



# IJEAST

INTERNATIONAL JOURNAL  
OF ENGINEERING APPLIED SCIENCE  
AND TECHNOLOGY



**VOLUME : 7    ISSUE : 09    Print / Issue Publication Date: 09-Mar-2023**



**ISSN : 2455-2143**



**DOI : 10.33564/IJEAST.2023.v07i09.002**

Indexed In



[WWW.IJEAST.COM](http://WWW.IJEAST.COM)

[editor@ijeast.com](mailto:editor@ijeast.com)

# COMPARISON OF THE GLOBAL ONLAP CURVE AND SEA-LEVEL CHANGES WITH TIMING OF UNCONFORMABLE SEQUENCE BOUNDARIES FORMATION OF A PALEOCENE SUCCESSION, SIRTE BASIN, LIBYA

Ayman Nassar, Akram Zafir, Ahmad Abuharara, Muneer Abdalla  
Department of Geology  
Omar Al-Mukhtar University, Al Bayda PO. Box 919, Libya

**Abstract**— The Paleocene sedimentary successions in the NW Sirte Basin in north central Libya have complex stratigraphic architecture and internal configuration. This stratigraphic architecture can provide information on timing of sea-level changes and associated onlaps. Therefore, this study uses the formation timing of the sequence boundaries separating between the stratigraphic sequences and correlate it with the global online curve and global sea-level changes. The number of sequences recognized in the Paleocene succession of the studied platform matches the number of third-order cycles, indicating that each sequence represents a single third-order cycle and was created as a consequence of one third-order cycle of sea-level fluctuation.

**Keywords**— 3D seismic, Sea-level changes, Isolated carbonate platform, Sirte Basin.

## I. INTRODUCTION

The study area is located in north central Libya within the Sirte Basin, the most productive petroliferous basin in Africa (Fig. 1). The basin is considered to be a rift basin formed due to large scale extension and resulted rifting and subsidence. It covers an area of around 600,000 km<sup>2</sup>. Thickness of the sedimentary strata of the basin ranges from ~ 6.5 km offshore in the northern Gulf of Sirte to less than 1 km in the south (Roohi, 1996; Guiraud and Bosworth, 1997; Hallett, 2002). The S Field in NW Sirte Basin is the focus of this study. It contains isolated carbonate platforms that are several square kilometers in size. Those isolated platforms contain several stratigraphic sequences bounded by unconformities, which indicate sea-level oscillation. This study aims to correlate those sequences to global sea-level changes reconstructed by Haq et al., (1987), and reveal the control of sea-level changes on the platform sequences.

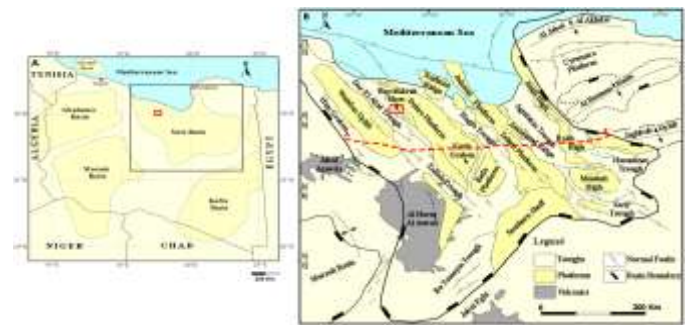


Fig. 1. (a) The major sedimentary basins in Libya (modified after Abdalla (2021a, 2021b)). (b) A simplified map of the Sirte Basin in (modified after Mouzoughi and Taleb, 1981; Abdalla and Yang, 2021, 2022). The study area is marked by the red square box.

## II. DATA AND METHODOLOGY

Three-dimensional seismic data was used in this study. The seismic volume occupies an area of 113 km<sup>2</sup> and contains 1000 in lines and 500 cross lines. The maximum two-way travel time is 4 seconds. The volume was recorded with SEG normal polarity, where the increase in acoustic impedance is shown as positive amplitude (Fig. 2). The frequency has a range of 12-60 Hz with a main frequency of 22-35 Hz. Unconformable sequence boundaries that separate stratigraphic sequence were correlated to global sea-level changes in order to establish a relationship between the global sea-level changes and formation of the stratigraphic sequences (Fig. 3).

## III. RESULTS AND DISCUSSIONS

A Comparison of the onlap curve from the platform with the global coastal onlap and correlation of the platform seismic sequences with the global eustatic sea-level fluctuations is shown in Fig. 4. Isolated carbonate platforms have no coastline; thus, they have no onlap (Eberli and Ginsburg, Notwithstanding, the platform was flooded multiple times.





