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New findings in the Eocene stratigraphy of Siwa-El Qara stretch, north western desert, Egypt

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ABSTRACT

The Upper Hamra Member of Said and Issawi (1964) is a clastic/carbonate succession at Qor El Hamra east of the Bahariya Oasis in the Western Desert, Egypt. Earlier, the authors changed this member into a new informal name, the Al Humaymat formation (Priabonian) at the Siwa Oasis, which consists generally of carbonate sediments and overlays the mushroom rock of the Mokattam Formation (Late Lutetian). The thickness of the Al Humaymat formation is about 22 m recorded at the El Qara section and at the El Arag section reaches 5 m, where the collected fauna from this formation is represented by larger foraminifera *Nummulites fabianii retiatus, Gaziryina* aff. *pulchellus, Silvestriella tetraedra* and *Grzybowskia* sp. are assigned to Late Eocene (Priabonian). The base of the Al Humaymat formation is composed of grey marl to varicolored small scale tabular cross-bedded limestone, which reflects sheet flood deposits with a great unconformity surface; the middle part is composed of reefal limestone and sandy limestone. The upper part of this formation is characterized by earthy white limestone, which is overlain by very hard brown ferruginous paleosol bands and pockets, which represent distal floodplain deposits.

Here it is interesting to notice that the Early and Late Priabonian decrease in depth of the sea over the studied area seems to be a reflection of a global decrease in depth of the sea as suggested from eustatic curves published by Haq et al., l987.

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1. Introduction

A study of the lateral and vertical variation in the sedimentary facies of the Eocene succession in the Western Desert trend is necessary as no satisfactory classification of these sediments exists and correlation with the type section in Europe complex.

The Eocene of the Siwa Oasis was relatively neglected in spite of the fact that it represents a significant part of the stratigraphic sequence in the region. Recently some authors (e.g., Selim et al., 2012; Sallam et al., 2015; Wanas et al., 2015) reported the occurrence of continental deposits in the Mid-Eocene (Bartonian) rocks, where the interest in alluvial-lacustrine deposits has increased worldwide as a tool to detect climatic changes.

A thorough knowledge of various aspects of the Eocene geology is very important for the global understanding of the structural evolution of the Siwa Oasis. This is because a report on petroleum resources of the Western Desert north of latitude 28° N suggests that approximately 90% of oil and 80% gas reserves await discovery (Hegazy, 1995). In order to evaluate oil exploration in Western Desert it is important to study the sedimentary rocks in the area utilizing petrographic and paleontological data from field and laboratory observations.

The Siwa area was chosen for this work and also as part of this study the Eocene oil bleeding limestone was cored in Burg El Arab (north Western Desert). A careful examination of the new geological map of the two sections El Arag and El Qara (Fig. 1) and introduced by Orabi et al. (2015) enables us to establish a regional picture of sedimentation and facies variations of the Eocene units in this area.

The fundamental aim of this study is to understand the Eocene stratigraphy of the area that covers the El Arag and El Qara sections (Western Desert, Egypt) and to correlate the stratigraphy between the localities.

