

TECTONICAL HISTORY OF ARABIAN PLATFORM DURING LATE CRETACEOUS: AN EXAMPLE FROM KURDISTAN REGION, NE-IRAQ

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Abstract

New simplified tectonic models and depositional history of Late Cretaceous rocks are established in a part of Zagros Orogenic Belt that is located in the Northeastern Iraq. These rocks constitute the most important Cretaceous oil reservoir in the Middle East. The dependent tools are petrography, field study and the concept of drowning phases. This concept is relatively new and accurate in explanation of development of growth of carbonate sequences and their termination by tectonic or environmental constrains. The columns of both carbonate and clastics rocks of the area are divided into three phases of drowning:

1-Pre-drowning phase of reefal limestone which is represented by Qamchuqa Formations (Mauddud and Shuaba fns in the south Iraq and in the Gulf). 2-Transitional phase of pelagic limestone and marl deposition which is transitional to post drowning phase during which Gulneri Shale and Dokan limestone Formations (Cenomanian- Turonian) are deposited. 3-Post drowning phase of deep carbonate sedimentation during which Kometan Formation (Santonian-Campanian) and 4-Burial Phase in which Shiranish and Tanjero Formations (Maasstrichtian) are deposited by which Arabian Platform was covered by siliciclastics sediments and main carbonate sedimentation was ended during Campanian in the studied area due to continental colliding of the Iranian and Arabian plates. These phases, as shown by suitable diagrams, are resulted from tectonics of Zagros and can replace the previously assigned complex tectonic and depositional history of the area during Later Cretaceous. The application of the phases revealed nearly a continuous history of deposition in foredeep during Early Cretaceous and foreland basin during later ages.

Introduction

The tectonic and depositional history of the Cretaceous Arabian Platform was under intense study during last century, especially the part that is located in the Kurdistan Region, Northeastern Iraq (Fig.1). Bellen et al., (1959), Buday (1980) referred to unconformities between formations such as Qamchuqa and Bekhme, Dokan and Qamchuqa, Qamchuqa and Kometan, Dokan and Gulneri, Gulneri and Kometan, Kometan and Shiranish, Tanjero and Kolosh Formations (Fig.1).

The above authors have divided the rocks of the Late Cretaceous into several depositional cycles that are separated by unconformities (cycles of uplift and erosion). According to above authors, the depositional history of the whole northwestern Iraq were assumed to be violent during complete time span of the Late Cretaceous by which basin isolation and uplift and erosion occurred. Numan (1997) has put the sediments of the Turonian and Campanian, in two tectonically different basins in Iraq. The first one is the northeastern basin which was diverging basin with midoceanic ridge and high igneous activity. This basin is located between Katarash and Walash volcanics.

In contrary, recent study by Karim (2004), Karim and Surdashy (2005a and 2005b), Al-Barzinjy (2005), Karim et al (2008), Amen and Karim(2008), Ameen (2008) and Taha,

(2008) introduced important changes to the previous unconformable contacts between formation and modified them to conformable ones. Another result of these recent studies is changed, the Miocene continental colliding of Iranian and Arabian plates to Campanian on the basis of field evidences such as deposition of 500m conglomerate during Maastrichtian and recording of red beds of late Cretaceous (for more details about these recent studies, see web site :www.Kurdistan-geology.com)

