Brachiopods from Devonian-Carboniferous Boundary,
Tuye Darvar Section Damghan Area, Eastern Alburz, Iran

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Abstract: Systematic Sampling enabled us to determine the Brachiopoda in Tuye Darvar Damghan Devonian Carboniferous transition boundary that has been located between Giraud and Mubarak formations. The following species are obtained. Centrornynchus charakensis, Tornyroferella echinula, Dimitria semiol, Prospira strumian, Unispirifer missouriensis, Unispirifer tornacensis, Tylothyris planimedia, Cleiothyridina coloradensis, Composita megala, Composita globosa, Athyris tau, Hemiplethorhynchus crassus, Rossirhynchus adamaninus, Paurogastroderhynchus nalisini, Mesoplica praelonga, Spinocarinifera sp., Buxtonia singularis, Tomprodusctus elegantus, Tomprodusctus vaughani, Leptagonia analoga, Rhipidistella michelini, Delepinea conoides, Athyris lamellosa. These brachiopods are biostratigraphical indexes of late Famennian and early Tournaisian.

Key words: Brachiopoda • Mubarak Formation • Giraud Formation • Tuye Darvar • Devonian • Carboniferous • Eastern Alburz

INTRODUCTION

The goal of this paper is to study Brachiopoda of Devonian-Carboniferous boundary in Tuye Darvar section Damghan area.

Famennian stage was introduced by Halley in 1839 and its duration is about 410 million years. Its type section locates in southern Belgium. The Global Stratotype section and point (GSSP) of the base of Famennian (F-F boundary) is designated in conuic section. Matagne Noire, SE of France. The base of Famennian is recognized at the base of Palmatelepis triangularis is conodont zone [1]. The global stratotype (GSSP) of Famennian-Tournaisian boundary is situated lowest part of layer number 89 in artificial hole E in lasere section (southeast of Montagne Noire) South of France [2].

Above- the mentioned section, the Carboniferous layers are specified by a sequence that is composed mainly of oolithic bioclastic limestone, in a pelagic matrix of shale and calcilutite [2].

In a general view Devonian-Carboniferous boundary in most parts of Alburz and Central Iran is discontinuous, but it is continuous in some Eastern Alburz section eg. Tuye Darvar.

The disconformity between Famennian and Tournaisian stages is situation can be observed in many section of Central and Eastern Iran such as Howze-e-Dorah and Kal-e-Sardar and Hutk [3].

This boundary can be continues in some section of Eastern Alburz eg. Kekariz section in North of Damghan [4].

MATERIALS AND METHODS

Systematic Sampling enabled determination of the species and precise recognition of D-C boundary in Tuye Darvar section. The specimens have been We put samples
in hydrogen peroxide for 12 hours in order to preparation. Most important properties of brachiopods are:

- Total shape of shell,
- Hinge line status,
- Foramen shape,
- Situation of Delthyrium (Being open or close) which is important for classification in class, order or family level.
- Inter area status.
- Commissur form.
- Biometry ratios for classification in each genus and species.
- Surface ornamentations in family, genus and species level.

Of course, other properties are also used which we didn’t mentioned.

Photos were taken from four directions of each brachiopod specimen in order to identification.

The Tuye Darvar section is located in 40 km of southwest of Damghan. Its coordinates are: 53°56’ E, 36°1’ N. We should pass 35 km westward in Damghan–Semnan road, then 6 km in Tuye Darvar road to access the section just next to a stone mine.

**DISCUSSION**

The Giraud and Mubarak formation: exposures are studied in Tuye Darvar section which we consider their boundary by means of brachiopods.

Giraud Formation and its equivalent sequences are widely exposed throughout the alburz. According to Aserto (1963), Giraud formation laterally changes to Mubarak formation and more exactly, B member is simultaneous with Mubarak limestone [5].

Therefore, continuousness of these two boundaries confirm the continuation of previous researches, which has also been specified in the interested region. But Stepanoph [6], consider Mubarak limestone formation from upper Tournaissian which regard to the investigated Brachiopoda in this research, its beginning is from lower Tournaissian, because it is the continuation of late Famennian and there isn’t gap of stratigraphy.