Correlation of the platform sequences with the global eustatic sea-level chart exhibits a close match between the development of the platform sequences and sea-level changes. For example, the five sequences recognized in the platform from the early Paleocene to late Paleocene-early Eocene boundary correlate with the five short-term changes in sea-level shown in the global eustatic sea-level chart. Thus, we interpret that each short-term change in sea-level creates one sequence. However, Haq et al., (1987) identified three short-term sea-level fluctuations in the lower Eocene interval where seismic sequence 6 developed. Thus, we speculate that sequence 6 of the lower Eocene may have resulted from more than one eustatic sea-level fluctuation.

#### IV. CONCLUSIONS

A correlation of the global coastal onlap curve and global sea-level changes with the timing of sequence boundaries formation in a detached isolated platform within the tectonically complex Sirte Basin was established. The study found that the number of stratigraphic sequences recognized in the Paleocene sedimentary succession of the platform matches the number of third-order cycles, suggesting that each sequence represents a single third-order cycle and was created because of one third-order cycle of sea-level fluctuation.

#### V. REFERENCE

- [1]. Abdalla, M., Yang, W., (2021). Progradation of a middle Eocene carbonate slope system, Assamoud Field, Sirte Basin, north central Libya – Implications on the dynamics of lateral growth of isolated carbonate platforms. *Marine and Petroleum Geology*, 105119.
- [2]. Abdalla, M. Seismic Attributes Aided Detection of NW-SE Trending Faults Developed on an Isolated Carbonate Platform in the NW Sirte Basin, North Central Libya. *IJEAST* (2021a).
- [3]. Abdalla, M., & Yang, W. (2022). Characterization and evolution of a carbonate basin floor fan on a leeward side of an isolated carbonate platform, Sirte Basin, Libya. *Journal of African Earth Sciences*, 196, 104675.
- [4]. Abdalla, M. A. (2021b). Seismic Attributes Aided Characterization of Margin Backstepping and Advance along Isolated Carbonate Sequences, Sirt Basin, Libya. *Al-Mukhtar Journal of Sciences*, 36(4), 280-287.
- [5]. Eberli, G. P., & Ginsburg R. N. (1989) Cenozoic progradation of northwestern Great Bahama Bank, record of lateral platform growth and sea-level fluctuations. In: Crevello P. D., Wilson J. L., Sarg J. F., & Read J. F. (eds) Controls on carbonate platform and basin development. *SEPM Special Publication* 44, Tulsa, pp 339–354.
- [6]. Guiraud, R., & Bosworth, W. (1997). Senonian basin inversion and rejuvenation of rifting in Africa and Arabia: synthesis and implications to plate-scale tectonics. *Tectonophysics*, 282 (1-4), 39-82.
- [7]. Hallett, D. (2002), *Petroleum geology of Libya*: New York, Elsevier, 503p.
- [8]. Mabruk Oil Operations Company, (2002). West Mabruk Geomodal Report, Sirte Basin, Onshore Libya (internal report).
- [9]. Mouzoghi, A. J., & Taleb, T. M. (1981). *Tectonic Elements of Libya* (1: 2,000,000). National Oil Corporation of Libya.
- [10]. Roohi, M. (1996). A geological view of source-reservoir relationships in the western Sirt Basin. *The geology of Sirt Basin*: Amsterdam, Elsevier, 2, 323-336.

# IJEAST

INTERNATIONAL JOURNAL  
OF ENGINEERING APPLIED SCIENCE  
AND TECHNOLOGY

## ABOUT IJEAST

International Journal of Engineering Applied Science and Technology (IJEAST) is a peer-reviewed, open access journal that publishes high-quality research papers in the field of Engineering, Applied Science and Technology.

IJEAST aims to provide a platform for researchers, academicians, and professionals to share their innovative ideas, research findings, and practical experiences with the global scientific community.

## FOCUS AREAS

- Engineering
- Applied Science
- Technology
- Innovation & Development
- Interdisciplinary Studies



### PEER REVIEWED

All submissions are rigorously peer reviewed to ensure quality.



### OPEN ACCESS

Free and unrestricted access to research for all.



### GLOBAL REACH

Connecting researchers and professionals worldwide.



### TIMELY PUBLICATION

We ensure a swift and efficient publication process.



For more information, visit our website

[www.ijeast.com](http://www.ijeast.com)



INTERNATIONAL JOURNAL  
OF ENGINEERING APPLIED SCIENCE  
AND TECHNOLOGY

✉ [editor@ijeast.com](mailto:editor@ijeast.com)

🌐 [www.ijeast.com](http://www.ijeast.com)

📍 India



2455-2143