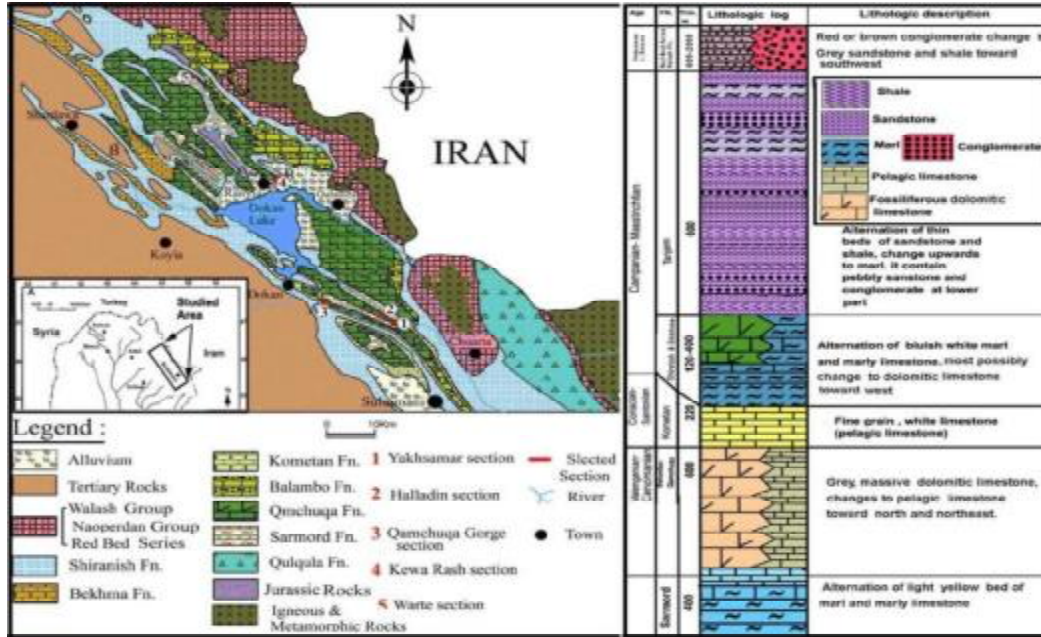


Fig. (1) Right) Location and geological map of the northeastern Iraq (modified from Sissakian, 2000) showing location of the studied section. Left) General stratigraphic column of the northeastern Iraq.

New Tectonic History of Late Cretaceous

Depending on the above recent studies, more realistic tectonic history and tectonic models are established which is connected with the principles of the drowning phases that are resulted from tectonics of the Arabian Platform.

Pre-Drowning Phase

This phase, in the studied area is represented by reefal limestone of Qamchuqa Formation (Aptian-Albian) which was covering the Arabian platform (Fig.1,2, 3 and 4). This phase is called Type C (Keep up-upbuilding and outbuilding of shallow water carbonate) by Kendall and Schlager (1981). The deposition of reefal limestone is attributed to what mentioned by Ameen (2008) that inside Iran and near to the present location of Sanandaj-Sirjan belt, the oceanic part of the Iranian and Arabian plates had collided and divergent boundary is generated by which Iranian plate obducted over Arabian one during Berremian. By this obduction, the previously deposited radiolarites and ophiolites had begun to accumulate in the trench between the two plates forming accretionary prism (Fig.3D). He added that during Valanginian to Cenomanian, the accumulation and southwest migration of the wedge (or prism) were continuous. The load of the wedge forced the basin of Qamchuqa Formation to subside under the effect of loading (Fig.3B and C). Under the load of the

accretionary prism, the previous forebulge on which Qamchuqa Formation was deposited tectonically subsided.

