

## **Sedimentary Environment of Late Devonian deposits in the North-East of Baghin area (West Kerman) based on Litofacies and Conodontfacies**

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### **Abstract**

*Thirty-two conodont species and subspecies from the Baghin section indicate that the strata span Frasnian and five biostratigraphic intervals can be discriminated: 1- Early falsiovalis- late falsiovalis zones, 2- transitans- punctata zones, 3- Early hassi- jamieae zones, 4- Early rhenana zone, 5- Late rhenana- ? Linguiformis zones. The oldest Devonian unit in the area, equivalent to the Padeha formation, consists to white and red sandstones. The Padeha formation is overlaid by a unit previously thought to be Devonian in age, equating the Bahram formation. The Bahram formation is disconformably and thrusting overlaid by bedded limestone of Cretaceous. Sedimentary Environment this section is based on Lithofacies and Biofacies identified of sub tidal to open marine.*

**Key words:** Conodonts, Late Devonian, Sea level, Sedimentary Environment, Litofacies Biofacies.

### **Introduction**

The Baghin Section is near Baghin city, 20 km east of Kerman. Its geographical coordinates are N 30° 12' 59" & E 56° 51' 13". The slope of layers is between 30 to 35 eastern-western degrees. (F.1). In order to determine the exact age of Baghin section and control the conodont biozones, 40 samples of 3-4 kg were collected from layers systematically and conodonts were separated. In Baghin section, a large number of genera and species of conodont elements were identified and studied which are totally 4 genera and 32 species, subspecies. Dastanpour (1988) identified the age of Baghin section, Frasnian to Fammenian based on Brachiopods.

### **Lithostratigraphy of Baghin Section**

The approximate thickness of Late Devonian strata in Baghin section which belong to the formations of Padeha & Bahram is 126 m. From this thickness, 25 m. belongs to Givetian and 101 m. belongs to Frasnian.

Their lithology is mainly composed of red sandstone, white sandstone intercalated with chalk beds, dolomite, shale and light to dark gray thin and thick layered limestone, gray shale, and alternative of limestone and shale. (F.2)

1-Section base including dark red terrigenous facies related to the formation of Padeha. 2- 16 m. white sandstone with between strata chalk located on Padeha formation 3- 7 m. thin layered limestone. 4- 1m. Coral reef. 5- 24 m. limestone dolomite intercalated with shale beds. 6- 70

m. including light to dark gray thin and thick layered limestone, with layers of gray shales. 7- Upper part of the section is covered with light colored thick limestone with the age of Cretaceous.

Frasnian stones compose the major part of Bahram formation in Baghin are located on red sandstones of Givetian with paraconformity? which, itself, is covered with Upper part of the section is covered with light colored thick limestone with the age of Cretaceous limestone discontinuously. (Eskandary and Dastanpour, 1998)

### **Biofacies and Litofacies**

Studies related to palaeoecology are mainly on the basis of observations, fossil ,microfacies and statistical data 7 biofacies have been discovered in Baghin outcrop section (F.3).

#### **Biofacies 1: Icriodus-Polygnathus (I-P), sample (A)**

This facies located in Baghin outcrop base includes abundance of Icriodus as well as species of Ancyrodella which are abundantly in central Iran. This genus is particular to deep environments. However, some believe that these genera have planktic or nektonic lives and could have lived in both deep and shallow environments. As Icriodus is abundant in continental shelf (sub -tidal) and shallow environments and the ratio of Icriodus to Polygnathus is higher, this facies belongs to the shallow continental shelf environment. Additionally, due to the fact that Icriodus samples are narrow and long, they have lived in upper parts of the continental shelf. They live with Brachiopoda, Ostracode and Echinodermata some of which are dolomitic. This biofacies belongs to the biozone 1- Early *falsiovalis*- late *falsiovalis*. (Sandberg & Dreesen, 1984).(Plate 1, 2).

#### **Biofacies 2: Polygnathus- Icriodus (P-I), sample (Ba6)**

This facies is located in the middle parts of Baghin outcrop and includes various types of Polygnathus. Polygnathus are mostly in sub-tidal zones toward the open sea. Since Icriodus are large-sized with a large basal cavity and Polygnathus have large (big) platforms and strong ridges, they live in energetic environments. Some evidence of Intraclast, Brachiopoda and Ostracode is found in the biofacies of thin sections and existence of Intraclast indicates energetic environments. Hence, the environment of this biofacies is a part of sub-tidal and lagoon and it belongs to the biozone 3- Early *hassi-jamieae*.

