

Hydrocarbons generation potential of the Jurassic–Lower Cretaceous Formation, Ajeel field, Iraq

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Abstract Organic geochemical analysis and palynological studies of the organic matters of subsurface Jurassic and Lower Cretaceous Formations for two wells in Ajeel oil field, north Iraq showed evidences for hydrocarbon generation potential especially for the most prolific source rocks Chia Gara and Sargelu Formations. These analyses include age assessment of Upper Jurassic (Tithonian) to Lower Cretaceous (Berriasian) age and Middle Jurassic (Bathonian–Tithonian) age for Chia Gara and Sargelu Formations, respectively, based on assemblages of mainly dinoflagellate cyst constituents. Rock-Eval pyrolysis have indicated high total organic carbon (TOC) content of up to 18.5 wt%, kerogen type II with hydrogen index of up to 415 mg HC/g TOC, petroleum potential of 0.70–55.56 kg hydrocarbon from each ton of rocks and mature organic matter of maximum temperature reached (T_{max}) range between 430 and 440 °C for Chia Gara Formation, while Sargelu Formation are of TOC up to 16 wt% TOC, Kerogen type II with hydrogen index of 386 mg HC/g TOC, petroleum potential of 1.0–50.90 kg hydrocarbon from each ton of rocks, and mature organic matter of T_{max} range between 430 and 450 °C. Qualitative studies are done in this study by textural microscopy used in assessing amorphous organic matter for palynofacies type belonging to kerogen type A which contain brazinophyte algae, *Tasmanites*, and foraminifera test linings, as well as the dinoflagellate cysts and spores, deposited in dysoxic–anoxic environment for Chia Gara Formation and similar organic constituents deposited in distal suboxic–anoxic environment for Sargelu Formation. The palynomorphs are of dark orange and light brown, on

the spore species *Cyathidites australis*, that indicate mature organic matters with thermal alteration index of 2.7–3.0 for the Chia Gara Formation and 2.9–3.1 for the Sargelu Formation by Staplin's scale.

These characters have rated the succession as a source rock for very high efficiency for generation and expulsion of oil with ordinate gas that charged mainly oil fields of Baghdad, Dyala (Baquba), and Salahuddin (Tikrit) Governorates. Oil charge the Cretaceous–Tertiary total petroleum system (TPS) are mainly from Chia Gara Formation, because most oil from Sargelu Formation was prevented passing to this TPS by the regional seal Gotnia Formation. This case study of mainly Chia Gara oil source is confirmed by gas chromatography–mass spectrometry analysis for oil from reservoirs lying stratigraphically above the Chia Gara Formation in Ajeel and Hamrine oil fields, while oil toward the north with no Gotnia seal could be of mainly Sargelu Formation source.

Keywords Source rocks · Palynomorphs · Hydrocarbon generation · Middle Iraq

Introduction

The study area of Ajeel oil field is located in the low folded zone of the Zagros Fold Belt with transition toward northern part of the Mesopotamian Foredeep Basin (Fig. 1a) and geographically within Salahuddin Governorates in the east of Tigris River between the cities of Tikrit and Beiji. Structurally, Ajeel oil field is of double-plunging anticline trending NW–SE with closure of 150 m in height and 10 km long on top of the Qutnia Formation (Fig. 1b). This field is part of many fields of structurally oriented NW–SE within northern part of adjacent to the low folded zone of the Zagros Fold Belt.

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