Considered section has lithology of sandstone, shale, limestone, Dolomite and marly limestone, which its stratigraphy column is as follows.

<table>
<thead>
<tr>
<th>Limestone</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Red shale</td>
<td>Grey thin-medium bedded fossiliferous marly limestone</td>
</tr>
<tr>
<td>Medium-thick bedded white quartzitic sandstone</td>
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<tr>
<td>Faulted boundary</td>
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<tr>
<td>Red and green shale</td>
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<tr>
<td>Green dolomite</td>
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<tr>
<td>Grey sandy dolomite</td>
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<td>Medium-thick bedded brown sandstone</td>
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<td>Medium-thick bedded white quartzitic sandstone</td>
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<td>Faulted boundary</td>
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<td>Red shale</td>
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</tbody>
</table>

**Famennian:**
- *Ashbyia lanana*
- *Buxtonia singularis*
- *Centrotelrhytchus charakensis*
- *Cleiothridina coloradensis*
- *Composite glosbosa*
- *Dimitria seminae*
- *Mecoptica praetonga*
- *Paurogastrotelurynchus salvinii*
- *Prospera ruminia*
- *Ptychomaleta echinulata*
- *Ptychomaleta echinulata*
- *Spinocariniferus sp*
- *Toryniferella echinulata*

**Tournaissian:**
- *Rhgodoidorella michelini*
- *Leptagonia analoga*
- *Tomproductus vaughani*
- *Tomproductus elegantulus*
- *Rossibrytchus adamanitius*
- *Hemiplectothyris crassus*
- *Composita megalus*
- *Typhoyps Planimeda*
- *Unispirex tarmacicus*
- *Unispirex missouricensis*
- *Delpineana conoides*
- *Ashbyia lamellosa*

The total thickness is about 260 meter which overlies the member 5 of Mila Formation (Early Ordovician).

In this section, Giraud formation divides to two lithologic units:
Table 1: Species of Brachiopoda of Devonian Carboniferous boundary, Tuye Darvar Region. Names of interested Brachiopoda are presented at end of this paper.

<table>
<thead>
<tr>
<th>Age</th>
<th>Species</th>
<th>Devonian</th>
<th>Carboniferous</th>
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<td></td>
<td>巴斯那 -singularis</td>
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<td></td>
<td>Spinocamerasa sp.</td>
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<td></td>
<td>Merucipula praetonga</td>
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<td></td>
<td>Contrastrophamus chachameras</td>
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<td></td>
<td>Pseudoastronihilus melvina</td>
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<td>Athys tiku</td>
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<td>Cuspidata gibbosa</td>
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<td>Clusohedra caldronata</td>
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<td>Priscina superstina</td>
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<td></td>
<td>Torymothale octobulata</td>
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<td></td>
<td>Dimitrio romanii</td>
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<td></td>
<td>Rhodophyllum michelin</td>
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<td></td>
<td>Lepidogipha analogica</td>
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<td></td>
<td>Tomacipula vaughani</td>
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<td>Tomacipula elegansulare</td>
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<td>Rosariphus ashenmocron</td>
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<td>Hemiplethoiphalus crassus</td>
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<td></td>
<td>Cuspidata nealya</td>
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<td>Tyschothra planmedia</td>
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<td>Uchagricriformis tannuminus</td>
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<td>Uchagricriformis trisetensis</td>
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<td></td>
<td>Delopotina constans</td>
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<td>Athys taimaciliana</td>
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- Part A -140 meter shale-brown sandstone and white quartzite arenite sandstone.
- Part B -120 meters limestone, gray fossiliferous marly limestone and dolomite.

