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Microfacies, sedimentary environmental model and relative sea level change of marly strata of the Qom Formation in Zarrin-Abad section, South of Zanjan

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Abstract

In order to reconstruct the sedimentary environment of marly strata related to the upper parts of Qom Formation, one stratigraphic outcrop have been studied. Studied section is located in the Zarrin-Abad area (South of Zanjan) and is composed of 135 meters of marls and argillaceous limestones. These strata are limited by thick bedded limestone (related to the F Member of the Qom Formation) at the base. There is a thick bed of evaporate layer at the top of these strata with sharp boundary that can be stratigraphically related to the Upper Red Formation. Based on petrographic and texture studies, eight microfacies have been identified. These microfacies are related to the distal parts of inner shelf, patch reef, slope, toe of slope and deep shelf sub environments. Based on microfacies analysis we can propose an open shelf as sedimentary environment for these strata. Relative abundance of allochems show one cycle (rise and fall) in relative sea level along the stratigraphic column that can be correlated with eustasy curve.

Keywords: Microfacies, Sedimentary model, Qom Formation, Zarrin-Abad, Zanjan.

Introduction

The Qom Formation (Oligocene–Miocene) in central Iran is composed of carbonate and siliclastic strata that is related to the lagoon, reef and basin sedimentary environments (Reuter et al. 2009). Due to the hydrocarbon potential, this formation has been considered by many geologists. Different sedimentary environment (ramp and/or shelf) have been proposed for this formation. Thus, this study try to reconstruct the sedimentary environment for these strata in the south of Zanjan to complete the comprehensive plan for the sedimentary environment of the Qom Formation. This formation in the studied section (Zarrin-Abad) is unconformably underlain by siliclastic strata of the Lower Red Formation (Aalipour et al. 2017) and overlain (covered boundary) by the evaporitic package of Upper Red Formation. This study focused on upper parts of Qom Formation (marls and argillaceous limestones) in order to reconstruct sedimentary environment.

Material & Method

One stratigraphic section has been sampled in the South of Zanjan (Southwest of Zarrin-Abad). Forty two samples from 135 meters of marls and argillaceous limestones (Upper parts of Qom Formation) have been collected and thin sections

were prepared. Sampling intervals were about three meters in average and included hard and semi-hard sediments. The microfacies analysis using polarized microscope have allowed the reconstruction on carbonate environment of upper parts of the Qom Formation in this section. Carbonate rock classification, facies study and environmental interpretation on thin sections was based on Dunham (1962) and Flugel (2010). All thin sections have been housed in Paleontological Laboratory, Department of Geology, University of Zanjan.

Discussion of Results & Conclusions

Biostratigraphic studies confirm a Burdigalian age for these strata based on two index fossils (*Borelis meo curdica*, *Meandropsina Iranica*). One biozone has been identified based on first occurrence of *Borelis meo curdica* in the base of section (S1) and last occurrence of *Meandropsina Iranica* in the top of section (S39). This biozone can be correlated with (Adams and Bourgeois 1967) and (Daneshian and Ramezani Dana 2019) zonations. Microfacies analysis lead to identification of eight microfacies (1- Bioclast benthic foraminifera algal grainstone, 2- Coral boundstone, 3- Bioclast wackestone, 4- Sandy bioclast grainstone, 5- Sandy bioclast packstone, 6- Bioclast mudstone, 7- Pelagic

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mudstone/wackestone and 8- Pelagic packstone) related to the middle to outer carbonate shelf environment. Coral reef facies in lower parts of studied section can approve a carbonate shelf as sedimentary environment. Moreover, bioclast particles that consist of corals, benthic foraminifera, algae and some other fossils beside coral boundstone facies show fore reef facies in front of the platform margin. Based on presence of clastic particles in pelagic facies, we can conclude that there were some channels in coral reef areas that connect back reef environments to the open marine areas. Based on field observation and microfacies analysis, we proposed non-rimmed carbonate shelf as sedimentary

environment for the studied strata. Based on quantitative analysis on environmental data, most of samples (strata) are related to the deep shelf environment. Quantitative analysis diagrams (allochems percentage) shows in each samples that there were rising trend in relative sea level from the base of section to the middle part. Following this trend the falling trend towards the end of the section have been recorded. This trends can be correlated with the global sea level changes during this time (Burdigalian). Thus it can be concluded that the Burdigalian basin in this area had been connected to the open oceans.