

Stratigraphy of Vali-Abad Section (Central Alborz–North Iran) Based on Corals

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Abstract The Mobarak Formation in the Vali-Abad section (Central Alborz-South of Chalus) was studied at the central Alborz. The stratigraphical section show regressive sequences from Tournaisian to Namurian?. Three main environments containing rugosa and tabulate corals were identified: open shelf, oolitic shoals and lagoon. Up to 25 species of rugosa and tabulate corals belonging to 16 genera have been identified: *Zaphrentites parallela*, *Zaphrentites delanouei*, *Ampelexizaphrentis iraniense*, *Ampelexizaphrentis* sp., *Siphonophyllia cylindrica cylindrica*, *Siphonophyllia iranica*, *Siphonophyllia* cf. *dorlodoti*, *Kueichophyllum alborsense minor*, *Kueichophyllum alborsense major*, *Caninia* aff. *irinae*, *Dibonophyllum bipartitum*, *Quinghaiphyllum pygmaeum*, *Aullophyllidae* sp., *Kailingophyllum* sp., *Marzanophyllum chalusense*, *Marzanophyllum crassiseptum*, *Hapsiphyllum* sp.1, *Hapsiphyllum* sp.2, *Zaphrentoides* sp.A, *Zaphrentoides* sp. B, *Ufimia* sp., *Hapsiphyllidae* indet., *Syringopora* sp., *Michelinia* sp. and *Favositidae* indet. Coral assemblages allow us to distinguish three biozones, with local value. Lowermost assemblage is composed of small, solitary, undissepimented corals and it is typical open and deep platform. Corals at assemblage II are must diverse and abundant. This assemblage developed at shallow areas of the open shelf. Assemblage III proceed from lagoon and it is composed of small, solitary, undissepimented corals. Iranian Lower Carboniferous corals belong to shallow areas of open shelf-lagoon of unique oceans. Tournaisian-Namurian? platform are well-developed in the Alborz, Central Alborz and Baluchestan and rich in fossil corals. They are extended from southeast to northwest in the area of Lower Carboniferous deposition.

Keywords: corals, Tournaisian to Namurian?, Mobarak Formation, Vali-Abad section, Central Alborz, Iran

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1. Introduction

The Mobarak Formation with wide distribution in north of Iran is one of the fossiliferous geological formations in the Central Alborz. It comprises thick Lower Carboniferous sequence in different parts of Central Alborz. Corals are one of the most frequent and important fauna represented in the Mobarak Formation which considered by some investigators. The studied section comprises of relatively good-ordered alternations of limestone and shale rich in corals and other fauna. The Mobarak Formation is developed in the Northwest through the Northeast of Iran. It comprises thick Lower Carboniferous sequence (Tournaisian through the Namurian) in different parts of Central Alborz. Its lateral equivalents are developed in the Central Iran and East Iran Basins, and extended from northwest to northeast of Iran. The Mobarak Formation is represented by dark fossiliferous limestones with subordinate black shale intercalations in its lower part. In the type section, it rests disconformably on sandy-argillaceous beds of the Upper

Devonian and is overlain by marly limestone with ironstone lenses Upper Permian fossils (possibly, the Nesen Formation). The first systematic research on Iranian Carboniferous corals was made by [1], who described Permo-Carboniferous corals from Iranian Baluchestan. Since then many scholars studied corals in various parts of the country. Rugose and tabulate genera were used for correlation of different sections. Rugose complex typically includes solitary genera; only in the Vali-Abad a patch reef built by colonial *Siphonodendron* was known. Tabulate corals are widely distributed in Carboniferous deposits of the Iranian Platform.

Some descriptive papers have been published on Lower Carboniferous corals from several localities in the Central Alborz [2,3,4]. The paper by [2] is the most important for understanding of the Lower Carboniferous coral fauna of Iran. Carboniferous sequence of the Central Alborz is represented by more than 400 m of limestones yielding abundant rugose corals, brachiopods, foraminifers and other fossils. The Mobarak Formation developed in this area contains rich and diverse coral fauna. Biostratigraphy of the Mobarak Formation is based on conodonts and brachiopods [5], and also on corals [6], and [7].

