

Cretaceous Lithostratigraphy of Eastern Jeza - Qamar Basin and its Hydrocarbon Potential, Dhofar, Oman

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Abstract

Jeza-Qamar Basin is a roughly east-west oriented, funnel-shaped basin which straddles across Dhofar (Oman) and Mehra (Yemen) border. The basin tapers to the WNW direction and widens ESE-ward to the coastal region of the two countries. It is filled by Jurassic and Cretaceous succession, the former being confined in the axial center in Yemen. The Cretaceous strata onlap uplifted flanks of the basin, becoming progressively younger towards the highs, the western Fartaq High margin in Yemen and the eastern Marbat High margin in Oman. In the Omani portion of the basin (Dhofar), Barremian to Maastrichtian strata that include, in an ascending order, Qishn, Kharfot, Dhalqut, Qitqawt, Samhan and Sharwayn formations fill the basin. The lower three formations are the focus of current project and consist of prominent intervals with promising petroleum elements. The Qishn Formation (Barremian to middle Aptian) is characterized by a 40 m-thick basal sandstone (Shabon Mb), a middle lime mudstone to packstone lithofacies and subordinate dolomudstone interbeds (Hinna Mb) and an upper bioclastic packstone to grainstone lithofacies with pervasive, sucrosic dolostone interbeds (Hasheer Mb). The latter is unconformably overlain by the Kharfot Formation which is characterized by Orbitolina-rich marls that grade into bioclastic packstone to rudstone lithofacies. Dhalqut Formation conformably overlies the Kharfot Formation. The former consists of three members, Umbaraaf, Khadrafi and Sarfait, in ascending order. The Umbaraaf Member is characterized by Orbitolina-rich shales and marles interbedded with oyster- and rudist-rich biostromes and capped by storm-deposited, locally sandy, bioclastic and oolitic packstones and grainstones. The Khadrafi Member consists of bioclastic wackestone, packstone and grainstone (locally rudistic biostromes) and Orbitolina-rich marls. The top of the member is marked by a thick, fine-grained, calcisphere-rich mudstone and shales. The Sarfait Member is defined by thickly to massively bedded, bioclastic wackestone to rudstone lithofacies with subordinate coarse-crystalline dolostone layers. The most attractive reservoirs in this stratigraphic succession are the Shabon sandstones (□ up to 25%) and Hasheer dolomites (□□ up to 15%) and the cleaner carbonate lithofacies of the Dhalqut Formation (□ up to 15%). The late Jurassic Madbi shales and Naifa carbonates, rock units that sourced the oil in the adjacent Say'un-Al-Masila Basin, occur in the axial part (Yemen) of the Jeza-Qamar Basin. Samples collected from outcrops of the studied section show less than 1% TOC content; however, further work is needed. Structural elements associated with opening of the Gulf of Aden and lateral facies changes define significant structural and stratigraphic traps. Existence of tight mudstone, wackestones, shales and marls (e.g., the Hinna Mb and the Kharfot and Dhalqut formations) are considered to be potential cap rocks that could seal potential hydrocarbons in the reservoir horizons of the studied Cretaceous sequence. Further good news is a recent gas discovery in the Yemeni side of the basin; it underscores existence of a healthy petroleum system within the basin.