

Evidence For An Equivalent of The Late Aptian Oceanic Anoxic Event (OAE) Across The Kazerun Fault, SW Iran

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Abstract

A Late Aptian shale containing ammonites, planktonic foraminifers and radiolarians records a significant change in the ocean-climate system in the southeastern part of the Tethys corresponding to the Zagros Basin. In three surface sections located across the Kazerun Fault, the Daryan Fm contains a 25 m-thick, condensed interval of very thin, organic matter-rich black shales, interbedded with radiolarian-rich cherty limestones. Trochospiral and planispiral planktonic foraminifers with clavate or radially elongated chambers (*Leupoldina reicheli*, *L. pustulans*, *Hedbergella roblessea*, etc.) are present in the interval which proves an adaptation to the oxygen deficiency. Initial results suggest that the interval belongs to the Gargasian *Globigerinelloides ferreolensis* Zone and correlates with a major Ocean anoxic event (OAE). The dating is confirmed by newly identified Ammonites.

Key-words: Iran, Zagros Basin, Kazerun Fault, OAE

1- Introduction

The study area is in the southwest part of the Zagros Basin, SW of Iran (Fig.1). Three surface sections namely Kuzeh Kuh, Fahliyan and Dasht-e Gul were measured and sampled for micropaleontological investigations and facies analysis. Consistently, in the three surface sections, the studied interval is 25 m. thick. The main trend of the Kazerun Fault is N-S and it obliquely truncates the NW-SE trend of the Zagros Fold-Trust Belt. This active fault zone has controlled the sedimentation pattern and subsidence of the central part of the Zagros Basin since the Early Cambrian. The later reactivation of this fault zone during the Cretaceous resulted in major sedimentary thickness and facies variations along the belt [1].

2- Discussion

The studied interval is occurs in the upper part of the Lower Dariyan Formation, in each of the three studied surface sections. It consists of thin beds of shale and argillaceous limestone, containing abundant planktonic formaminifers, radiolarians, and well preserved ammonites (Fig.2). This horizon can be followed in hundred of kilometers throughout the Dezful south intrashelf basin, Zagros Fold-Belt.

Chert nodules are found the shale layers which contain much more radiolarians. The reduced rates of carbonate production observed within the studied interval suggest nutrient-rich condition which belongs to a coeval of Oceanic Anoxic Event (OAE).

Among the planktonic foraminifers, *Globigerinelloides ferreolensis* and species with radially elongated chambers (*Leupoldina reicheli*, *L. pustulans* and *Hedbergella roblessea*) are very common. In each of studied surface sections (Fig.3), they are associated with *Globigerinelloides paragottisi*, *G. blowi*, *G. aptiensis*, *Praehedbergella aptiana*, *P.*

infracretacea and *P. luterbacheri*. Organic matter, glauconite and phosphate are found in the laminations. Based on the biostratigraphical zonation of Global-Tethyan planktonic foraminifer zones for the southern Tethys [2], [3] and also, the planktonic foraminifer zones in the Iranian Zagros area [4], this assemblage is Gargasian (Late Aptian).

Next to the study area, index ammonites were collected, dating this part of the Lower Dariyan Formation from the Gargasian. [4].

The previous, considerable work carried out at Kuh-e Fahliyan and Kuh-e Mish yielded a very rich ammonite fauna, almost exclusively composed of Acanthohoplitinae. The most common species was assigned with doubt to the genus *Colombiceras*, shows affinities with *Colombiceras (?) alexandrinum* (d'Orb.). Apparently, it is restricted to the lower part of the Martinioides Zone, covering at least the Upper Aptian [4]. The oldest ammonites occur in the Radiolarian bearing interval at top of the Lower Dariyan in Kuh-e Fahliyan, therefore suggesting that this level is of same age (Upper Aptian, lower part of the Martinioides zone) [4].

Moreover, based on previous studies carried out in other neighboring areas, Kuh-e Meymand and Kuh-e Bangestan, $\delta^{13}\text{C}$ negative to positive excursion varying from 1-3 % were recorded which is comparable with the OAE? of Bralower et al, 1999, [4]. Those results are also in agreement with the North Tethyan margin dataset [5] and, also, with $\delta^{13}\text{C}$ analysis carried out in SE France and Italy [6]. Probably, they are coincident with the thermal maturity of a Late Aptian Oceanic Anoxic Event.

Geochemical analyses were carried out in the neighbouring area of Kuh-e Banesh, in the upper part of the Lower Dariyan Formation. The resulting Total Organic Carbon (TOC) varies from 1.06 to 1.9 %. The other main parameters are: Hydrogen Index (HI: 12-64), Oxygen Index (OI: 17-49) and T. Max: 432-451. [7]. Such a quite high amount of organic matter, low oxygen and high hydrogen content, associated with the presence of phosphates and glauconite, further confirm that these organic-rich black shales and strongly argillaceous cherty limestones were deposited under an anoxic condition.

