Upper Paleocene to lower Eocene microfacies, biostratigraphy, and paleoenvironmental reconstruction in the northern Farafra Oasis, Western Desert (Egypt)

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ABSTRACT: Three Paleocene–Eocene (P-E) stratigraphic transect sections namely, from the north to south, Ain Maqfi, Farafra-Ain Dalla road, and El-Quess Abu Said in the northern Farafra Oasis, Western Desert (Egypt) are described and interpreted based upon field observations, microfacies analysis, chronostratigraphy and foraminiferal paleobathymetry, to detect the effect of the Syrian Arc Fold System (SAFS) on the lateral and vertical facies changes, various stratigraphic breaks and to reconstruct the depositional paleoenvironments. Lithostratigraphically, the P-E successions are composed of the upper part of the Dakhla Formation, Tarawan Chalk and Esna Shale Formation. Vertical and lateral facies changes are noted between tectonic paleo-highs and paleo-lows in the Farafra Oasis. Eight microfacies types are recognized. The larger benthic and planktonic foraminiferal zones are here used to correlate the shallow and deeper facies. Two larger benthic (SBZ4 and SBZ6), six planktonic foraminiferal (P4–E4) and one calcareous nannofossil (NP9b) biozones are identified. The recorded basal Eocene Dababiya Quarry Member (DQM) within the Esna Shale Formation in the central Farafra Oasis is represented by units 4 and 5 of the DQM at its GSSP with a neritic facies types. Towards the northern part of the Farafra Oasis, the P-E interval occurs within the base of the Maqfi Limestone Member that contains the larger benthic foraminiferal SBZ6 Zone and is correlated with the DQM. A major sea-level fall near the upper part of P5 Zone, followed by a prominent sea-level rise with a minor hiatus across the P-E interval in the Farafra Oasis reflects the complex interplay between sea level changes and tectonic signatures. Two inferred paleoenvironments, namely inner neritic and mid-outer neritic shelf have been identified.

Keywords: Paleocene; Eocene; microfacies; biostratigraphy; paleoenvironment; Farafra Oasis, Egypt, Syrian Arc Fold System.

INTRODUCTION

The Farafra Oasis is the second largest depression in the Western Desert of Egypt and one of the best localities to study the Upper Cretaceous–lower Paleogene stratigraphic successions in Egypt due to their excellent exposures (text-fig. 1). It has received much attention by many paleontological and stratigraphical studies that have greatly contributed to the understanding of its geological evolution and stratigraphy (e.g., LeRoy 1953; De La Harpe 1883; Schwager 1883; Zittel 1883; Youssef and Abdel-Aziz 1971; Khalifa and Zaghloul 1985; Abdel Kireem and Samir 1995; Boukhary et al. 1995; Strougo and Hewaidy 1999; Wielandt 1999; Strougo and Faris 2000; Hewaidy and Strougo 2001; Hewiady et al. 2006; Haggag et al. 2010; El Ayyat 2013; Orabi and Zaky 2016; Abu Shama et al. 2018; Faris et al. 2018; Sherif et al. 2019). On the other hand, only a few studies have been focused on the P-E interval (e.g., LeRoy 1953; Youssef and Abdel-Aziz 1971; Strougo and Hewaidy 1999; Farouk 2016). In spite of previous work, the Paleocene–Eocene (P-E) interval still represents a stratigraphic problematic point due to the tectonic movements that affected the Farafra Oasis and resulted in complicated stratigraphic relationships represented by vertical and lateral litho-biofacies changes. The P-E interval is clearly observed with different recorded time gaps even on the land marker exposed sections such as at north Gebel El-Gunna (see Abdel Kireem and Samir 1995; Haggag et al. 2010; Abu Shama et al. 2018; Faris et al. 2018). Therefore, the present work sheds light on the Farafra Oasis through a detailed study using the planktonic and larger benthic foraminiferal (LBF) biostratigraphy.

The objectives of the present study are to: 1) document the lithological and stratigraphical variations from north to south; 2) determine the presence of the P-E interval based upon planktonic and larger benthic foraminiferal biostratigraphy in addition to calcareous nannofossils; 3) correlate the basal Eocene in different depositional settings based upon lithostratigraphic position and biostratigraphic results to introduce an accurate chronologic relationship between the Maqfi Limestone Member and the Dababiya Quarry Member (DQM) in the study area; 4) infer the paleoenvironments based upon facies characteristic and foraminiferal parameters; 5) evaluate the effect of the Syrian Arc Fold System (SAFS) on the sedimentation and microfacies changes along reefal to slope environments.

REGIONAL AND GEOLOGICAL SETTING

Egypt is tectonically subcategorized into less deformed stable shelf (central and south Egypt) and tectonically deformed unstable shelf (northern Egypt) that is geologically known as the SAFS (Said 1962; Farouk 2016). The SAFS is formed as a con-