Deposits yielding corals, specifically Tournaisian and Viséan, are represented by black limestones rich in corals and brachiopods.

2. Material and Methods

2.1. Study Area

The Vali-Abad section is located approximately 65 km south of Chalus (North of Iran).

The section is located on the northern side of the Chalus Valley at coordinates N: 36° 14' and E: 51° 17' (Figure 1). This sequence is the most complete Carboniferous exposures in the Vali-Abad region.

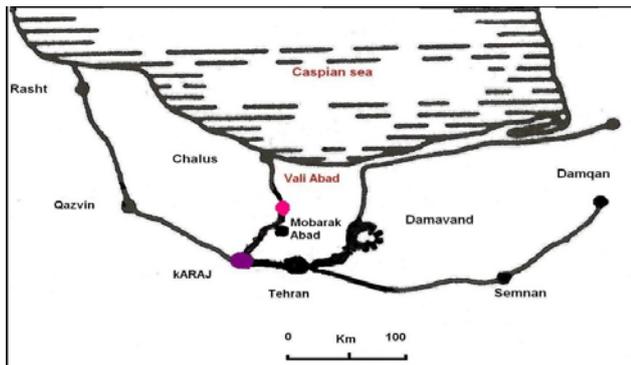


Figure 1. Geographical position and accessibility of the studied section

2.2. Lithology of the Studied Section

The measured section with general trend of N60E and dip of 45° has been consisted of relatively good-ordered alternations of limestone and shale beds.

The Mobarak Formation in the Vali-Abad section is about 200 meters thick (Figure 2). The Formation unconformably overlies the limestone of the Girud Formation (Frasnian) and is overlaid by the Dorud Formation (Permian). Lithologically, the Vali-Abad Formation can be divided into three parts:

The lower part consists of about 45 meters of thin bedded limestone with shale intercalation (Member A). Generally thin-bedded limestones are grey and buff in color with slightly weathered and bearing great amount of different fauna including corals, brachiopods, and trilobites.

The middle part consists of thick beds limestone with intercalations of shale (B) with 100 meters of thick.

The upper part consist of 55 meter intercalations of median to thick beds of limestone and shale (C). Shale beds are mostly grey to black and in some parts of the section possess rare fauna consisting of brachiopods and corals.

2.3. Methods

During field trips, more than 120 samples were collected and transported to the laboratory. In order to remove the waste materials encompassing the samples, corals were soaked in the cold water for about 10 days. In the next step, the samples were cleaned by a fine brush and photographed. Before being sent to sectioning, some of the physical and external characteristics of the studied corals including diameter, length and features of calice

were written down. Samples were sectioned just beneath their calice. Besides transverse and longitudinal sections are helpful for better identification of corals. Binocular microscope was used for study of samples.

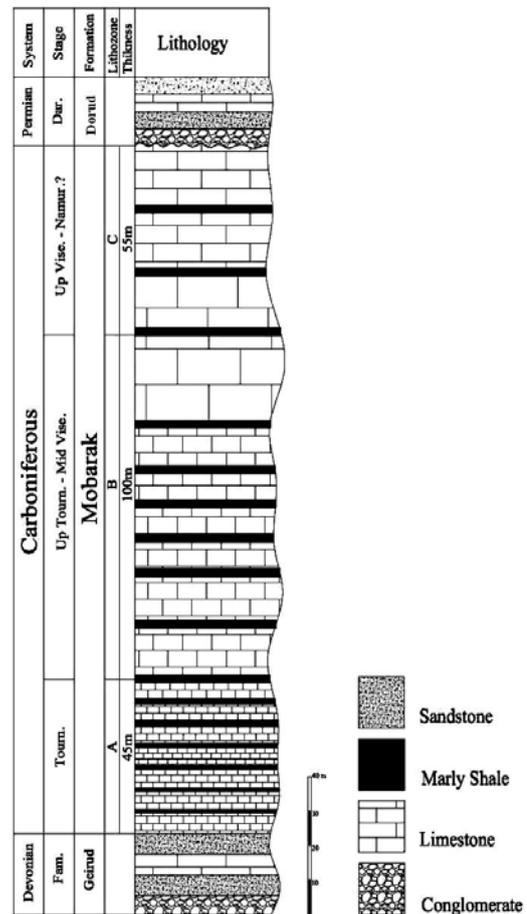


Figure 2. Stratigraphic column of the studied section

3. Discussion

Three main environments containing rugosa and tabulate corals were identified: open shelf, oolitic shoals and lagoon.

