Recognition of aragonitic original mineralogy of the upper part of the Mobarak Formation based on geochemical studies

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Abstract

Recognition of original carbonate mineralogy based on petrography studies is difficult in ancient carbonates, because aragonite (A) and high-Mg-calcite (HMC) transformed to Low-Mg-calcite (LMC) during diagenesis in this study major and minor elements, O and C isotopes used to determine the original carbonate mineralogy of the Mobarak Formation. The study area is the part of Mobarak Formation which is located 24 km from Semnan in North of Shahmirzad and consists of carbonate succession was deposited during Lower Carboniferous due to transgression. The upper part of Mobarak Formation has a total thickness of about 105m. Sedimentary sequence of the Mobarak Formation in Shahmirzad area is underlain disconformably by Jeirud Formation and is overlain with laterital horizon between Mobarak and Elika Formation. Major and minor elements such as (Ca, Mg, Sr, Na, Fe, Mn) and $\delta\ ^{18}O$ *and* $\delta\ ^{13}C$ *values with trace elements in carbonates, are used for recognition of original carbonate mineralogy. Elemental and isotopic Composition of Mobarak Carbonates fall within subtropical aragonite mineralogy of Ordovician Gordon Limestone and Mozduran aragonite carbonates of upper Jurassic.The carbonates are affected mostly by meteoric diagenesis, in Semi – Closed to Open diagenetic system. Paleotemperature calculation indicates an ambient temperature about 37° C.*

Keywords*: Geochemically studies, Microfacies, Mobarak Formation, Shahmirzad.*

Introduction

Geochemical studies

Determination of major and minor elements

15 carbonate samples relation to carbonate facieses of upper part of Mobarak Formation, especially for elemental experiences studies and microfacies changing had been selected.
First of all, the powder of these samples were prepared from the parts of micritic, and then we have analyzed 0/25 gr from each sample in order to determine the major and minor elements.
Major element value that contain: mg, ca, has been measured base on percentile and minor element such as Fe – Mn – Na – Sr also has been measured base on PPM

Oxygen 18 and carbon 13 isotopic composition determination

In order to determination stable isotopes values in isotopic analyses stage, they selected 11 samples of carbonate rock powder and send them to central science laboratory of Tasmania university in Australia after powdering the samples, it has been measured about 15 ml/gr of samples by Mass spectrometry system (Micromass,602D). Measurement mistake is about ±0/1 in this analyze, it has been trying to use powders that hare usage in elemental analyses.

Geochemistry studies results

Strontium

Searching the results of upper part of Mobarak Formation shows that value range of sr^{++} is difference between 1035 till 4679.

All of limestones in confine of subtropical Ordovician Gordon group limestone of Tasmania. That is because of the mineralogy composition similarity between these two Formations.

Sodium

Sodium extension in limestone samples of Mobarak Formation is between 130 till 515 (average 350) P.P.M low extension of sodium in Mobarak Formation shows that these samples are affected by meteoric diagenesis in Mn diagram for Na, most of the upper part of Mobarak Formation data are situated in a genetic confine of Mozduran Formation and Tasmania Gordon Group.

Na/Sr:

Paleo tropical carbonates and resent are separate table with non-tropical carbonates because of the value of Mn and Sr/Na. the value of Mn in resent tropical aragonitic limestones is low and proportion of Sr/Na is high on the other hard, in resent temperate calcitic limestones it's converse . These proportions are also reserved in paleo carbonates.

Most of the samples are in the confine of Gordon Group aragonitic limestones.

It has been understood that these limestones like Gordon Group limestones have been formed in tropical condition and warm and shallow waters.

Sr/Mn:

During the solution process, the value of Sr decrease but Mn increase and proportion of Sr/Mn will decrease the reason that some samples can't be in Tasmania Gordon Group is because of decreasing the value of Sr and focusing during the solution process and changing to stable low Mg calcite.

Oxygen and carbon isotopes:

Mobarak Formation carbonates isotopes values are mostly inside and round the aragonite Mozduran formation limestones and aragonitic Gordon Group limestones confine in Australia. But they have distance from Great Barrier and resent temperate Tasmania and Newzeland. Changing process of oxygen and carbon isotope in upper part of Mobarak Formation follows an inverse J trend, that representative the meteoric digenesis effect on upper part of Mobarak Formation carbonates. The manner of oxygen and carbon in minor elements of limestone samples is explanatory Aragonitic original mineralogy.

Carboniferous seawater paleo temperature calculation

In this research, it has been tried to use combination that are less by diagenesis. The measured Paleo temperature for upper part of Mobarak Formation, considering δw is (+0/5‰) (Brand, 1982) and the heaviest oxygen isotope in Anderson and Arthur formula (1983) $T^{\circ C} = ۱۶ - ۴/۱۴(\delta c - \delta w) + ۰/۱۳(\delta c - \delta w)^{۲}$ is measured about 37° and it's comparable with measured thermal confine for carboniferous sea.

Conclusion

Evaluation the result of the geochemical, such as major and minor elements and δ_o^{18}, δ_c^{13} comparison with recent and Paleo aragonite limestones such as Ordovician subtropical Gordon Group limestone of Tasmania and Mozduran Formation limestones and recent temperate Tasmania Limestones is explanatory that you can consider a aragonite original mineralogy composition for this sedimentary basin.

Distribution of major and minor elements of Mobarak formation isotope is comparable with subtropical Gordon Group aragonite limestones and Mobarak Formation shallower part, most of the data are in or neighborhood of this two confine. And that is because of confine mineralogical similarity.

High proportion of Sr/Na will also confirm the aragonite mineralogy in this basin.

The measured temperature of this sedimentary basin has compatibility with tropical environment that aragonitic sediment usually occurs in shallow and tropical warm seas.

