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Sedimentology and Sedimentary Environment of Mobarak Formation in Haraz area – Mobarakabad village, Iran

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Abstract

In this study, facies and depositional environment of Mobarak formation in central Alburz particularly in Haraz area near Mobarakabad village are studied. This section consists of shale, sandstone, limestone, and dolomite, lower carboniferous in age. Based on field and microscopic investigations, the said section includes seven carbonates, and two clastic facies. These groups of facies were deposited in an open marine, bar, lagoon, and tidal flat sub-environments, related to a carbonate ramp platform.

Keywords: Mobarak Formation, Facies, Sedimentary Environment, Lower Carboniferous, Haraz Area.

1 Introduction

The study area is located in the North Mobarakabad village at latitude of 35° 47/ 38// North and longitude of 51° 58/ 26// East(Figure 1). Tectonically, this area is part of central Alburz zone. Since, conventional methods for classification of carbonate rocks not describe the detailed characterization of facies, this study follows the integration of the two well known methods of Pettijohn (1987) [7] and Dunham (1962) [4] for facies naming.

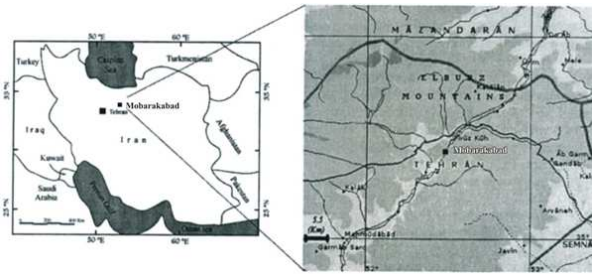

Figure 1: Location map of the studied area

2 Stratigraphy

The Mobarak formation was first investigated by Assertto in 1963, [1] for those sediments overlaying the Mila formation. In 1964 Assertto and Gattani redefined the Mobarak formation, according to Bozorgnia (1973), [2] they found that the sandstones and shales which directly overlying the quartzitic sandstones of Mila formation are upper Devonian in age. As a result, Assertto and Gattani (1964) limited the Mobarak formation to the limestones at the top of shales and sandstones of late Devonian and underlying discontinuity of Carboniferous- Permian. In a Stratigraphy sequence, the above part of Jairud consist of sandstones, sand-limestone, shale and lime-shale, while, the Mobarak formation in sedimentation unites of study area comprise of limestone, dolomites, clayey limetones, and lime-dolomite.

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3 Methodologies

In a field investigation, reconnaissance studies were carried out by identifying and measuring thickness of different units and lithological variations. Consequently, for thin sections studies totally 185 samples were collected of which 35 ones belongs to upper units of Jairud formation and 150 samples from Mobarak formation.

4 Microscopic studies

The microscopic characterization of thin sections revealed four kinds of facies which include nine sub-facies of carbonate and clastic ones. Comparisons of studied facies with those standard facies presented by Flugel (2004) [5] and Wilson (1975) [9] generally suggest a carbonate ramp is a depositional environment. In most of facies studied under thin sections, micrite texture, silication, vuggy, cellular and channel like porosities, compaction, dolomitization, cavity filling by sparcalcite are the most common diagenetic occurrences (Kayvani 2002) [6]

5 Open marine facies group

This group is dividing in to two facies, namely 1 and 2. Facies 2: Echinoderm packstone (Photo 2), The main allochem of these two facies is echinoderm (10 to 30 percent approximately), placed in a matrix.

6 Dam facies group

Consist only one facies of bioclast grainstone as facies 3 (Photo3). Its allochem is nearly 55 percent including, bivalves,

ooliths, oncolite, echinoderm radioles, sponge radioles, brachiopods, foraminifers, intraclasts, grapstone. The less frequent allochem are gastropods, corals, gastropods, pellets, and stormatolitic structures. These allochems are in calcitite matrixes that denote their formation in a dam environment.

7 Lagoon facies group

This group consists of one facies as bioclast packstone facies 4. The major allochem varying 30 to 50 percent consist of brachiopod radioles, bivalves, brachiopod, trilobite radioles, and pellets (Photo4). The minor allochem is echinoderms placed in matrix. The presences of dolomite in some sections as a matrix indicate the dolomite nature of depositional conditions.

8 Tidal flat facies group

This is a major group consist of five facies as 5, 6, 7, 8, and 9 which are describe as follow:

Dolomitized peloid grainstone as facies 5. In this facies, pellets are more than peloid with approximately 35 to 55 percent (Photo 5). The majority of pellets are lithic with 0.15 to 0.3mm in sizes, placed in calcite matrix but in some sections, the matrix is dolomitized that denotes the high energy condition. Bioclast peloid grainstone as facies 6. The numbers of pellets are more than peloids and bioclasts with nearly 55 percent (Photo 6). The most of pellets are lithic in a calcitite matrix with size of 0.15 to 0.3mm, with different bioclast such as brachiopods, bivalves, brachiopod radioles, and foraminifers (erlandia, ondotira) which indicating a high energy environment. Intraclasts grainstone as facies 7. In this facies, intraclasts are almost 55 percent, places in a calcite matrix, showing also a high energy environment (Photo 7). Mudstone as facies 8. This facies consist of two sub-facies of shale and siltstone (Photo 8). Under thin sections, siliceous dark gray mudstones nearly 62 micron in size, are actually as siltstone. Sandstone as facies 9. This facies also consist of two sub-facies of lithic arenite (Photo 9) and lithic wacke(Photo 10). In the study area the sandstones facies are layered type, alternatively are cross stratified structure with shale layers. Generally, quartz grains in upper part of Jayrud formation are fine in sizes ranging 0.02 to 0.15mm and are sub angular to sub rounded with shining surfaces which indicates their beach and river origins. In thin sections studies these quartz grains are monocrystaline and polycrystalline types. The abundant cherts in lithic arenite are microcrystalline and chalcedony types. While, pyrites and glauconites are less than 2 percent and the feldspars are almost absent. The presence of detrital quarts grains with erosion autogenetic siliceous cement also is another evidence for detrital sedimentary origin of the discussed grains(Figure 2).