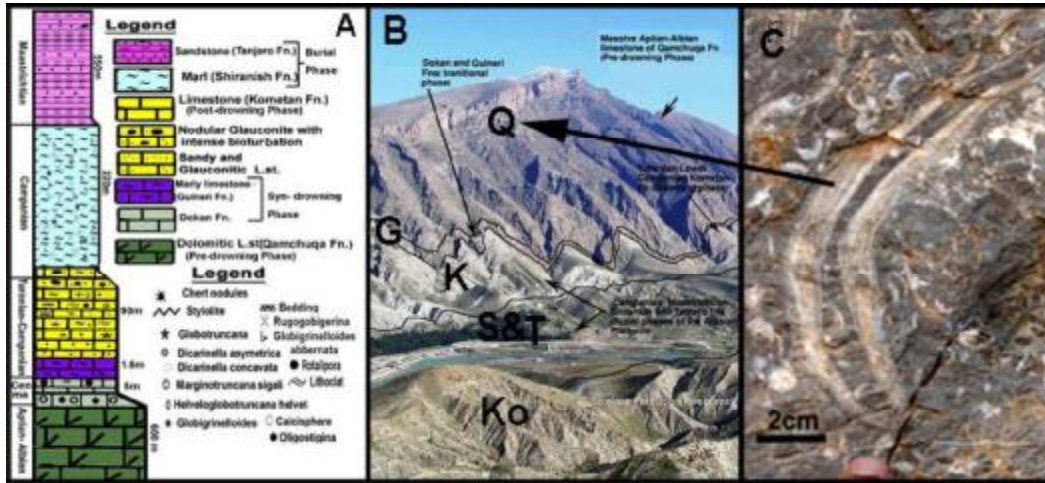


Fig. 2, A) Stratigraphic column of Sulaimani Area, and B) southwestern limb of Sara anticline in Dokan area showing the representative rocks of the four drowning phases of the Arabian Platform. Q) Aptian-Albian reefal limestone (Qamchuqa Fn) (Pre-drowning phase). G) Cenomanian-Turonian pelagic limestone and marl of Dokan and Gulneri Fns (Syn-drowning phase). S) Late Turonian-Campanian deep pelagic limestone of Kometan Fn (post-drowning phase). T and Ko) Burial phase of the Arabian Platform by siliciclastics sediments of Shiranish, Tanjero, Kolosh fns. C) Radiolitic rudist in the reefal limestone of Qamchuqa Formation.

Transitional phase (syn-drowning phase)

This phase is represented by Gulneri Shale (Turonian) and Dokan (Cenomanian) limestone formations which are deposited during the deepening of the previous shallow water platform. The lithologic study of these two formation show that they has intermediate depth between reefal Qamchuqa and deep Kometan Formations. His is because they contain oligostigina and dwarfed globotruncan forams revealing unstable transitional environment (Fig.4C and D). This phase is occurred by important events during Cenomanian which was tectonic subsidence (drowning) of the Arabian Platform by the load of the accretionary prism that is accumulated between Iranian and Arabian plates. This phase is very clear in the field and in the thin sections as there are about 5m of the oligostigial limestone with few beds of glauconites which is represented by Dokan Formation and about 1.5 of marly and marly limestone (Gulneri Formation) (Fig.1). These two formations are transitional between shallow marine Qamchuqa Formation and deep marine Kometan Formation; therefore they represent the transitional phase to post-drowning. The gradual but relatively rapid change from shallow marine (Qamchuqa Fn) to deep water facies (Kometan Fn) is represented by facies characterized by properties that are intermediate between the two end members.

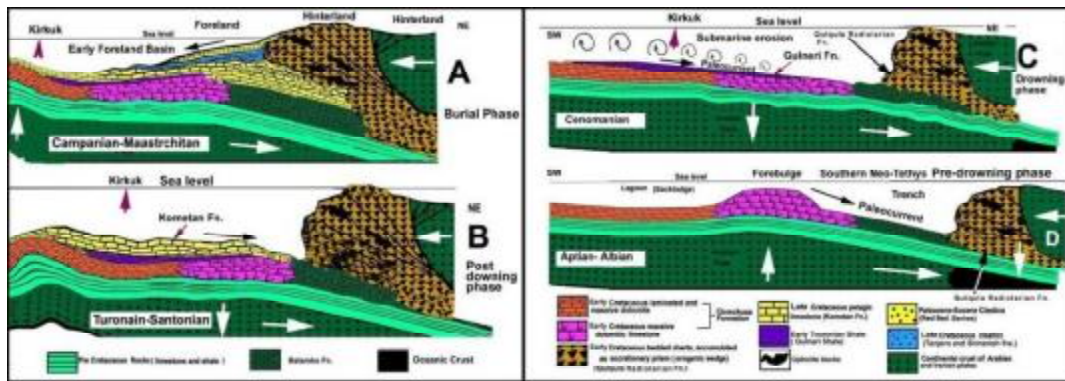


Fig.(3) Combination of tectonic, depositional history of Early and Late Cretaceous basin as considered in this study. A: From Karim and Surdasy (2005b), B and C: Model of Present study in which drowning phases and submarine erosion can be observed. D: From Ameen (2008).

