

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

¹Mohammad Taghvaie, ¹Khosro khosro Tehrani,
²Mohammad Reza Kebriaeezade, ³Hussein Gholamalian and ⁴Kaveh khaksar

¹Department of Geology, Science and Research Branch,
Islamic Azad University, Tehran, Iran

³Payam Noor University, Iran

⁴Hormozgan University, Iran

⁵Karaj Agriculture Organization, Iran

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. *Centronynchus charakensis*, *Toryniferella echinula*, *Dimitria seminoi*, *Prospira strunian*, *Unispirifer missouriensis*, *Unispirifer tornacensis*, *Tylothyris planimedia*, *Cleiothyridina coloradensis*, *Composita megala*, *Composita globosa*, *Athyris tau*, *Hemiplethorhynchus crassus*, *Rossirhynchus adamantinus*, *Paurogastroderhynchus nalivkini*, *Mesoplica praelonga*, *Spinocarinfera sp.*, *Buxtonia singularis*, *Tomiproductus elegantulus*, *Tomiproductus vaughani*, *Leptagonia analoga*, *Rhipidiomella 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 Halloy 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 Coumiac section. Matagne Noire, SE of France. The base of Famennian is recognized at the base of *Palmatolepis triangularis* conodont zone [1]. The global stratotype (GSSP) of Famennian-Tournaisian boundary is situated in the 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 oolitic 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 a situation that can be observed in many sections of Central and Eastern Iran such as Howze-e-Dorah and Kal-e-Sardar and Hutk [3].

This boundary can be continuous in some sections of Eastern Alburz eg. Kealariz 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 west-ward in Damghan- Semnan road, then 6 km in Tuye Darvar road to access the section just next to a stone mine.

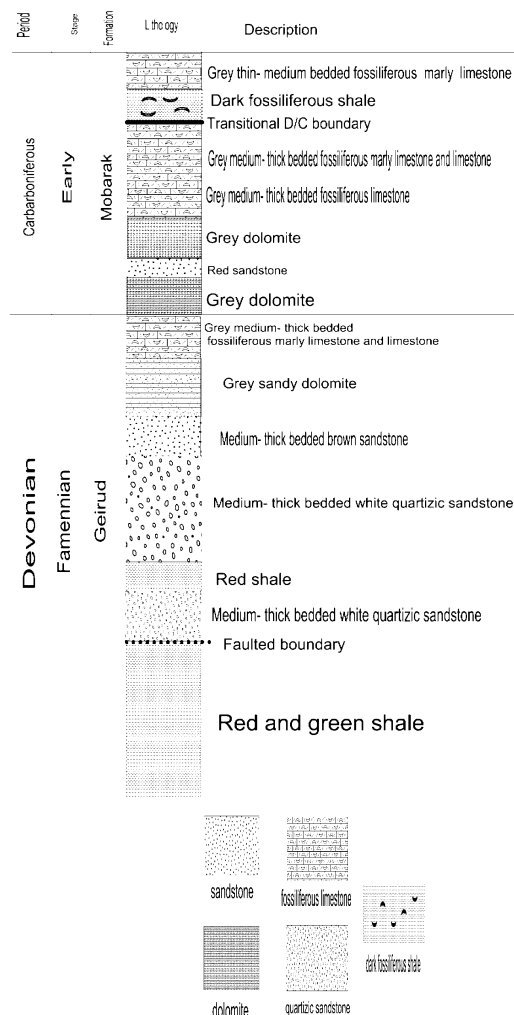
DISCUSSION

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 Tournaisian which regard to the investigated Brachiopoda in this research, its beginning is from lower Tournaisian, because it is the continuation of late Famennian and there isn't gap of stratigraphy.

