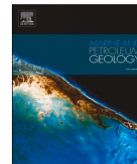




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Relationship between structural style and the petroleum system in the siba gas field, southern Iraq

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ABSTRACT

The Siba gas field is the only non-associated gas field in southern Iraq, located in an area primarily for oil production. The study aimed to identify the reasons for gas generation and accumulation in the field's Lower Cretaceous Yamama reservoir and the source of the gas. The study focuses on seven wells from the field, namely Siba-1, 4, 5, 6, 7, 8, and 9, and the structural and tectonic settings of the field were studied by interpreting seismic data. Geometric analysis showed that the Siba field is a non-cylindrical, asymmetrical, open, anticlinal fold. The anticline is northeast-southwest-trending with two culminations, of which the northeastern one is the higher by about 100 m. The Siba field overlies deepest parts of the Mesopotamian foreland basin, almost adjacent to the Zagros orogenic front, where burial depth and thermal conditions were ideal for organic-matter maturation and increased pore pressures that lead to hydrocarbon migration from Middle Jurassic source rocks to the Lower Cretaceous Yamama Formation reservoir. The geochemical parameters of oils from the Yamama Formation are like those of oils from Sargelu Formation in adjacent fields, indicating that the Middle Jurassic Sargelu Formation is the most likely source of Siba hydrocarbons. Vitrinite reflectance and thermal analyses of oils from the Yamama reservoir (0.87% R₀; 128.1 °C) and from the Sargelu Formation (1.36% R₀; 156.96 °C) show that only the Sargelu Formation had the right burial depths and temperatures in this area during Miocene deformation to source Yamama hydrocarbons in the Siba field. Although the anhydrites of the Upper Jurassic Gotnia Formation form a prominent regional seal separating Jurassic source rocks from Cretaceous reservoirs, structure-contour maps and seismic analyses indicate that many faults and fractures, mostly related to Miocene deformation, penetrate Gotnia anhydrites. Hence, the study interprets that these faults, as well as facies changes on the margin of the Gotnia basin, seriously impaired the Gotnia seal, allowing the vertical migration of hydrocarbons from the Middle Jurassic Sargelu Formation into the Lower Cretaceous Yamama reservoir in the Siba field.

1. Introduction

As natural resources, oil and gas play an important role, not only among individuals and companies in Iraq, but also among other countries around the world. Siba is a major gas field in southern Iraq and the only one producing natural gas from the Lower Cretaceous (Berriasian–Valanginian) Yamama reservoir. Yamama Formation is one of the most significant hydrocarbon reservoir formations in southern Iraq,

containing significant amounts of oil in most fields of southern Iraq. Although clearly a prolific reservoir rock (Sadooni, 1993; Aqrawi et al., 2010; Chafet, 2016), some researchers also consider the Yamama Formation to be a source rock (Handhal et al., 2020; Al-Khafaji et al., 2019).

This study deals with the origin of that gas, both from a structural point of view as well as from the view of its relationship to hydrocarbon migration and the high thermal maturation that led to gas generation.

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