Sequence stratigraphy and relative sea level changes of the Ab-Deraz Formation, based on palynological evidences (Sanganeh section)

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Introduction

The Kopeh-Dagh sedimentary basin formed after the middle Triassic orogeny in northeastern Iran. There is no evidence of major tectonic activity in this region; all formations are conformable, except for a few disconformities within the Cretaceous succession (Afshar-Harb, 1994). The lower contact of the Ab-Deraz Formation in Sanganeh section with the Aitamir Formation is paraconform, and the upper contact with the Ab-Talkh Formation is conform. This section of the Ab-Deraz Formation is about 300 meter thick. In this section, lithology is composed of light gray shale, olive green shale and three chalky limestone bands. Sequence stratigraphy can be used to interpret the sea level fluctuations during deposition of any stratigraphic succession. The new method of palynological factors, such as biological degradation of palynological particles, roundness and homogeneity of equidimensional phytoclasts, the relative abundance of opaque phytoclasts to transparent phytoclasts, the relative marine palynomorph to terrestrial particles ratio, relative abundance and diversity of dinoflagellate cysts and relative chorate to proximate, proximochorate and cavate (C/PPC) morphotype ratio can be use for interpretation of stratigraphic sequences (Schioler, 2002). In this study, these factors were used for differentiation of sequences.

Discussion

Palynological factors can be use for determination of sequence units. Usually for the sequence stratigraphic analysis of the palynological facies, three major groups of elements including frequency of palynomorphs (MP), amorphous organic matter (AOM) and the phytoclast (Ph) can be used (Carvalho *et al*., 2006). Amorphous organic matter also use to determine the ecological interpretation and study of sea level changes and the receding sequence units as the most important elements. The relative abundance of AOM increases in a proximal to distal, and AOM is the dominant kerogen constituent in distal dyoxic to anoxic shelf environments. The abundance of AOM increases during transgression and early highstand. High percentage of phytoclast is mostly related to proximal depositional condition (Van Der Zwan, 1990). Generally, large amount of phytoclast particles are deposited by rivers in estuaries and delta, both close to shorelines. However, redepositional also occurs in deep waters by turbidity currents. Phytoclast are generally divided into two categories: black and brown. The relative abundance of black phytoclast increased in distal facies; however the relative abundance of brown phytoclast decreases in offshore environments. Increases the ratio of chorate to proximate, cavate and proximocavate form is show that the rise of water see level (Progressive conditions), and the increases the cavate form is show the fall of see level (regressive conditions). Palynological factors such as the terrestrial to marine particles ratio, the chorate/proximate, proximochorate, cavate cyst ratio (C/PPC), differences in dinoflagellate assemblages and rarity and abundance of dinoflagellate cyst groups were used for sequence stratigraphic analysis (Gorin & Steffen, 1990; Steffen & Gorin, 1993; Pittet & Gorin, 1993). Based on this study, three depositional sequences were identified and will be summarized below:

First Sequence: The lower boundary of this sequence is marked by a sharp change in lithology from sandstone to shale and chalky limestone. Based on field and palynological evidence, its lower boundary is disconform with Aitamir Formation. The upper boundary is picked at about 120 meters above the section and is marked by a sharp increase in phytoclasts, especially the brown phytoclasts, and a sharp decrease in abundance and diversity in the marine palynomorph, a sharp decline in C/PPC and a sharp decline in ratio of ON/IN cyst. Three system tracts including LST, TST, and HST were identified within this sequence that has been deposited in marginal basin toward distal shelf.

Second Sequence: The lower boundary of this sequence is conforming to the upper boundary of the lower sequence. The upper boundary of this sequence is placed at some 275 meter above the base of the section. This boundary is identified by high abundance of phytoclasts and sudden decrease in diversity and abundance of Dinoflagellates and sudden decrease in the C/PPC ratio. Depositional environment changes from distal shelf to proximal shelf (Marginal basin) within the sequence. This sequence contains two system tracts including TST and HST.

Third Sequence: The lower boundary of this sequence is conform to the upper boundary of the second sequence and the upper boundary is picked at 530m above the base of section at the top of the third layers of chalky limestone. Similar to the second sequence, this one is made up of two system tracts: TST and HST. It is worth mentioning that, based on the depth of the desired facies composition (LST can't be identified based on palynological evidence and thus, two system tracts, namely, LST and TST, are taken into consideration altogether). They are identifiable by the existent evidence in palynological slides.

Result

The Ab-Deraz Formation in the studied section was analyzed for sea level fluctuations and sequence stratigraphy using palynological factors. To test accuracy of this method, we used palynology and palynofacies process and change in organic matter contents and correlation using parameters, such as the terrestrial/marine particle ratios, the C/PPC ratio, diversity and abundances in dinoflagellate cysts, changes in organic materials (Phytoclasts, palynomorphs and amorphous organic materials) and integration of these data with identified palynofacies. Based on this study, three sequences with four sequence boundaries (3 boundaries of type II and one boundary of the type I) were identified.

Keywords: Sequence stratigraphy; Relative sea level changes; Palynological factors; Ab-Deraz Formation.

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