The first assemblage I corresponding to lower part of the section and has been composed of two species of corals *Zaphrentites parallela* and *Zaphrentites delanoui*, of Tournaisian in age. This assemblage is composed of small, solitary and undissepimented rugosa corals and belongs to cyathaxonia fauna and proceed from open shelf and deep platform.

Assemblage II of Upper Tournaisian to Middle Viséan in age containing rugosa and tabulate corals and belong to open shelf to oolitic shoals. According to corals morphology, a ecological assemblages were distinguished. This assemblage is composed of solitary dissepimented rugosa corals of medial to large size belong to caninia-clisiophyllid fauna and occurs at massive oolitic limestones of middle part of the section and corresponding to shoal area. These funas were adapted to shallow limestone seas, well lighted and oxygenated but with little terrigenous material. Up to 12 species of corals belong to 7 genera have been distinguished. The following species are:

Ampelexizaphrentis iraniense, *Ampelexizaphrentis* sp., *Siphonophyllia cylindrica cylindrica*, *Siphonophyllia*

iranica, *Siphonophyllia* cf. *dorlodoti*, *Kueichophyllum alborsense minor*, *Kueichophyllum alborsense major*, *Caninia* aff. *irinae*, *Dibonophyllum bipartitum*, *Aullophyllidae* sp., *Quinghaiphyllum pygmaeum*, and *Michelinia* sp.

Assemblage III occur in the uppermost of Mobarak Formation in the Vali-Abad section and its lithology has composed of: Intercalation of dark to green shale and shaly limestone.

Based on the corals assemblage and the present microfossils and the stratigraphical position, proceed from lagoon.

The recovered corals in member (C) of the section belong to two Suborders of Tabulata and Rugosa. Rugosa corals belongs to cyathaxonia fauna, as represented typically in the Carboniferous the sea floor was generally muddy, with decaying organic matter, but must have been fairly well oxygenated.

up to 12 species of 9 genera have been identified and they are as follows:

Kailingophyllum sp., *Marzanophyllum chalusense*, *Marzanophyllum crassiseptum*, *Hapsiphyllum* sp.1, *Hapsiphyllum* sp.2, *Zaphrentoides* sp.A, *Zaphrentoides* sp. B, *Ufimia* sp., *Hapsiphyllidae* indet., *Zaphrentites parallela*, *Syringopora* sp. and *Favositidae* indet.

The thickness of marlyshale intercalations piecemeal increases upward in this section. Absence of Lower Carboniferous corals after the early Namurian?, relates to sea-level and an off lap sequence of erosional Alborzian phase. Indeed the off lap sequence has occurred later as compared to the Eastern part of Alborz in this period.

The small undissepimented solitary Rugosa corals belonging to Cyathaxonia fauna, and the attendant fauna is containing Brachiopods, Bryozoans, Dasyclad Algae, Foraminifera and Gastropods.

These evidences of microfacies and the existent biota confirm totally that they have occurred in the back reef zone, the cyathaxonia and tabulata corals available in this area can tolerate this condition. The cyathaxonia adaptive morphology enables them to exist in lagoon condition to 4000 m depth. A relative abundance of these corals is in two habitats of the subnatural terms of marine for purposes of salinity, temperature, amount of Oxygen and nutrient currents.

Some of the recorded micro fauna and flora in this facies are:

Archeodiscus planus, BOZORGNIA, 1973 from Foraminifera and *Windsporella tulayae* (CHANTON-GUVENC, 1972), [8] from Algae, they estimate upper Viséan to Namurian? age for this part of the section.