#### **Biofacies 3: Polygnathus (P), sample (Ba7)**

This facies in which *Palmatolepis* (an extremely rare genus in Southeast of Iran) emerges is in the middle parts of Baghin outcrop and includes abundance of Polygnathus. This genus is exclusively found in deep and dim environments and lives in the open sea and continental slope. Some people believe that this genus has planktonic and nektonic life so it can live both in shallow and deep water. In view of the fact that some evidence of Trilobites, Echinodermata and Ostracode is found in the biofacies of thin sections, Trilobites indicate shallow environments and the open sea. Therefore, this biofacies is related to the area of the open sea and upper sections of the continental slope which shows the progress of the seawater. As a whole, this biofacies belongs to the biozone 3- Early *hassi-jamieae*.

**Biofacies 4: Polygnathus- Icriodus (P-I), sample (Ba9)**

This biofacies includes abundant large conodonts which indicates suitable environment for nutrition and growth. Moreover, based on a general rule, lower speed of sedimentation will result in more abundance of conodonts. Some Icriodus has wide and big platform which shows living in down parts of the continental shelf. Due to the large platform and strong ridges, this facies belongs to lagoonal and shallow environments and related to the biozone 4- Late *hassi*. (Sandberg & Dreesen, 1984)

**Biofacies 5: Polygnathus (P), sample (Ba13)**

This facies exists mainly in sub- tidal area toward the open sea. Some evidence of Brachiopoda, Echinodermata and Gastropods is discovered in the biofacies of thin sections. Due to the abundance of Gastropods, this facies belongs to lagoonal environments specifically. However, as the open sea fossils have been observed, this facies belongs to the lagoonal environment related with the open sea. This facies is recognized to be related to the biozone 4- Late *hassi*.

**Biofacies 6: Polygnathus- Icriodus (P-I), sample (Ba15)**

Polygnathus mostly exist in sub-tidal zones toward the open sea with abundance of conodonts. Some evidence of Aggregate or Gripstone, Brachiopoda and Ostracode is discovered in the biofacies of thin sections having sparite cement. The existence of the cement indicates energetic environments and hence Shoal environment. This facies belongs to the biozone 5- Late *rhenana* –? *Linguiformis*.

**Biofacies 7: Polygnathus- Icriodus (P-I), sample (Ba16)**

This biofacies exists in sub- tidal area toward the open sea. It is oligofossil having micritic cement. In this facies, the size and abundance of conodonts has been reduced which suggests deep or lagoonal environments. This facies is related to the biozone 5- Late *rhenana* – ?*Linguiformis*.

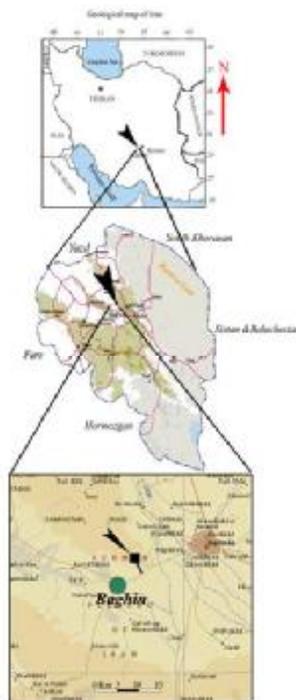
**Conclusion**

The base in the section Baghin is Late Givetian .The upper part of the sequence is Frasnian. 7 biofacies have been discovered in Baghin outcrop section. (1: Icriodus- Polygnathus, 2: Polygnathus- Icriodus, 3: Polygnathus, 4: Polygnathus- Icriodus, 5: Polygnathus, 6: Polygnathus- Icriodus, 7: Polygnathus- Icriodus).The Icriodus –Polygnathus biofacies represents a sea level decrease indicates a shallowwater environment. The Polygnathus – Icriodus and Polygnathus biofacies represents a sea level rise indicates a deep shelf to open marine environment. Sedimentary Environment this section is based on Lithofacies and Biofacies identified of sub tidal to open marine.

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**Fig1: Geological map showing the location of the studied area.**



Fig2: Lithostratigraphy of Baghin Section.

