



# Stratigraphy of the Middle Eocene – Lower Oligocene successions in northwestern and eastern Jordan



Sherif Farouk<sup>a,\*</sup>, Fayez Ahmad<sup>b</sup>, Ahmad A. Smadi<sup>c</sup>

<sup>a</sup> Exploration Department, Egyptian Petroleum Research Institute, Nasr City 11727, Egypt

<sup>b</sup> Earth and Environmental Sciences Department, Hashemite University, Jordan

<sup>c</sup> Faculty of Marine Science, Marine Geology, King Abdulaziz University, Saudi Arabia

## ARTICLE INFO

### Article history:

Received 26 November 2012

Received in revised form 8 May 2013

Accepted 8 May 2013

Available online 16 May 2013

### Keywords:

Biostratigraphy

Calcareous nannofossils

Planktonic foraminifera

Eocene/Oligocene unconformity

Wadi El Ghadaf

Jordan

## ABSTRACT

Rocks of Eocene and Oligocene age, consisting mainly of carbonate ramp facies, are widely distributed in Jordan, but no previous stratigraphic works have dealt with the Eocene – Oligocene contact. Stratigraphic analysis, based on field exploration, and detailed lithostratigraphic and biostratigraphic preliminary data detected a major hiatus that separates the Middle Eocene (Lutetian) from the Early Oligocene (Rupelian) in the studied exposures in the Wadi El Ghadaf and Ash Shunah areas of Jordan. Our results reveal that the planktonic foraminifera *Turborotalia cerroazulensis*/*Pseudohastigerina* spp. (P18) Zone and the calcareous nannoplankton *Ericsonia subdisticha* (NP21) Zone of early Oligocene age were recorded immediately above the *Morozovelloides lehneri* (E11) Zone and the *Discoaster tanii nodifer* (NP16) Zone indicating, a period of non-deposition as a result of tectonic activity and/or sea level changes. A correlative hiatus and time gap were also reported in different parts of the Arabian and African plates, which representing the contemporaneous paleo-high areas. The presence of the early Oligocene shallow marine calcareous planktonic assemblages indicates that shallow shelves of the Tethys Ocean occupied the paleotopographic lows of Jordan, with deepening of the depositional basin toward the north.

© 2013 Elsevier Ltd. All rights reserved.

## 1. Introduction

There have been few investigations of Paleogene calcareous planktonic biostratigraphy in Jordan (Koch, 1968; Bender, 1974; Hamam and Haynes, 1976; Yassini, 1979; Basha, 1978 and; Guasti and Speijer, 2007) and several remain unpublished (Karam, 1973; Al-Mashagbah, 1996).

This work, is the first investigation of the litho- and biostratigraphy of the Eocene – Oligocene successions in the Wadi El Ghadaf and Ash Shunah areas of Jordan (Fig. 1), using both of planktonic foraminifera and calcareous nannofossils. The aim of this research is to: (i) establish a detailed lithostratigraphic and biostratigraphic framework; (ii) interpret the depositional environments based upon the microfacies and faunal content; and (iii) delineate the chronostratigraphic hiatus represented by the Eocene/Oligocene contact in the study area to constrain its palaeogeographic evolution. The results increase understanding of the stratigraphic and the tectono-sedimentary nature of the Middle Eocene – Lower Oligocene contact in Jordan.

More detailed lithostratigraphic and biostratigraphic investigations need to better define the Middle Eocene – Lower Oligocene sedimentary succession in Jordan. The age of Wadi Shallala

Formation is a controversial point in the stratigraphy of Jordan. Many authors have reached different conclusions (Fig. 2): Middle Eocene (Powell, 1989; Fadda, 1996; Moh'd, 2000; Powell and Moh'd, 2011); late mid to Late Eocene age (Wetzel and Morton, 1959); Early Oligocene (Zachos et al., 2008; Hamdan et al., in press); Early Eocene to Oligocene? (Zalmout et al., 2000; Mustafa and Zalmout, 2002).

Until now, there has been little detailed information concerning the Middle Eocene – Lower Oligocene stratigraphy in Jordan. This Lower Oligocene carbonates succession forms the main petroleum reservoir unit in the surrounding Arabian countries of United Arab Emirates and northern Iraq and in Iran, which inevitably raises questions concerning the potential of coeval rocks in other areas, particularly, in the northern and southern Arabian Gulf (Whittle et al., 1995; Alsharhan and Nairn, 1995).

## 2. Geological setting

Jordan is situated on the northern part of the Arabian Plate with exposed rocks ranging in age from Precambrian to Quaternary (Fig. 1). In general, Jordan consists of different distinctive geomorphological and topographic features (Figs. 1 and 2) trending north–south. These units are related to rifting along the Jordan

\* Corresponding author. Tel.: +20 2 01281719573.

E-mail address: [geo.sherif@hotmail.com](mailto:geo.sherif@hotmail.com) (S. Farouk).