In the studied samples, the average size of planktonic foraminifers increases toward the top of the interval, reaching values in excess of 330 microns. By comparison with the size of modern planktonic foraminifers [8] and, also, with data from the mid-Cretaceous [9], [10], [11], in the studied samples, our values are consistent with a Gargasian age.

Data gathered so far suggests that the study interval corresponds to a condensed section accumulated under the following conditions: fast sea level rising with low latitude fluctuations, sea level drop, global warming followed by global cooling. These will be discussed in a forthcoming report.

3- Conclusions

A condensed section inclusive of organic matter-rich black shale, strongly argillaceous limestone, abundant planktonic foraminifers, radiolarians, phosphate and glauconite, records an Oceanic Anoxic Event (OAE) east and west of the Kazerun Fault, throughout the Zagros Fold-Belt. The presence of planktonic foraminifers with radially elongated chambers, including, *Leupoldina reicheli*, *L. pustulans* and *Hedbergella roblesea*, is a criteria for an oxygen deficiency in the ecosystem. The interval contains *Globigerinelloides ferreolensis*, a

marker for the Gargasian (Late Aptian). This age is confirmed by the newly identified ammonites collected from the same horizon in the neighboring area.

4- Acknowledgement

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5- References

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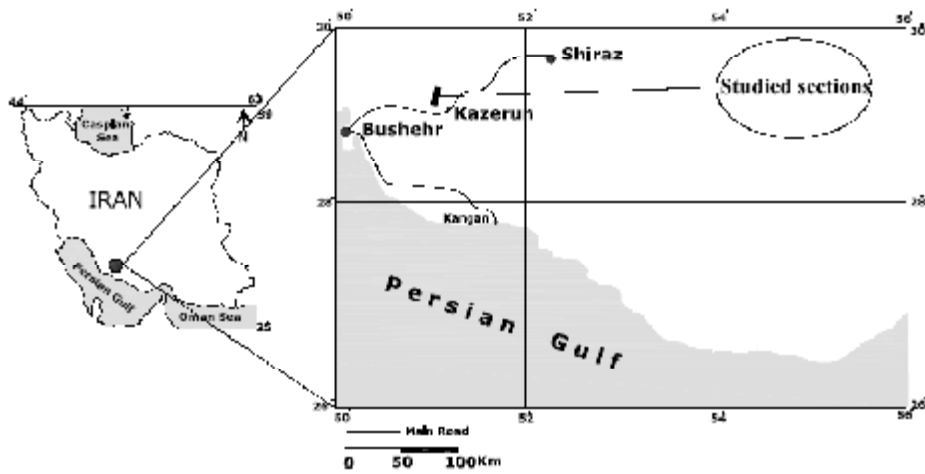


Fig.1, Location map of the studied sections.

