The comparison of geochemical data of carbonate rocks of Mozduran Formation at central and eastern part of the Kopet-Dagh Basin

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Abstract
The upper Jurassic (Hemispartites-Tithonian) Mozduran Formation in the Kopet-Dagh basin mainly composed of carbonate rocks intercalated with siliceous and evaporite sediments. In central Kopet-Dagh, Mozduran Formation has been divided into five portions that mainly composed of calcite, dolomite, anhydrite, limestone, shale, and siltstone, based on lithostratigraphic evidence. The purpose of this article is to compare carbonate geochemistry of the central and eastern parts of Kopet-Dagh basin. Determination of original carbonate mineralogy on petrography is not as clear because argonite and high Mg calcite turn to low Mg calcite during diagenetic processes. In present study, major and trace elements and carbon and oxygen isotope values are used to determine the original carbonate mineralogy, paleotemperature and diagenetic trend of Mozduran Formation carbonate rocks. Major and trace elements and oxygen and carbon isotopes data in carbonate sequence of Mozduran Formation indicates a burial diagenesis. The paleotemperature of marine water during deposition of Mozduran Formation was around 11°C. The geochemical signatures also indicate that original carbonate mineralogy of the carbonate rocks was mixed argonite-carbonate mineralogy. Finally, obtained data indicate that the primary mineralogy of the carbonate rocks of the central basin shares similar characteristics with those in eastern part of the studied basin.

Key words: Isotope Analysis, Diagenetic, Mozduran Formation, Lithostratigraphic

Introduction
The Kopet-Dagh Basin is located in north-east of Iran. It is composed of carbonate and siliciclastic rocks with minor amounts of evaporite and has deposited during Jurassic-Oligocene time. Mozduran Formation is one of the most important gas interval in this basin that has been partly high tension and also attracted a lot of attention and so many examination on that including Mousavi Harandi, 1991, Adabi, 1995, and Pase and Nae, 1991, Lassen, 1995, Aghaei et al., 1982.

The purpose of this study is to interpret diagenetic process of Mozduran Formation in central part of Kopet-Dagh Basin by using geochemical data and comparison with eastern part of this basin.

One stratigraphic section in North of Mashhad, near the Boghmag village with 780 m thickness is measured and sampled. This area is located on N 36°49'05.33" and E 59°17'45.33". 120 samples are selected for stable isotope (δ18O, δ13C) and elemental analysis (Fe, Mn, Sr, Na, Mg and Ca). The stable isotopes carried out by Mass Spectrometer in Tasmania University, Australia and elemental analysis carried out by atomic absorption spectrometer in Ferdowsi University of Mashhad, Iran.

Discussion
Petrographical studies revealed that sediments of study area are influenced by various post depositional processes including metasomatism, cementation and compaction (Fig.1). Metasomatism is the first diagenetic process which tended to form micrite envelope around
most of skeletal grains. The effects of sediment compaction in various facies in Central part of Mudurnoo Formation are characterized by changing in fabric that mostly represent the influence of overlying sediment load and physical compaction. A widespread evidence of compaction is indicative of deep burial condition and beginning of chemical compaction. The most important evidence is the stylolitic formation and relevant filled fabrics. Stable isotope analysis showed that δ^18O and δ^13C ratios studied ranged between -8.4 to -3.0% PDB and 0 to 3.0% PDB, respectively. Cross plotting show high variations of δ^18O and low variations of δ^13C. These variations as also support burial diagenesis interpretation.

In order to achieve more accurate results, geochemical analysis of central part is compared with eastern part of Koper-Dagh Basin (Adabi, 1991). The stable isotope value (δ^18O, δ^13C) of eastern part, shows -1.7 to -7.4% PDB, 0.9 to 4.5% PDB, respectively. This trend also supported burial diagenesis in eastern part.

Generally, most of the carbonate are affected by meteoric and burial diagenesis processes, so determining the original mineralogy based on petrographical evidences is not reliable because they were replaced by stable mineralogy (LMC). According to Rao (1991), Adabi and Rao (1991), Rao and Adabi (1993), Winterfield et al. (1996), utilizing of trace element variation, especially Sr/Mn ratio and oxygen and carbon isotope can help us to distinguish original mineralogy of calcite and aragonite.

In order to determine the original mineralogy of the carbonates in central part and comparing them with eastern part we used thermal equilibrium lines (Fig.2). Adabi and Rao (1996) considered the value of atmospheric CO2 equilibrium to 7.2 during late Jurassic. With respect to Fig.2 the equilibrium lines of aragonite and mixed aragonite and calcite cross the carbonate samples of central and eastern parts of Mudurnoo Formation. Due to the solution of the original minerals and replacing with LMC calcite during the diagnostic processes, the Sr concentration decreases with increasing Mn and consequently the Sr/Mn ratio will decrease (Fig.3). This process was being facilitated during burial diagenesis and is a strong evidence of reequilibration. So the Sr/Mn diagram can be a good way to represent the solution of carbonate rocks (Rao, 1991). According to our diagram, the data shows mixed aragonite carbonates in mineralogy in central part of Koper-Dagh. The diagram of Central part of Koper-Dagh (Adabi, 1996) indicated mixed mineralogy as its analogue in eastern part.

Conclusions
Carbonate rocks of Mudurnoo Formation in Central part and eastern part of Koper-Dagh are affected by burial and marine diagenesis environment. The importance petrography significant in young marine carbonates. Geochemical analysis (oxygen and carbon isotope) also confirm burial diagenesis. Based on trace element interpretation, these sediments had mixed aragonite-calcite original mineralogy.

References


Fig.1. Thin-section photomicrographs of limestones from the Meotian Formation: A) The overgrowth cement around skull fossil fragment, B) Microcrystalline precipitates in

Central Part Eastern Part

Fig. A cross-plot of $\delta^{18}O$ against $\delta^{13}C$ shows that the thermal equilibrium lines of aragonite and magnesium calcite are passed among Morduian Limestone (dash box).

Central Part Eastern Part

Fig. 1. Variations of Sr/Mn against Mn in Mudurian Formation, compared with the recent invertebrate bulk carbon (Yamada).