



Calcareous nannofossil biostratigraphy of Miocene-Pliocene sequence in the Monaga-1 Well, Nile Delta, Egypt

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Abstract

The Miocene-Pliocene sequence at the Monaga-1 Well, eastern of the Nile Delta, has been examined using sixty-six ditch cutting subsurface samples, to subdivide this interval litho- and biostratigraphically based on calcareous nannofossils. Four lithostratigraphic formations and their age assignment have been recognized, organized from the highest to the lowest as follows: Kafr El-Sheikh, Abu Madi, Sidi Salem, and Qantara formations. Eight calcareous nannofossil biozones have been documented, arranged from the top to the base as follows: NN15, NN14, NN13, NN11, NN9, NN5, NN4, and NN3. The recognized biozones were compared with their respective biozones in and outside Egypt, and used to shed some light on the boundaries of the Neogene stage. Three hiatuses have been noted in the Abu Madi Formation owing to structure control as that of the depositional conditions of this formation which were tectonically unstable. Pliocene lies unconformably above the Miocene, and a small hiatus was determined where NN12 zone is missing. The Tortonian/Messinian boundary cannot be exactly determined because there is a small hiatus that is suggested by the absence of the upper NN9 zone in addition to the whole of NN10 biozones. Late Miocene overlies unconformably the Middle Miocene. This unconformity was detected by the misplaced NN6, NN7, and NN8 zones and probably the basal part of NN9 zone. At the lower boundary of the zone (NN5), the Burdigalian/Langhian boundary was drawn.

Keywords Nannofossils · Miocene · Pliocene · Well · Nile Delta · Egypt

Introduction

The subsurface Miocene successions in the Nile Delta engrossed the attention of many geologists after the massive gas discoveries in the subsurface (Vandre et al. 2007), so these successions are one of the most important gas reservoirs in Egypt. Little calcareous nannofossil biostratigraphic studies have been carried out on the subsurface Miocene-Pliocene sequence, Nile Delta.

The most important biostratigraphical and paleoenvironmental studies on the Miocene are Rizzini et al.

(1978), Harms and Wray (1990), Haggag and Abu El Enein (1991), El Heiny and Morsi (1992), Ouda and Obaidalia (1995), Obeid et al. (2000), Faris et al. (2007), Ismail et al. (2010), Boukhary et al. (2012), Samir (2013), Hewaidy et al. (2014), Farouk et al. (2014), Boukhary et al. (2016), Faris et al. (2016), El-Sorogy et al. (2017), Hewaidy et al. (2018), Ied et al. (2019), and Ayyad et al. (2020).

The aim of this study is to subdivide the Miocene-Pliocene interval into several nannofossil biostratigraphic zones, to correlate them with those in the standard biozone scheme in Egypt and abroad aiming to delineate the chronostratigraphic boundaries.

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Geological setting

The Nile Delta area is part of Egypt's unstable shelf, and the existence of a dense, Neogene-Quaternary section, consisting of at least 15,000 ft. of shales and sandstones to the north, which becomes thinner southward, is suggested by gravity and aeromagnetic and seismic data assisted by drilling.