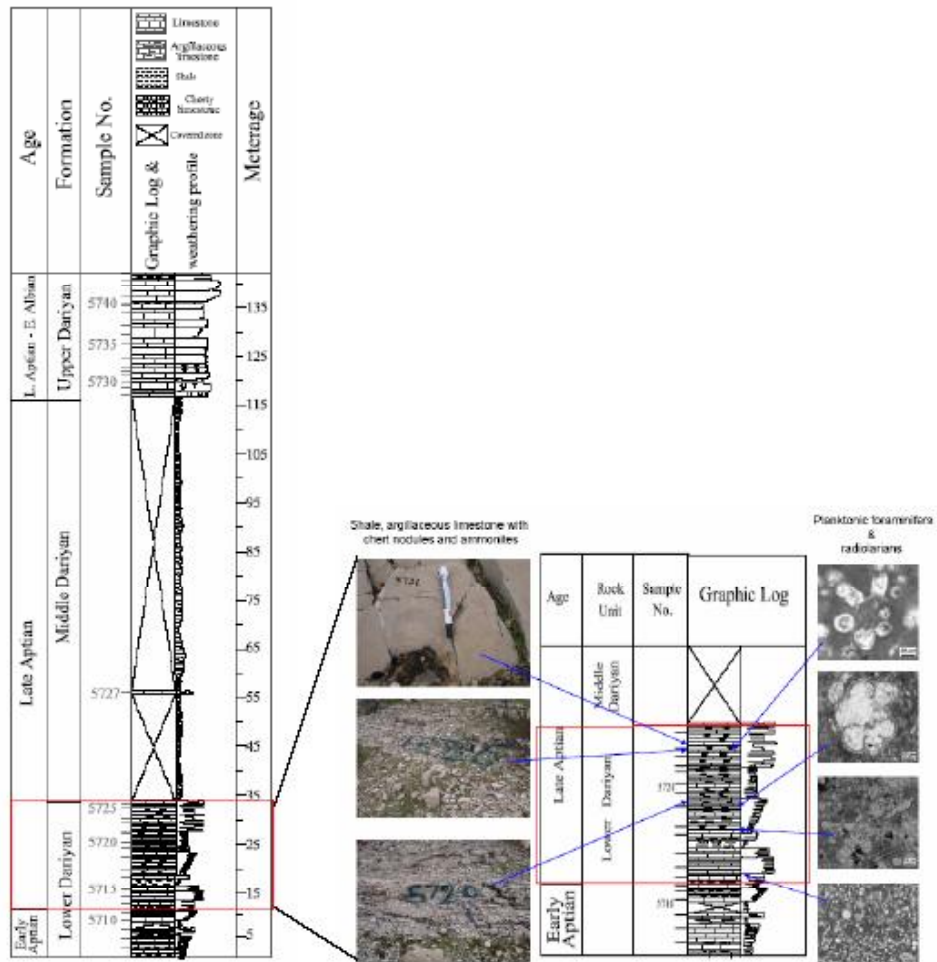


Fig.2, Dasht-e Gul surface section stratigraphical column of the studied interval. Planktonic foraminifers and field bedding patterns are shown.

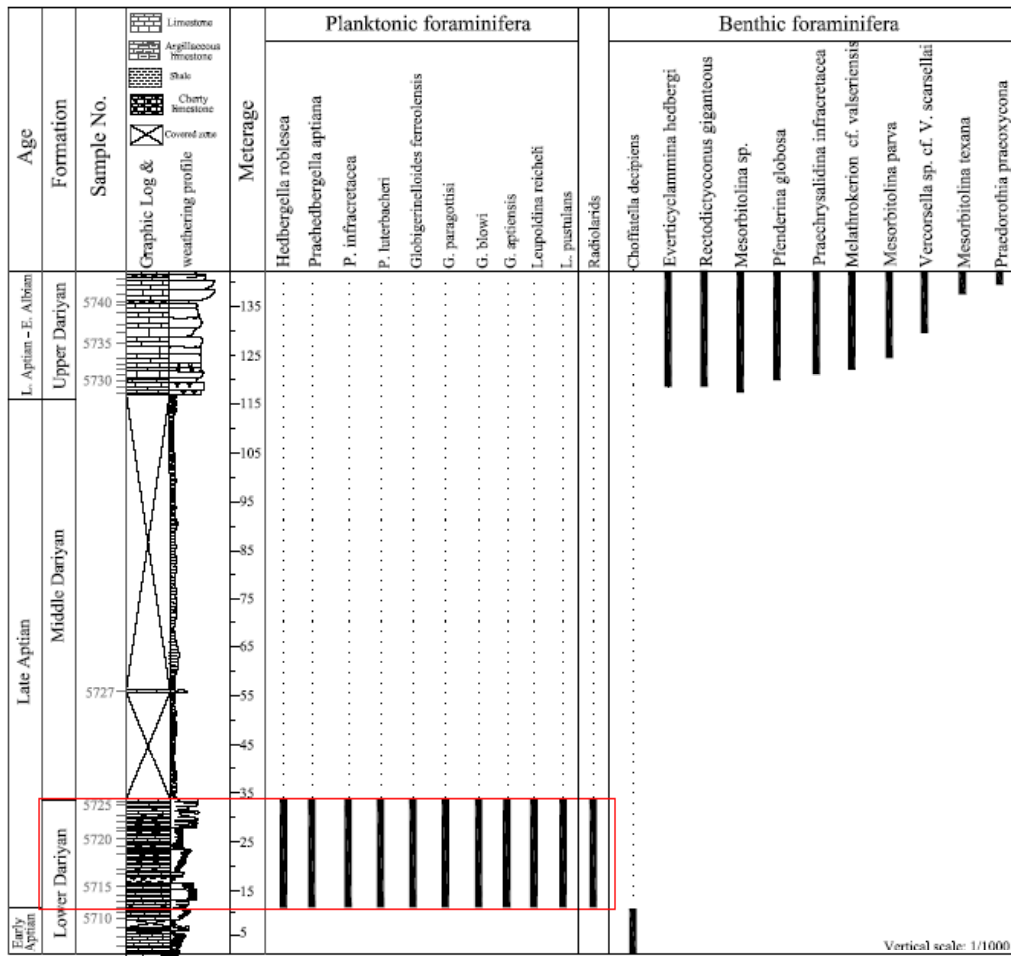


Fig.3, Biostratigraphical data and chronostratigraphy of the studied interval in Dasht-e Gul surface section.