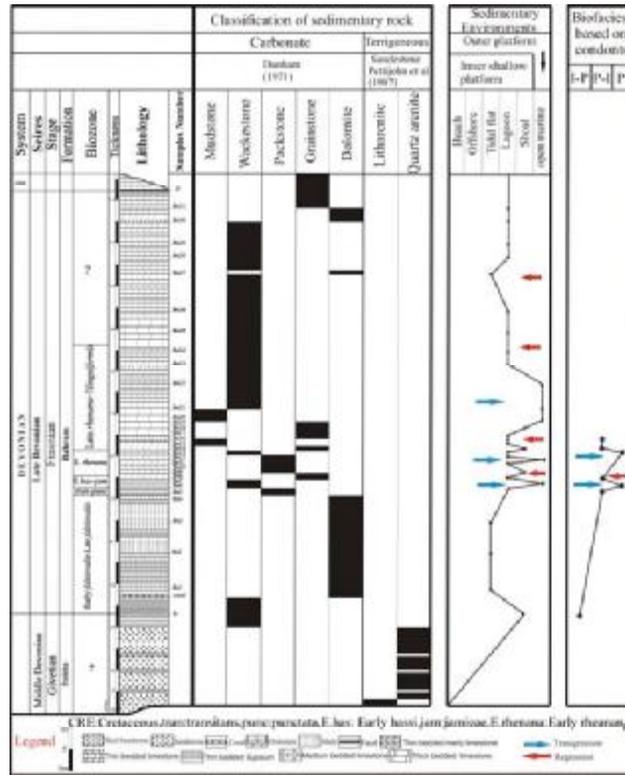
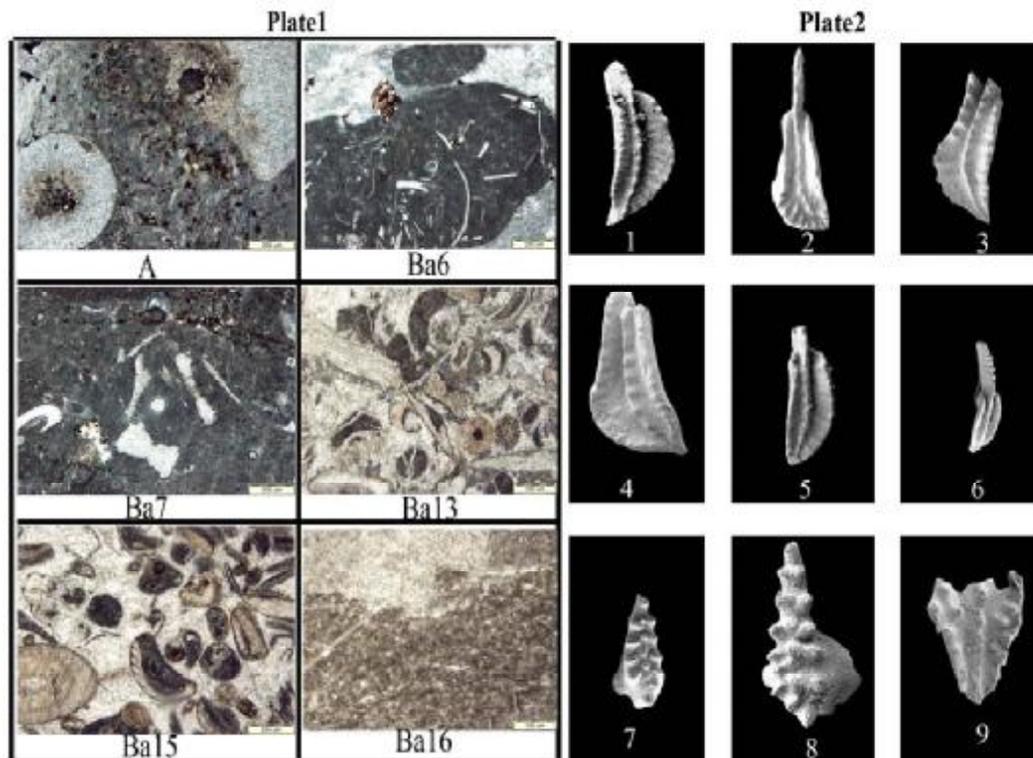


Fig3: Sea level changes pattern in the studied Baghin section based on Classification of Sedimentary rock, sedimentary environment and conodont biofacies.



Fig4: Boundary between Padeha and Bahram formations.



**Plate 1**

**Fig A:** Bioclast Wackestone with Dolomitization, **Fig Ba6:** Intra, Bioclast Wackestone.

**Fig Ba7:** Bioclast Wackestone, **Fig Ba13:** Bioclast Packstone.

**Fig Ba15:** Bioclast Grainestone, **Fig Ba16:** Mudstone.

**Plate 2**

**Fig.1-** *Polygnathus webbi* Stauffer, 19381: Upper view, ×68, Sample Ba6, Baghin section.

**Fig.2-3-** *Polygnathus aequalis* Klapper and Lane 19852: Upper view, × 62, Sample Ba6, Baghin section. 3: Upper view, × 83, Sample Ba6, Baghin section.

**Fig.4 -** *Polygnathus subincompletus* Ovnatanove et Kononova, 1996

**Fig.5 -** *Polygnathus praepolitus* Kononova, Alekseev, Barskov et Reimers, 19965: Upper view, ×91, Sample Ba6, Baghin section.

**Fig.6 -** *Polygnathus xylus* Stauffer, 19386: Upper view, ×94, Sample Ba6, Baghin section.

**Fig.7 -** *Icriodus cf. expansus* Branson and Mehl 19387: Upper view, ×119, Sample A, Baghin section.

**Fig.8 -** *Icriodus symmetricus* Branson and Mehl 1935: Upper view, ×86, Sample Ba9, Baghin section.

**Fig.9 -** *Ancyrodella pristina* Khalymbadzha and Tchernyshova, 1970. 1: Upper view, ×118, Sample A, Baghin section.