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Sedimentary characteristics, sequence stratigraphy and geochemistry of the Tiz Kuh Formation in the Pol-e-Zoghal section (South of Chalus)

Boshra Soleimani Porlak
M.Sc. Student of Sedimentology and Sedimentary Petrology, Shahid Beheshti University, Tehran, Iran
boshra.soleimani21@gmail.com
Mohammad Hossein Adabi*
Professor, Department of Sedimentary Basin and Petroleum, Shahid Beheshti University, Tehran, Iran
m-adabi@sbu.ac.ir
Ehsan Dehyadegari
Assistant Professor, Department of Sedimentary Basin and Petroleum, Shahid Beheshti University, Tehran, Iran
e_dehyadegari@sbu.ac.ir

Abstract
In this study, the Tiz Kuh Formation of Aptian age in the Pol-e-Zoghal section (south of Chalus) with a thickness of 113 m was evaluated for depositional environment, sequence stratigraphy, and elemental geochemistry. The Tiz Kuh Formation in this section with disconformity lies on the Lower Cretaceous volcanic unit and associated disconformity of the Upper Cretaceous volcanic subdivision. According to calcimetric studies, the Tiz Kuh Formation in this section is composed of limestone and argillaceous limestone. Field and laboratory investigations led to the identification of eight microfacies belonging to 3 sub-environments of lagoon, shoal, and shallow open marine. Gradual microfacies changes and the absence of large barrier reefs, oncoids, pisoids, aggregate grains, and slump structure along with the presence of dasycladeceae family algae (e.g. *Terquemella* sp. and *Bakalovaella elitzae.*) and gymnocodiaceae (*Permocalculus* sp.) confirm the existence of a ramp-type carbonate platform. This evidence may indicate warm marine shallow very saline environment; These conditions highlight the shallow sedimentary and aragonitic environment. Sequence stratigraphic studies in this section identified three third order sedimentary sequences associated with the HST and TST with SB1 and SB2 sequence boundaries depositional sequence. In this study, sedimentary depth resulted in variation of orbitolinid shape The results of the geochemical analysis, of major and minor elements, Sr / Na values of more than one, Sr / Mn values (mean 7) and plotting of Sr / Ca values against Mn indicate that the primary mineralogy was aragonite and have been affected by non-marine diagenesis in a closed to slightly open diagenetic systems. Variation of elements along the stratigraphic section shows that the amount of Sr in the upper part decreases as the Mn content increases; These conditions indicate the greater impact of meteoric diagenesis on the upper part.
Keywords: Tiz Kuh Formation, Alborz sedimentary basin, Sedimentary characteristics, Sequence stratigraphy, Geochemistry.

Introduction

The Tiz Kuh Formation is introduced by Assereto and Ippolito (1964), derived from the Tiz Kuh near Pleur, which contains two clastic and carbonate lithological units. At the type locality, this formation is located between the Lar Formation and the Cenomanian Rows (Aghanabati 2010). Cartier (1971) defined the Chalus Formation and described it as consisting of Lower Volcanic, Lower Limestone, Middle Volcanic, Upper Limestone, and Upper Volcanic units (Aghanabati 2010). The second member of the Chalus Formation in the Pol-e-Zoghal section is known as the Tiz Kuh Formation and is of Aptian age (Yarijoo et al. 2010). Since few studies have been done on sedimentary properties of the Tiz Kuh Formation in Alborz Zone, In the present study, microfacies, sedimentary characteristics, elemental geochemistry and sequence stratigraphy of the Tiz Kuh Formation were studied in the Pol-e-Zoghal section south of Chalus city.

Material & Methods

For the present study, one surface section of the Tiz Kuh Formation in the south of the Chalus city (Pol-e-Zoghal section) has been studied. The section measured a total thickness of 113 m and consists of limestone, argillaceous limestone, calcareous marl, and marl. During the fieldwork studies, 135 rock samples from carbonate deposits and 3 marl have been taken for petrographic studies. To accurately determine the lithology of the Tiz kuh Formation in this section on all samples, calcimetric analysis was performed and the results were compared with Pettijohn 1975 classification. To differentiate ferroan and non-ferroan calcite from ferroan and non-ferroan dolomite in thin sections, the staining method of Dickson (1965) was applied. Sedimentary sequences were determined based on the concepts of sequence stratigraphy (Haq et al. 1987; Catuneanu 2006). Elemental geochemistry analysis was performed form 38

*Corresponding author

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samples of carbonates at the geochemistry laboratory of Shahid Beheshti University, Iran.

Discussion of Results & Conclusions

Based on the field and petrographic studies, the microfacies and depositional environment of the Tiz Kuh Formation were recognized. This formation in the Pol-e-Zoghal section has been made of eight microfacies which occur in three facies belts. The lagoon facies belt consists of four microfacies; mudstone, benthic foraminifera wackestone, bioclast wackestone, and interaclast orbitolina packstone. Presence of benthic foraminifera (such as miliolids and Orbitolina) and dasycladacea, represent restricted conditions in the lagoon environment (Bachmann and Hirsch 2006). Shoal facies belt is composed of bioclast orbitinolina grainstone microfacies. Grainstone's texture with an abundance of benthic foraminifera and echinoderms indicates that the environment's energy has been moderate and high (Flügel 2010). The open marine facies belt includes bioclast orbitolina wackestone\packstone, orbitolina wackestone\packstone, and bioclast packstone microfacies. One of the major elements in the shallow open marine facies category is the presence of long shape orbitholinid. The presence of this orbitholinid indicates the normal and open marine environment (Simmons et al. 2000; Tasli et al. 2006). Gradual microfacies change, the absence of calciturbidites, aggregate grains, and slump structure, confirms a carbonate ramp. Based on the sequence stratigraphic studies, three depositional sequences were identified in the studied sequence. The lower boundary of sequence1 characterized by disconformity. The upper boundary of this sequence and the sequence 2 are determined by the mudstone microfacies. The upper boundary of the sequence 2 and sequence 3 are also characterized by mudstone microfacies and the upper boundary of sequence 3 is marked by disconformity. The MFS in these sequences is determined by bioclast packstone microfacies. Geochemical analysis in limestone parts of the formation including Ca (36.17–39.2%), Mg (0.2–1.5%), Sr (397–1075 ppm), Na (40–160 ppm), Mn (55–250 ppm) and Fe (122–3407 ppm), and their variations indicate that the original carbonate mineralogy is aragonite and closed to slightly open diagenetic systems. Variation of elements along stratigraphic section shows that the amount of Sr in the upper part decreases as the Mn content increases; These conditions indicate the greater impact of meteoric diagenesis on the upper part.