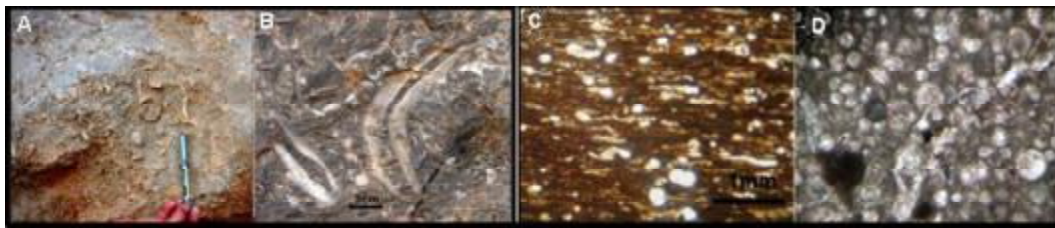


Fig. (4)Pre-drowning facies of the Arabian Plate (Qamchuqa Formation), A) coarse bioclastic rudstone with gastropod skeletons. B) Rudist (radiolitids) floatstone. Syn-drowning facies of the Arabian Platform. C) Calcareous shale with dwarfed and deformed planktonic forams (Hemipelagite) of Gulneri Shale Formation. D) Oligostegial bearing limestone.

Post- Drowning Phase (Kometan Formation)

In the studied area, this facies is represented by about 70m of fine grain, occasionally, bioturbated limestone of Kometan Formation (Turonian-L.Campanian). This formation is deposited in relatively deep basin on the previously drowned Arabian Platform which contains abundant globotruncan forms with few thin beds of glauconite and can be seen on the top of Gulneri and Dokan formations (sediments of intermediate depth).

Burial Phase: Siliciclastics prograding on the Arabian Platform

The age of this phase is Middle Campanian which coincides with the first appearance of clastic sediments on the Arabian platform in the studied area. The first arrival is represented by the lower part of Shiranish Formation which consists of marlstone then changes to sandstone and conglomerate of Tanjero Formation during Maastrichtian. The influx of the clastics was associated with the main tectonic event of Zagros Fold-Thrust Belt during which the orogenic belt is generated by colliding of continental parts of Iranian and Arabian plates. From this belt the clastic deposits of both formations are derived. These clastic rocks covered the Arabian Platform and the paleocurrent direction is changed from northeast to southwest direction Fig.(3A) (Karim and Surdasy, 2005a). The sediment influx (paleocurrent) was from southwest during deposition of Gulneri and Kometan Formations. But, when the Iranian plate is thrust over the Arabian platform, the direction of sediment transport, in studied area was changed toward southwest as indicated by black arrows in the (Fig.3B).

Conclusions

The following phases are identified: 1-Pre-drowning phase (Qamchuqa Formation). 2-Syn-drowning phase or transitional to post drowning phase (Gulneri Shale and Dokan limestone Formations), 3-Post drowning phase (Kometan Formation) and 4-Burial Phase which is resulted from siliciclastics prograding on the Arabian Platform (Shiranish and Tanjero Formations). These phases, as resulted from tectonic of the area, can replace the complex previously assigned tectonic and depositional history during Later Cretaceous. The new model revealed nearly a continuous history of deposition in foredeep or foreland basin in contrast to previous episodic deposition in the studied area with the absence of the previously assigned unconformities.

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