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

Yasaman Rafighdoust[1]*, Reza Moussavi Harami[1], Mohamad Hossein Adabi[2], Asadollah Mahboubi

[1] Department of Geology, Faculty of Science, Ferdowsi University of Mashhad, Iran

[2] Department of Geology, Faculty of Earth Science, University of Shahid Beheshti, Tehran, Iran
E-mail address: y_rafighdoust@yahoo.com

Abstract
The upper Jurassic (Kimmeridgian-Tithonian) Mozduran Formation in the kopet-dagh basin mainly composed of carbonate rocks intercalated with silisiclastic and evaporite sediments. In Center of kopet dagh, Mozduran Formation has been divided in to five portions that mainly composed of calcilutite, dolomite, dolomitic limestone, shale and sandstone, based on lithostratigraphic evidence. The purpose of this article is to compare carbonate geochemistry of the central and eastern of kopet dagh basin. Determination of original carbonate based on petrography is not so clear because aragonite 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 Formatin indicate a burial diagenesis. The paleotemperature of marine water during deposition of Mozduran Formation was around 19.6 °. The geochemical signatures also indicate that original carbonate mineralogy of the carbonate rocks was mixed aragonite-calcite mineralogy. Finally, obtained date indicate that the primary mineralogy of the carbonate rocks of the central basin shows similar characteristics with those in eastern part of the studies basin.

Key words: *Isotope Analysis, Diagenesis, Mozduran Formation, Lithostratigraphic*

Introduction
The Kopet-Dagh Basin is located in north-east of Iran. It is composed of carbonate and silisiclastic rocks with minor amounts of evaporate 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 extent and also attracted a lot of attention and do many examination on that including Moussavi Harami, 1991., Adabi., 1369, Adabi and Rao.,1991, Lasemi.,1995, Aghaee et al.,1382.
The purpose of this study is to interpret Diagentic process of Mozduran Formation in Central part of Kopet-Dagh Basin by using geochemical data and comparison with Eastern part of this basin.
One strasigraphic section in North of Mashhad, near the Boghmej village with 780 m thickness is measured and sampled. This area is located on N 36 49' 9.3" and E 59 13' 40.33". 120 stained thin sections are studied. 25 samples are selected for stable isotope ($\delta^{18}O$, $\delta^{13}C$) 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 spectrophometer in Ferdowsi University of Mashhad, Iran.

Discussion
Petrographical studies revealed that sediments of study area are influenced by various post-depositional processes including micritization, cementation and compaction (Fig.1). Micritization is the first diagenetic process which tended to form micrite envelope around

most of skeletal grain. The effects of sediment compaction in various facies in Central part of Mozduran 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 an indicative of deep burial condition and beginning of chemical compaction. The most important evidence is the stylolite formation and relevant fitted fabrics.

Stable isotope analysis showed that $\delta^{18}O$ and $\delta^{13}C$ ratios studied ranged between -2.7 to -8.4‰ PDB and 0 to 3.6‰ PDB, respectively. Cross plotting shows high variations of $\delta^{18}O$ and low variations of $\delta^{13}C$. These variations as also support burial diagenisis interpretation.

In order to achieve more accurate results, geochemical analysis of central part is compaired with eastern part of Kopet-Dagh Basin (Adabi, 1991). The stable isotopes value ($\delta^{18}O$, $\delta^{13}C$) of eastern part, shows -1.7 to -7‰ PDB, 0.9 to 4.5‰ PDB, respectively. This trend also supported burial diagenisis in eastern part.

Generally, most of the carbonates are affected by meteoric and burial diagenisis 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), Winefield 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 equivalent 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 Mozduran formation. Due to the solution of the original minerals and replacing with LMC calcite during the diagenetic 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 digenesis and is a strong evidence of reduction condition. 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 calcite mineralogy in central part of kopet-Dagh. The diagram of Central part of Kopet-Dagh (Adabi, 1369) indicated mixed mineralogy as its analogue in eastern part.

Conclusions

Carbonate rocks of Mozduran Formation in Central part and eastern Part of Kopet Dagh, are effected by burrial and marine digenesis environment. The importance petrography significant including micritization, cementation, chemical and physical compaction. Geochemical analysis (oxygen and carbon isotopes) also confirm burial diagenesis. Based on trace element interpretation, these sediments had mixed aragonite-calcite original mineralogy.

Reffrences

- Adabi, M.H, and Rao, C.P., 1991. Petrographic and geochemical evidence for original aragonitic mineralogy of Upper Jurassic carbonates (Mozduran Formation), Sarakhs area, Iran: Sedimentary Geology.
- Aghaee, A., 1983. Depositional of history of Mozduran Formation in west of Aghdarband. M.S. thesis, Geology Department, Ferdowsi University.
- Al-Aasm, I.S., and Veizer, J., 1986. Diagenetic stabilization of aragonite and low-Mg calcite, stable isotope in rudists: Journal of Sedimentary Petrology, v.56, p. 763-770.