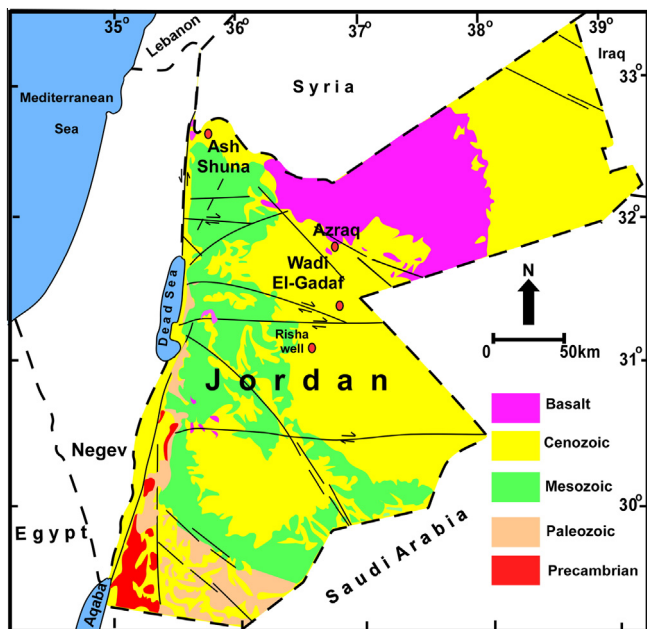


Fig. 1. Simplified geological map showing the location of the study area (modified after Al-Rifaay et al., 1993).

Valley-Dead Sea-Wadi Araba-Red Sea line, which was formed in the last few tens of millions of years.

The Precambrian and Palaeozoic units are only exposed in South Jordan and in small parts along the Wadi Araba-Dead Sea-Rift. They are unconformably overlain by Mesozoic sediments, which cover large areas of the country. Cenozoic sedimentary deposits are widely distributed and exposed throughout Jordan. A Neogene and Quaternary sheet basalt province covers large areas of northern Jordan (Bender, 1974). During Cretaceous to Eocene time, and for much of the early Mesozoic, Jordan lay at the southern margin of the Neo-Tethys Ocean which episodically transgressed, south

and east, over the margins of the Arabian Craton (Powell and Moh'd, 2011).

3. Materials and methods

Seventy-six rock samples were collected, approximately every 25–50 cm from two different sections in Jordan at (1) Wadi Al Ghadaf area, south of Azraq towards the western border with Saudi Arabia (latitude 31°27'23"N and longitude 36°36'42"E) and (2) Ash Shunah area towards the extreme west northern part of Jordan south western border with Syria (latitude 32°34'56"N and longitude 35°36'45"E; Fig. 1). Field exploration, descriptions of lithology, facies types, faunal content and lateral changes in facies and thickness are used to assist in the interpretation of the age assignments, palaeoenvironment and regional correlation of equivalent rock units.

Calcareous nannofossils were analyzed using standard smear slides, which were examined using a light photomicroscope at 1250× magnification. A qualitative estimation of the abundance of calcareous nannofossil taxa are noted as follows: A = abundant (more than 5 specimens/field of view, fov), C = common (1–5 specimens/fov), R = rare (one specimen/6–10 fov) and VR = very rare (one specimen/ more than 10 fov). For the foraminiferal analyses, about 200 g of dry rock carbonate sample were soaked in hydrogen peroxide, disaggregated in water, washed through a 63 μm sieve, and then dried. The number of species was semi-quantitative calculated from several fields of view using low magnification microscope as follows: abundant, >26%; common, 16–25%; few, 6–15%; rare, 2–5%; very rare, <2%.

4. Lithostratigraphy

Thick successions of Eocene marine shelf carbonate ramp facies are marked by widely distributed outcrops in Jordan. On the other hand, the Lower Oligocene outcrops are patchy, occurring as a thin belt and limited to the marginal marine facies. These Paleogene carbonates exhibit rapid facies changes in Jordan resulting from

Age		Macdonald (1965)	Parker (1970)	Bender (1974)	Fadda (1996)	Mohe'd (2000)	Zalmout et al., (2000)	Sharland et al. (2004)	Zachos et al. (2008)	Powell and Mohe'd (2011)	Present study
Oligocene	Lower		Hiatus			Tayba Limestone Fm.		Dahabkia Fm.?	Wadi Shallala Fm.	Not studied	Tayba Fm. U. Wadi El Ghadaf
	Upper	Chalk Fm.	Shallala Fm.	Chalk Limestone & marly limestone.			Wadi Esh-Shallala Fm.	Ma'an Fm.	Not studied	Wadi Shallala Fm.	Hiatus
Eocene	Middle				Shallala Chalk Fm.	Shallala Chalk Fm.					
	Lower	Chalk, limestone & chert Unit (B4)	Rijam Fm.	Chert limestone Unit	Not exposed	Umm Rijam Chert-Limestone Fm.					

Fig. 2. Comparison of previous lithostratigraphic schemes showing the disparity in the age assignments and lithostratigraphic nomenclatures of the Paleogene outcrops in Jordan.

Download English Version:

<https://daneshyari.com/en/article/6444520>

Download Persian Version:

<https://daneshyari.com/article/6444520>

[Daneshyari.com](https://daneshyari.com)