It's a good reason for confirmation of aragonite original mineralogy for this part of Mobarak Formation.

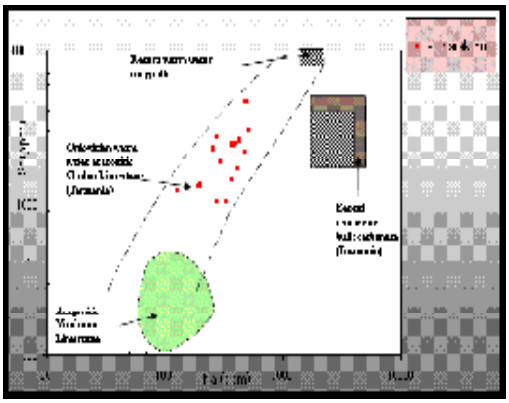

Diagram 1: trace the values of Sr proportion to Na related to Mobarak Formation. This diagram shows that all studied carbonate samples are located in Ordovician Gordon Group limestone of Tasmania confine with aragonite mineralogy combination.

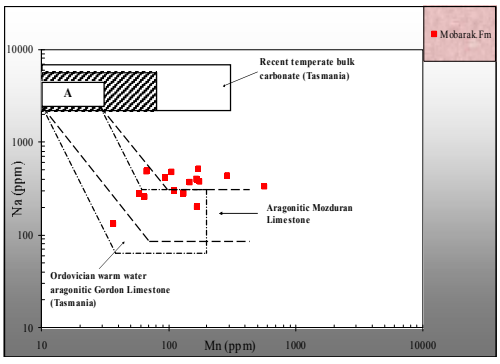

Diagram 2: Mn changing versus Na. Attention to determined limitations, most of the upper part of Mobarak Formation of carbonated data is in Gordon Group and Mozduran Formation confine.

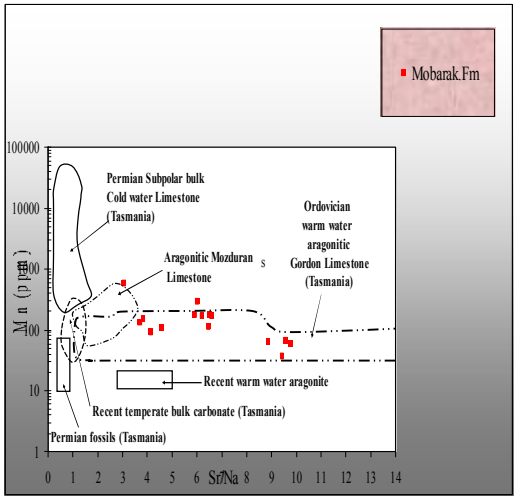

Diagram 3: comparison between the value of Sr/Na and Mn within Mozduran limestone field of shallow part of basin. Tasmania Ordovician Gordon Group limestone in Australia and resent part of Mobarak Formation. The samples of upper part of Mobarak formation are mostly located in Tasmania Gordon confine with aragonite mineralogy combination the proportion of Sr/Na is higher than the samples and it's a sign of tropical depositional environment.

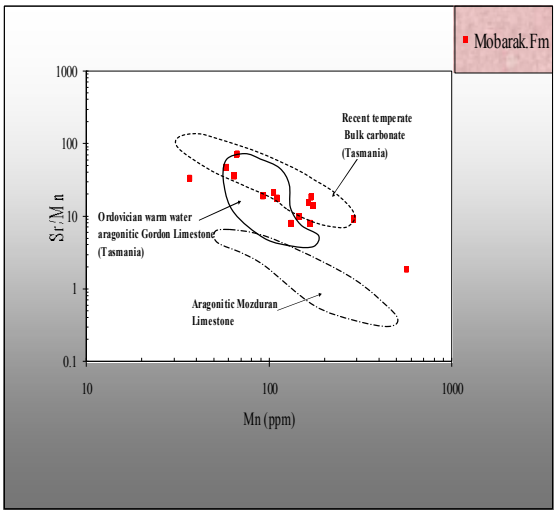

Diagram 4: Sr/Na changing versus Mn in upper part of Mobarak Formation limestones pay attention that limestons data are located in aragonite Gordon Group limestones confines. You can separate resent and paleo tropical carbonates with non-tropical equivalents, with this diagram.

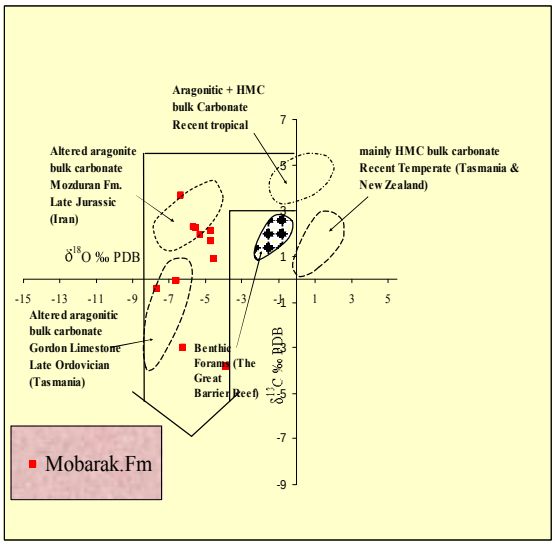

Diagram 5: carbon and oxygen diagram in balk carbonate recent tropical, recent temperate – (Tasmania) and Newzeland, Bentic forams as (the Great Barrier Reef) and Mozduran formation Gordon Group. The most samples of upper part of Mobarak Formation and Gordon Group Gordon Group are located in around the Mozduran Formation and Tasmania Gordon Group. The process of carbon and oxygen isotopes changing follows an inverse J trend and it issues the effect of meteoric diagenesis on Mobarak carbonates.

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