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Sedimentology, rhythmicity and basin-fill architecture of a carbonate ramp depositional system with intermittent terrigenous influx: The Albian Kharfot Formation of the Jeza-Qamar Basin, Dhofar, Southern Oman

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ABSTRACT

The Albian Kharfot Formation is preserved in the eastern margin of the Jeza-Qamar Basin which straddles across the Oman–Yemen border. This study addresses the sedimentological attributes of the formation and deduces its depositional setting, cyclicity and relative sea level changes in local (within the basin) and regional (Arabian) contexts. The interaction among siliciclastic influxes, in-situ carbonate production and tectono-climatic controls on the stacking nature of the various lithofacies that build-up the formation is discussed. In the study area, the formation lies unconformably over Barremian–Aptian Qishn Formation and conformably under late Albian–?Turonian Dhalqut Formation. The Kharfot Formation thickens from ~140 m in the eastern side of the study area to ~300 m at the Oman–Yemen border. It consists of eight lithofacies: *Orbitolina*-rich marls, peloidal bioclastic packstone, bioclastic mudstone to wackestone, argillaceous, bioclastic floatstone to rudstone, bioclastic rudstone, sandy, peloidal, bioclastic mudstone to packstone, peloidal, bioclastic grainstone and dolostone. The vertical arrangement of these lithofacies defines recurring meter- to decameter-scale, shallowing-upward units deposited on a westward-deepening inner- to outer-ramp setting. Tectonic rejuvenation of the siliciclastic source area was accompanied by warm, humid climatic conditions as suggested by high kaolinitic marls of the Kharfot Fm. and coeval quartz-rich sandstone units (Harshiyat Fm.). The shallowing-upward rhythmic sedimentation of the formation has close resemblance with cycles of the Nahr Umr Formation in northern Oman and partially comparable with the global sea level changes. The Kharfot basin was an intrashelf depression that was part of the much larger Arabian epeiric platform. The latter is defined by a rimmed margin in northern Oman where Al-Hassanat Formation represents platform margin deposits and Nahr Umr Formation representing back-rim intrashelf depression which received fine-grained siliciclastic influx from the land (westward). In southern Oman where Kharfot Formation accumulated, the platform was unrimmed ramp type basin with high fine clastic influx along with elevated carbonate production.

1. Introduction

The Mesozoic sedimentary sequence of the Arabian Peninsula is dominated by a thick succession of carbonate rocks deposited in vast, epicontinental, epeiric platform. The succession is well known for its prolific hydrocarbon production, and intensive research in various aspects of the strata has been rigorously going on for the past scores of years. Oman occupied an important place in the Arabian Peninsula, being located at the eastern margin of the platform. The Cretaceous System of the Sultanate is dominated by shallow marine carbonates punctuated by unconformities and subordinate clastic rocks (Hawkins et al., 1981; Harris et al., 1984; Houghs Clarke, 1988; Hughes and Beydoun, 1992). This is also true in most of the neighboring countries of Arabian Peninsula as the region was a site of extensive shallow marine carbonate platform during the Mesozoic Era (Beydoun, 1970; Murris, 1980; Alsharhan, 1995; Ziegler, 2001). The Jeza-Qamar Basin is among a set of Mesozoic rift basins that occur in the eastern margin of the Arabian Peninsula, including Yemen and southern Oman (Beydoun, 1964, 1966, 1970, 1991; Beydoun and Greenwood, 1968) (Fig. 1). The basin lies across the Oman–Yemen border and its sedimentary fill started in the Jurassic Period (Beydoun et al., 1996; Brannan et al., 1997). Progressive filling allowed sedimentation to reach in later stages in the uplifted flanks of the basin (Roger et al., 1987). In the eastern margin of the basin (the Marbat High), the oldest post-rifting

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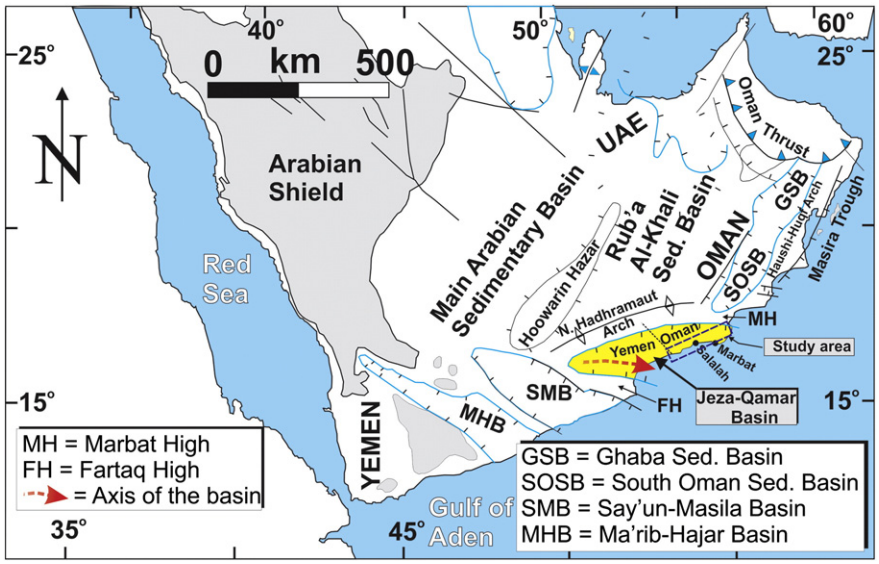