- Kalantari, A., 1969. Foraminifera from the Middle Jurassic-Cretaceous Successions of Kopet-Dagh region (N.E Iran): National Iranian Oil Company (NIOC).
- Lasemi, Y., 1995. Platform carbonate of Upper Jurassic Mozduran Formation in the Kopet-Dagh basin, NE Iran, facies, paleoenvironments and sequences: Sedimentary Geology, v.99, p.151-164.
- Mahboubi, A., Moussavi-Harami, R., Brenner, R.L. and Gonzalez L.A., 2002. Diagenetic history of late Palaeocene potential carbonate reservoir rocks, Kopet- Dagh basin, NE Iran.
- Moussavi-Harami, R., 1989. Depositional history of Upper Jurassic (Oxfordian-Kimmeridgian) carbonates and evaporates in northeastern Iran (abs.): Proceeding of the 28th International Geological Congress, Washington DC. v. 2, p. 471.
- Moussavi-Harami, R., and Brenner, R.L., 1992. Geohistory analysis and petroleum reservoir characteristics of Lower Cretaceous (Neocomian) sandstone, eastern portion of Kopet-Dagh basin, northeast Iran: A.A.P.G. Bulletin, v. 76, p.1200-1208.
- Winefield, P.R., Nelson, C.S., and Hodder, A. P. W; 1996. Discriminating temperate carbonates and their diagenetic environments using bulk elemental geochemistry:a reconnaissance study based on New Zealand Cenozic limestones: Carbonates and Evaporites,v.11,p.19-31
- Brasier, M.D., Anderson, M.M., and cornfield, R.M., 1992. Oxygen and carbon isotope stratigraphy of early Cambrian carbonates in southeastern Newfoundland and England: Geology Magazine; v.129, p. 255-279.
- Nelson, C.S., and Smith, A.M., 1996. Stable oxygen and carbon isotopes compositional fields for skeletal and diagenetic components in New Zealand, Journal of Geology, Geophysics, v.39, p.93-107.

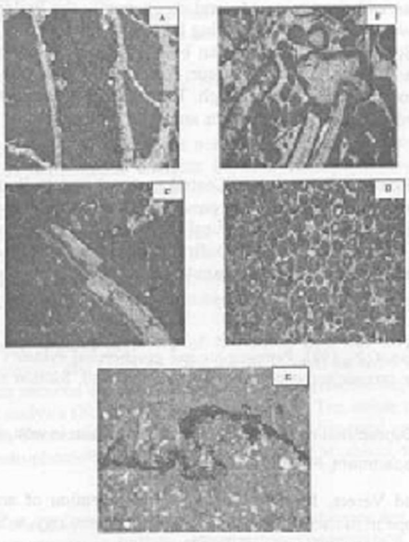

Fig.1. Thin-section photomicrographs of limestone from the Mozduran Formation. A) The overgrowth cement around echinoderm fragment. B) Micritization process in

bioclastic grainstone. C) Physical compaction in bioclastic wackestone. D) convex-concave contact in oolotic grainstone. D) Forming stylolite in effect of chemical compaction.

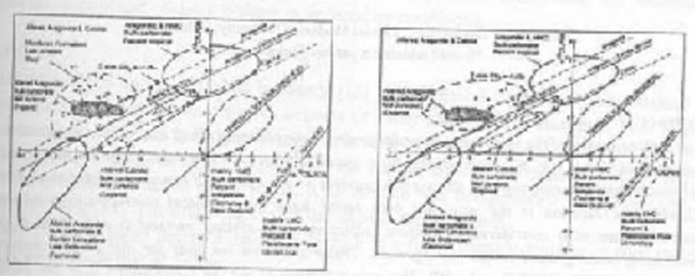

Fig2. A cross-plot of $\delta^{18}O$ against $\delta^{13}C$ shows that the thermal equilibrium lines of aragonite and aragonite-calcite are passes amount Mozduran Limestone (dash line).

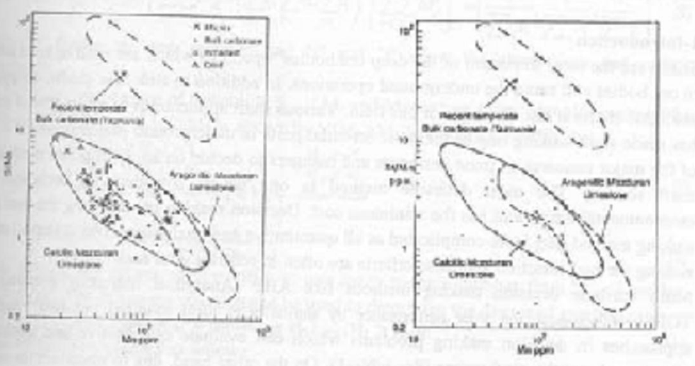

Fig3. Variation of Sr/Mn against Mn in Mozduran Formation, compared with the recent temperate bulk carbonate (Tasmania)