Giraud Formation contains many fossils groups excluding brachiopods such as:
- Gastropods, corals and crinoids. Few brachiopod species were recognized at the tope of Giraud Formation including.
Tuye Darvar Region Map

Plate: Dervar section (Famennian)

1-(a-d) = Athyris tau, Famennian
2-(a-d) = Buxtonia singularis, Famennian
3-(a-d) = Centrorhynchus charakensis, Famennian
4-(a-d) = Cleiothyridina coloradensis, Famennian
5-(a-d) = Composite globosa, Famennian
6-(a-d) = Dimitria seminol, Famennian
Tuye Darvar Region Map

Plate: Dervar section (Famennian)

7-(a-d) = Mesoplica praelonga, Famennian
8-(a-d) = Paurogastroderhynchus naliykin, famennian
9-(a-d) = Prospira struniana, Famennian
10-(a-d) = Ptychomaletoechia omaliusiy, Famennian
11-(a-d) = Ptychomaletoechia sp, Famennian
12-(a-d) = Spinocarinifera sp, Famennian
13-(a-d) = Tornyiferella echinulata, Famennian
Plate: beresh Darvar (Tournaisian)

1. (a-d) = Athyris lamellosa, Tournaisian
2. (a-d) = Composita megala, Tournaisian
3. (a-d) = Delepinea conoides, Tournaisian
4. (a-d) = Hemipleothyrcychus, Tournaisian
5. (a-d) = Leptagonia analoga, Tournaisian
6. (a-d) = Rhipidomella micheli, Tournaisian
7. (a-d) = Rossirhynchus adamantinus, Tournaisian
Tuyé Darvar Region Map

Plate: beresh Darvar (Tournaisian)

8. (a-d) = Tomiproductus elegantulus, Tournaisian
9. (a-d) = Tomiproductus vaughani, Tournaisian
10. (a-d) = Tylothyris planmedia, Tournaisian
11. (a-d) = Unspirifer missouriensis, Tournaisian
12. (a-d) = Unspirifer tornacensis, Tournaisian
13. (a-d) = Unspirifer sp., Tournaisian
14. (a-d) = Cleothridina kusbassica, Tournaisian
**Toryniferella echinulata**, *Prospira struniana*, *Cleiothyridina coloradensis*, *Composita globosa*, *Athrysi
tau*, *Nalivkin 1937*, *Paurogastroderhynchus naliqini*, *centrorhynchus charakensis*, *Mesoplica praelonga*, *Spinocarminifera sp.*, *Buctoria singularis*.

Brachiopods those are repected from the late Famenian (Strunian just below the D-C boundary) of other areas of eastern Albirz and central Iran. (Kerman and Esfahan) and Afghananistan, are present here: *Prospira struniana*, *Composita globosa*, *Toryniferella echinulata*, *Nalivkin*, *paurogastroderhynchus*, *Mesoplica praelonga* [7].

By considering the presence of marly limestones at a partition between two formations of Giraud and Mubarak, it seems that Devonian- Carboniferous boundary is continuous.

Bagheri et al., [8], considered some limestone and dark shale beds in Mubarak members above the top of Famenian Sequence as the top of Giraud Formation (and the D-C boundary), but new studies (present work) do not confirm their opinion.

Lowest part of Mubarak Formation in this section is rich of Brachiopods, corals and crinoids. Then brachiopod species of this part are:

*Unispirifer missouriensis*, *Unispirifer tornacensis*, *Tylothyris planimedia*, *Composita megalia*, *Hemiplethorynchus crassus*, *Rossirhynchus adamantis*, *Tomiproduxus elegantulus*, *Tomiproduxus vaughani*, *Leptagonia analoga*, *Rhipidiomella michelini*.

These species were identified in other regions of Albirz and represents the age of early Tourmaisian [9].

The same age is proposed for this assemblage in Caucazu [10].

**CONCLUSION**

Investigation on Brachiopods in Darvar section revealed the transition Famenian – Tourmaisian boundary Giraud and Mubarak formations.

**REFERENCES**

5. Aserto, 1966. Studied of Giraud formation and Mubarak formation, B member is simultaneous with Mubarak limestone.
6. Stepanoph, 1967. Consider Mubarak limestone formation from upper Tourmaisian which regard to the investigated Brachiopoda in this research, its beginning is from lower Tourmaisian, because it is the continuation of late Famenian and there isn’t gap of stratigraphy.