Fig. 1. Location of the Jeza-Qamar Basin lying across the Oman–Yemen border. The studied area forms roughly the easternmost one-third of the basin. The axis of the basin lies in the Yemen side of the basin and preserves oldest (Jurassic) Mesozoic strata in the basin. Sediments onlapped the uplifted shoulders of the basin [i.e., Marbat High (MH) to the east and Fartaq High (FH) to the west]. The oldest strata in the study area are Lower Cretaceous (Barremian) in age.

sediments are the Barremian to Aptian Qishn Formation (Salad Hersi et al., 2014; Fig. 2). It is unconformably overlain by Albian to ?lower Turonian Qamar Group which consists of Kharfot Formation and conformably overlying Dhalqut Formation (Platel et al., 1987a; Roger et al., 1987, 1989). Previous work on the Mesozoic succession of the eastern (Oman) side of the basin (e.g., Platel et al., 1987a,b,c; Roger et al., 1987, 1989; Khalifa, 1988; Qidwai, 1988) was in the scope of regional mapping with minimal consideration of their lithostratigraphic attributes, depositional setting and tectono-eustatic controls of the basin-fill architecture. Recently, an intensive research project addressing the Cretaceous sequence of the Jeza-Qamar Basin in Oman has been launched and the results of the project have been partially

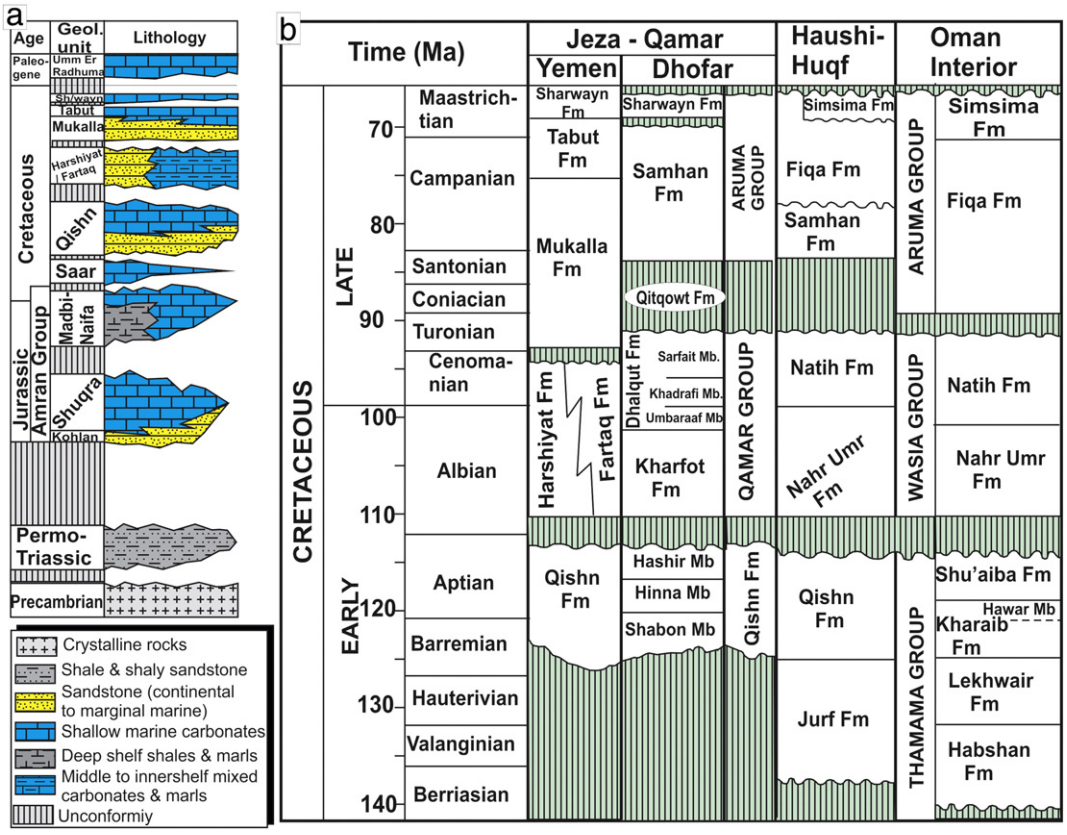

Fig. 2. a) The Cretaceous stratigraphic nomenclature, lithology and prominent unconformities of the western portion (Yemen) of the Jeza-Qamar Basin. b) Lithostratigraphic nomenclature of the Cretaceous strata in the study area and their correlatives in eastern Yemen (Mahra Region) and other regions in Oman. The Kharfot Formation laterally merges to Frataq Formation (mixed fine clastics and carbonates) which in turn merges to the (lower) Harshiyat Formation (mainly continental to marginal marine sandstones). Compiled from Brannan et al., 1999, Roger et al., 1987 and Immenhauser et al., 2004.