9 Sedimentary model

To present the sedimentary model, along with Walter's law, the sequential Stratigraphy principles also are considered. The results obtained are compared with old and recent environments [5, 3, 9] to present sedimentary model of studied area. Based on environment origin of discussed facies, the sequence of Mobarak formation indicates the relative depth of Dip in carbonaceous open marine (facies 1 and 2) in the beginning and then gradual decreasing of depth to create the bar (facies 3), lagoon (facies 4), and tidal flat (facies 5, 6, 7, 8, 9) environments. The sedimentary environment of Mobarak formation is carbonaceous shallow marine which related to a carbonate ramp platform (Figure 3).

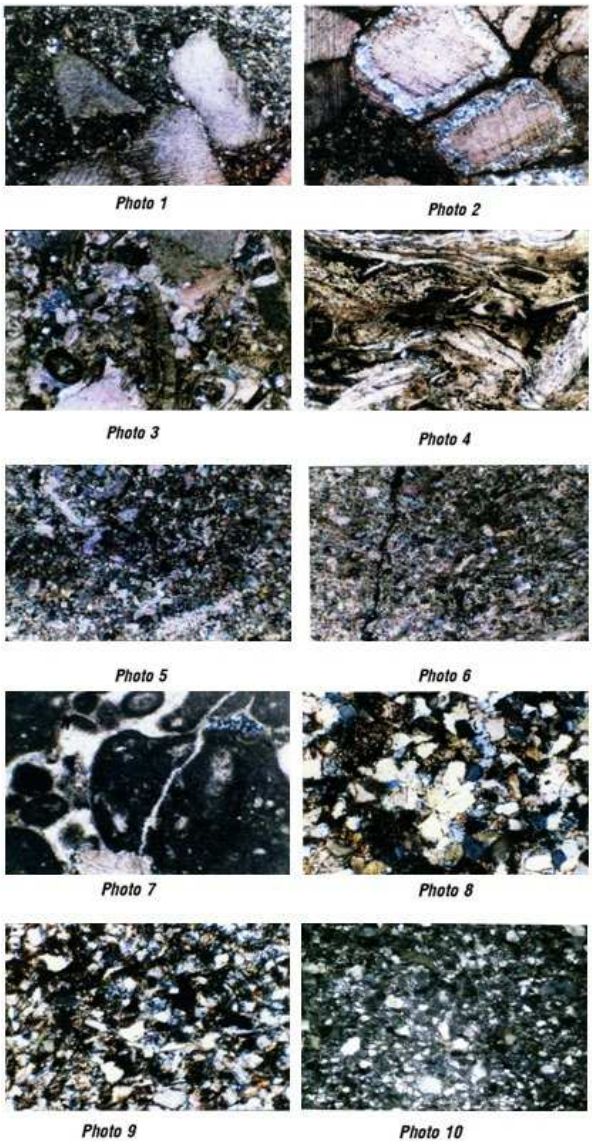

Figure 2: Different types of facies groups in target area; Open marine (1&2), Dam (3), Lagoon (4), Tidal flat (5, 6, 7, 8) and Clastics (9, 10)

10 Conclusions

In this research works, totally 9 facies are identified which divided in four groups related to bar, lagoon, tidal, and open-marine environments. These groups of facies occur in a ramp type carbonaceous platform which including the open marine (facies 1 and 2), bar (facies 3), lagoon (facies 4), and tidal flat (facies 5, 6, 7, 8 and 9) systems. With refer to the studied facies and sub-environments and also their succession, the proposed sedimentation environment of Mobarak formation is a shallow marine carbonate ramp with developing bioclast sandy bar and the lagoon behind it. In addition, the presence of primary fine dolomites and intraclasts and pellets in sparites matrix belongs to supratedial environments indicating a dry

and warm to semi-warm weathering condition resemble to the condition presented by Tucker and Wright (1990) [8].

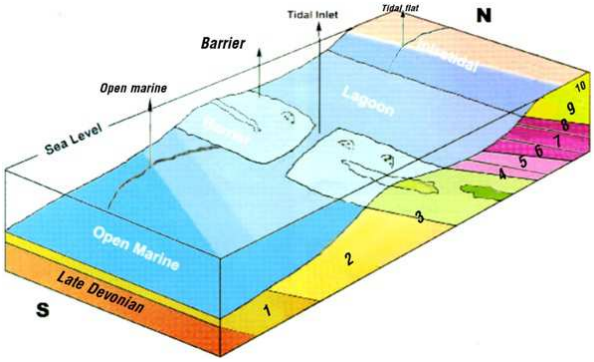

Figure 3. Sedimentary model of Mobarak formation in the studied area.

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