin, among which the most famous is the Middle Cretaceous–Early Miocene Petroleum System (Bordenave, 2002; Bordenave and Hegre, 2010). This petroleum system comprises two reservoirs (the Asmari and Bangestan Formations) with two active source rocks (the Albian Kazhdumi Formation and the Middle Eocene to Early Oligocene Pabdeh Formation) (Opera et al., 2013). The most generated hydrocarbons in the Basin originated from Albian organic-rich shale containing Type II or mixed Type II/III kerogen. Total organic carbon (TOC) content of this shale ranged from <1 to 5+ weight percent, Hydrogen Index (HI) values ranged from less than 150 to 450+ and T_{max} values ranged from 425 to 450 °C. In addition, vitrinite reflectance values ranged from 0.6 to 0.9 %R (Alizadeh et al., 2012). Nonetheless, geochemical data on gases and our knowledge of their geochemistry in this area have been disregarded for years. Knowledge of gas formation and accumulation can be gained based on gas composition and molecular isotopic C, H and O compositions. Several The main objective of this study is to provide an overview of geochemical characteristics of these gases, as well as identifying their sources and constraining the thermal evolution of major gas source rocks. A set of nine gas samples from two oilfields were analyzed for isotope and chemical composition. This would help to better understand petroleum systems in this area.

Results

The gases studied are dominated by methane with nitrogen and H_2S being the main non-hydrocarbon components present. Based on the results obtained, the gases appear to be predominantly marine-sourced and thermogenic gases. The gases studied are subdivided in three thermal-distinctive groups: (1) low-maturity thermogenic (the Asmari and the Bangestan reservoir gases of the Marun oilfield, (2) moderate-maturity thermogenic (the Asmari reservoir gases of the Pazanan oilfield), and (3) high-maturity thermogenic gas (the Khami reservoir gas of the Pazanan oilfield). The presence of H_2S gases in the Bangestan reservoir of the Marun oilfield ($\delta^{34}S$ = -1.2) is the result of thermal cracking of S-bearing compounds in the oil; the newly-formed H_2S gases were stopped from migrating to the Asmari reservoir by the means of the Bangestan's cap rock. However the only sample from Asmari reservoir in Marun oilfield showing $\delta^{34}S$ values is Sample MN-As 4 ($\delta^{34}S$= +3.5), resulted from introduction of two gases to Asmari reservoir, first injection of Pazenan gases ($\delta^{34}S$ =+9.5) into the related section for maintaining pressure, and second, migration of Bangestan gases into the Asmari reservoir due to casing rupture.

Conclusion

According to the results, all of the studied samples are thermogenic in nature and are derived from Type II kerogen. Yet, the natural gases taken from both reservoirs of the Marun oilfield

(Asmari and Bangestan) are isotopically slightly lighter than those from Pazenan, probably due to the presence of lower mature gases or mixing. Sample Mn-As-4 is slightly heavier (less negative value), possibly due to the injection of gases from the Asmari reservoir of the Pazenan oilfield, to maintain the pressure of sector. The natural gas samples studied could be classified in three distinctive groups:

Natural gases taken from the Pazenan oilfield could be the result of mixing of two or more thermogenic gases, multiple expulsions-phases mixed with gases from previous expulsion-phases from Kazhdumi source rock at higher levels of maturation due to deeper depth of burial. Burial history reconstruction of the source rock in the Pazenan oilfield (Fig.1) showed that Kazhdumi source rock maturation at the axis of the synclines could have reached as high as 1.2% Ro; therefore, the gases in the Asmari reservoir of the Pazenan oilfield, like the Marun oilfield, would have also derived from the Kazhdumi shales.

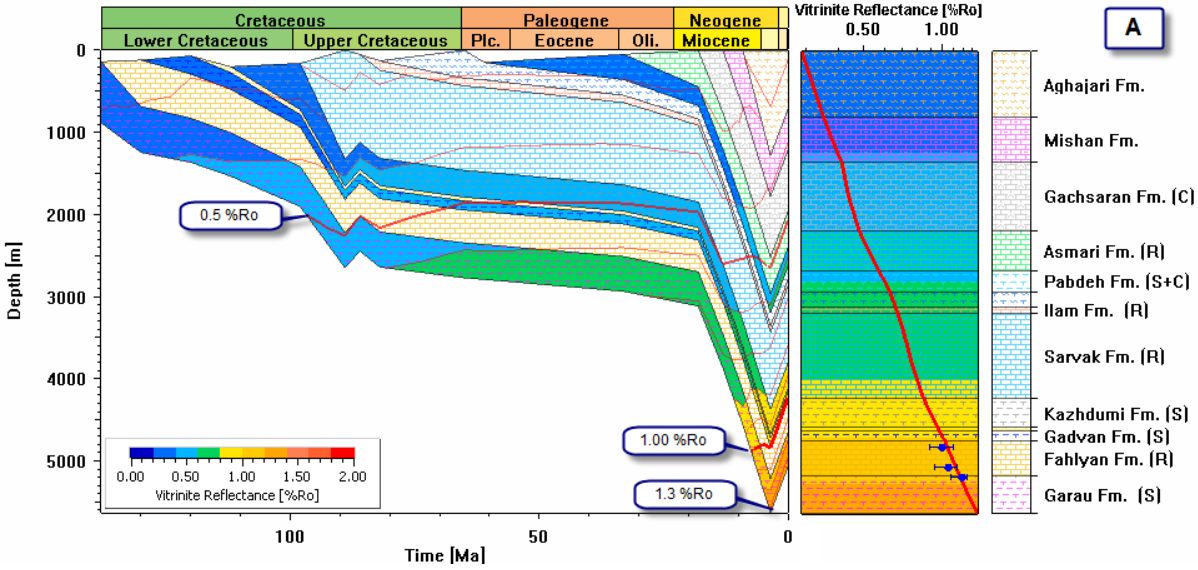

Figure 1 *Burial and temperature histories Pazenan-17*

Acknowledgment

The authors wish to thank the National Iranian South Oil Company (NISOC), especially the Research and Technology office, for the provision of the financial support of the project.

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