2. Geological setting

In the northern part of the Western Desert, between the Ras

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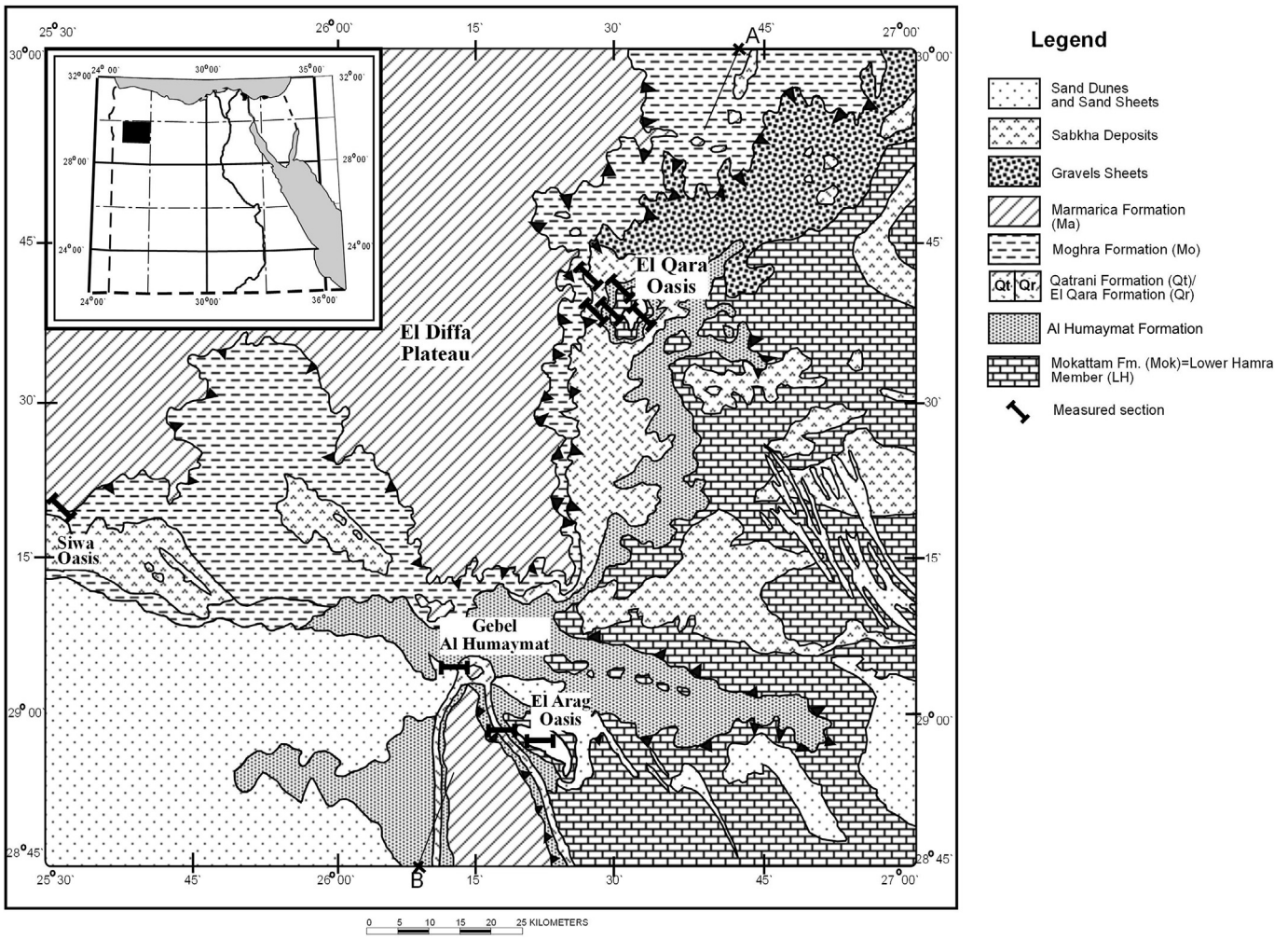

Fig. 1. Geological map of Siwa-El Qara stretch, North Western Desert, Egypt.

Qattara Ridge and the Mediterranean Sea, the prospective northern basins contain up to 6000 m of sediments WEC (1995). The Siwa Basin is a north-south oriented Paleozoic basin that covers wide stretches in the north-western part and reaches to the Western Desert and can be considered as a northern extension of Libya's Kufra Paleozoic Basin (Issawi et al., 1999) . It contains thick Paleozoic sequences, ranging from Cambrian to Carboniferous, no Jurassic or Lower Cretaceous sediments but has a thick Eocene fill.

In the northeastern parts of the Western Desert, many local folds and flexures were developed in a general NE-SW orientation. This trend of geological structures is known as the “Syrian Arc System” (Krenkel, 1924). The resulting uplift structures acted as islands in the Paleocene depositional basin.

Later on, the Eocene marine transgression covered most of the northern Western Desert. This resulted in the deposition of carbonates and shales of typical deep marine facies in most of the Western Desert, at least till the Middle Eocene (Issawi et al., 1999). By the close of the Middle Eocene, uplifting of the land started and the regression of the sea commenced and Upper Eocene deposits were mainly restricted within the Western Desert to its northern part. South of latitude 29° 30′ N no Upper Eocene deposits are recorded.

3. Methods

In order to present a clear picture of vertical and horizontal changes in lithology a new geological map of Orabi et al. (2015) was examined based on lithostratigraphical field observations, which was useful for a better understanding of the El Arag and El Qara sections studied in the present work (Fig. 2).

The identification of larger benthic foraminifera mainly follows Hottinger (1983, 1998), Boukhary et al. (2005) and Muftah and Boukhary (2013), from thin sections made of isolated larger foraminifera. These studies have been achieved to facilitate the paleoecological interpretation of the various fossil assemblages and to reveal the stratigraphy of the investigated sections.

The hard beds, which are not favorable for any appropriate washing techniques, were thin sectioned and studied for their microfacies. The terminology proposed by Dunham (1962), Friedman (1965), Wilson (1975) and Flügel (1982, 2005) in describing different carbonate rock types was followed. The larger benthic foraminiferal thin sections were deposited at Banha University, Geology Department.

4. Stratigraphy

The area under study includes many depressions; El Arag, Siwa and the extreme western part of the Qattara Depression, the top surface overlooking these depressions is known as El Diffa Plateau.

A careful examination of the geological map and cross section (Figs. 1 and 3) enables to establish a regional picture of sedimentation and facies variations of the Eocene in the area under