Table 1. Horizontal extension of coral species

Species	Age	Early Carboniferous	
		Tournasian- Mid Viséan	Up Viséan- Namurian
<i>Zaphrentites parallela</i>			
<i>Zaphrentites delanouei</i>			
<i>Ampelexizaphrentis iraniense</i>			
<i>Ampelexizaphrentis</i> sp.			
<i>Siphonophyllia cylindrica cylindrica</i>			
<i>Siphonophyllia iranica</i>			
<i>Siphonophyllia</i> cf. <i>dorlodoti</i>			
<i>Kueichophyllum alborsense minor</i>			
<i>Kueichophyllum alborsense major</i>			
<i>Caninia</i> aff. <i>irinae</i>			
<i>Dibonophyllum bipartitum</i>			
<i>Quinghaiphyllum pygmaeum</i>			
<i>Kailingophyllum</i> sp.			
<i>Marzanophyllum chalusense</i>			
<i>Marzanophyllum crassiseptum</i>			
<i>Hapsiphyllum</i> sp.1			
<i>Hapsiphyllum</i> sp.2			
<i>Zaphrentoides</i> sp.A			
<i>Zaphrentoides</i> sp. B			
<i>Ufimia</i> sp.			
<i>Hapsiphyllidae</i> indet.			
<i>Syringopora</i> sp.			
<i>Michelinia</i> sp.			
<i>Favositidae</i> indet.			

4. Results

As mentioned above, the studied section contains different faunal assemblages comprising rugosa corals, brachiopods, crinoids, trilobites, bryozoans, and gastropods. Brachiopods with good preservation are the most abundant fauna in the section. Trilobites have a great share as associated assemblage in the section. Commonly, this group has poor preservation. The rest of accompanied fauna such as gastropods and bryozoans with the lower degrees of abundance and preservation have not precise value for biostratigraphy and dating. In addition to corals, the macro and micro biota presents in the limestone and

marlyshales intercalations deposits of Mobarak Formation, include gastropods, brachiopods, crinoids, bryozoans, calcareous algae and foraminifera, in this range show that a warm water running around the Central Alborz region, although the global had been influenced by a cold condition in the early Carboniferous.

Distribution of corals in the Lower Carboniferous of Iran is influenced by both regional and world transgression and regression episodes. Tournaisian-Visean marine deposits are well-developed in the Alborz and Baluchestan. They extend from southeast to northwest in the area of Lower Carboniferous deposition (Figure 3).



Figure 3. Tournaisian to Namurian carbonates platform distribution in Iran

Also the identified microfacies among the vertical and horizontal subsequences suggests that a shallow carbonate Ramp has dominated in this region during the Lower Carboniferous epoch and as for the Iran location in the South-West of the old Tethys, presence biota belong to warm condition, indicate the current rotation of warm water from the higher latitude flowed around the Alborz zone.

Detailed studies of Carboniferous sequence made mainly in the Alborz Mountains, Shotori Range and wider Tabas area confirmed that in most areas, marine sedimentation during the Carboniferous was restricted to the Early Carboniferous (Tournaisian through the Visean). Only in the some areas of Central and East Iran it persisted through the Namurian?. We can assume, therefore, that at the beginning of Late Carboniferous, Hercynian tectonics affected the Iranian Platform and resulted in epeirogenic episode, wide uplifting and local disturbances. A vast area was exposed to denudation which caused local erosion of thick Lower Paleozoic rocks. However, we may also suggest that important sea-level changes contributed to the erosion. After a general

regression in the Late Carboniferous, a new phase of transgression started during the Permian. Permian deposits covered the older geological units with important disconformities.

In the Tournaisian–Namurian?, the Iranian Platform represented the area of marine sedimentation

5. Conclusion

1-up to 25 species belong to 16 genera of corals have been recognized in this section. There are a new genus and 2 new species of corals among them.

2- The corals of assemblage C is representative of a subnormal marine environment which these corals can tolerate this condition.

3- Based on the biostratigraphical and lithostratigraphical characteristics, the Mobarak Formation in Vali-Abad section have been determined Tournaisian to Namurian? in age.

4- According to these studies represent there was a regressive sea which had extended from open sea to lagoon.

5- In the Tournaisian–Namurian?, the Iranian carbonate Platform represented the area of shallow marine sedimentation.

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