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



Famennian:

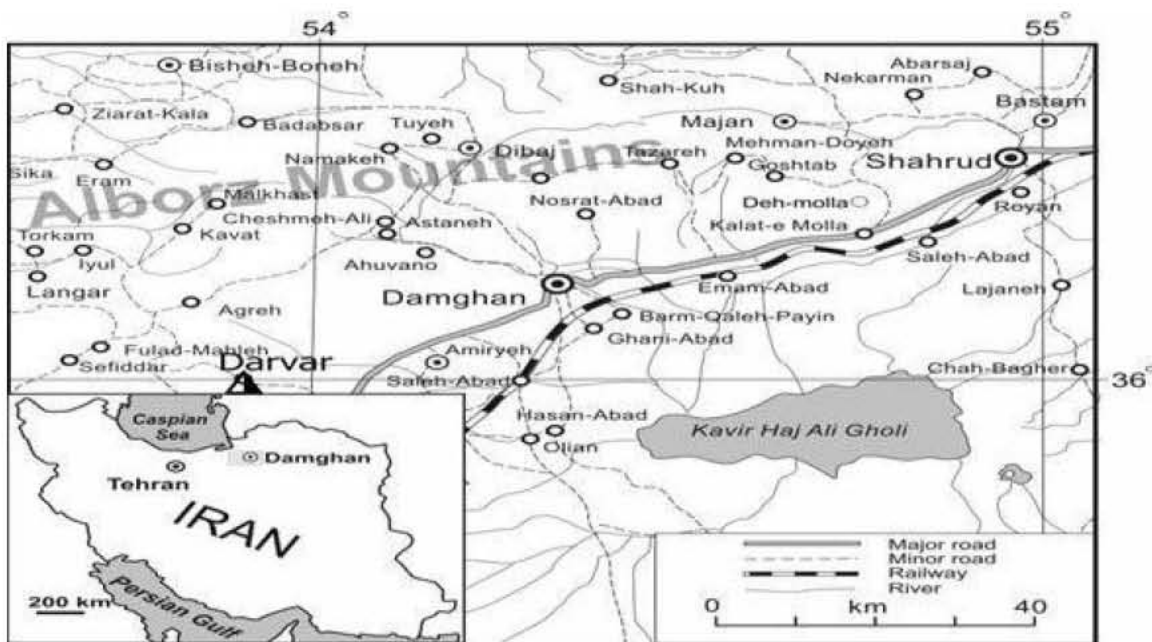
- . *Athyris tau*
- . *Buxtonia singularis*
- . *Centrorhynchus charakensis*
- . *Cleiothridina coloradensis*
- . *Composite globosa*
- . *Dimitria seminoi*
- . *Mesoplica praelonga*
- . *Paurogastroderhynchus nalivin*
- . *Prospira stuniana*
- . *Ptychomaletoechia omaliusi*
- . *Ptychomaletoechia sp*
- . *Spinocarimifera sp*
- . *Toryniferella echimulata*

Tournaisian:

- . *Rhipiodirella michelini*
- . *Leptagonia analoga*
- . *Tomiproductus vaughani*
- . *Tomiproductus elegantulus*
- . *Rossirhynchus adamantinus*
- . *Hemiplethorhynchus crassus*
- . *Composita megalia*
- . *Tylothyris Planimedia*
- . *Unispirifer tormacensis*
- . *Unispirifer missouriensis*
- . *Delepinea conoides*
- . *Athyris 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 litho logic units:



Tuye Darvar Region Map

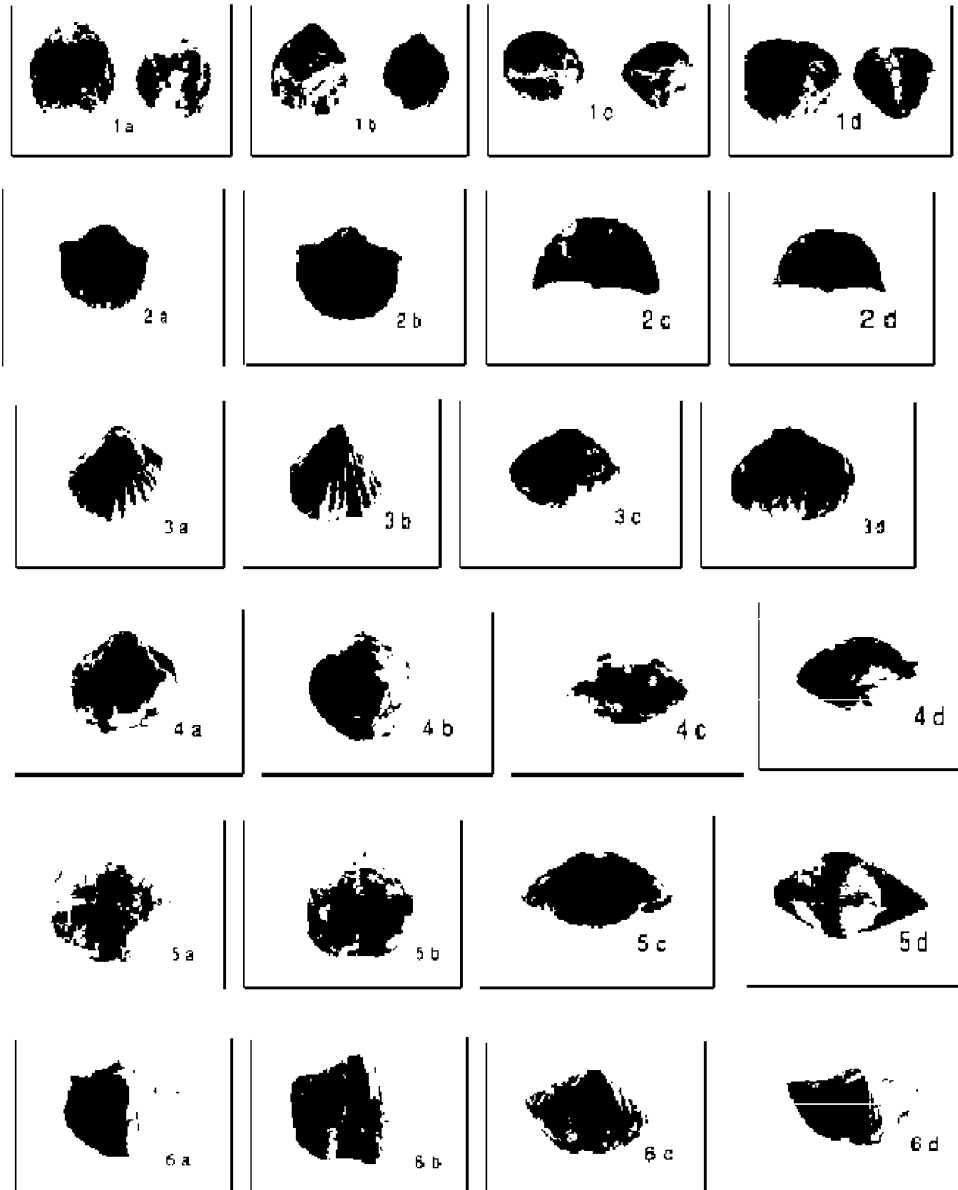
Table 1: Species Brachiopoda of Devonian Carboniferous boundary, Tuye Darvar Region Plates of interested Brachiopoda are presented at end of this paper

Age Species	Devonian	Carboniferous
	Famernian	Tournaisian
<i>Buxtonia singularis</i>	-----	-----
<i>Spinocariniifera sp.</i>	-----	-----
<i>Mesoplica praelonga</i>	-----	-----
<i>Centrorhynchus charakensis</i>	-----	-----
<i>Paurogastroderhynchus nalivkari</i>	-----	-----
<i>Athyris tau</i>	-----	-----
<i>Composita globosa</i>	-----	-----
<i>Cleiothyridina coloradensis</i>	-----	-----
<i>Prospira strumiana</i>	-----	-----
<i>Toryniferella echinulata</i>	-----	-----
<i>Dimitria sominovi</i>	-----	-----
<i>Rhipoidiomella michelini</i>	-----	-----
<i>Leptagonia analoga</i>	-----	-----
<i>Tomoiproductus vaughani</i>	-----	-----
<i>Tomoiproductus elegantulus</i>	-----	-----
<i>Rossirhynchus adamantinus</i>	-----	-----
<i>Hemiplethorhynchus crassus</i>	-----	-----
<i>Composita megalia</i>	-----	-----
<i>Tylothyris planimedia</i>	-----	-----
<i>Unispirifer tornacensis</i>	-----	-----
<i>Unispirifer missouriensis</i>	-----	-----
<i>Delepineia conoides</i>	-----	-----
<i>Athyris lamellose</i>	-----	-----

- Part A -140 meter shale-brown sand stone 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:

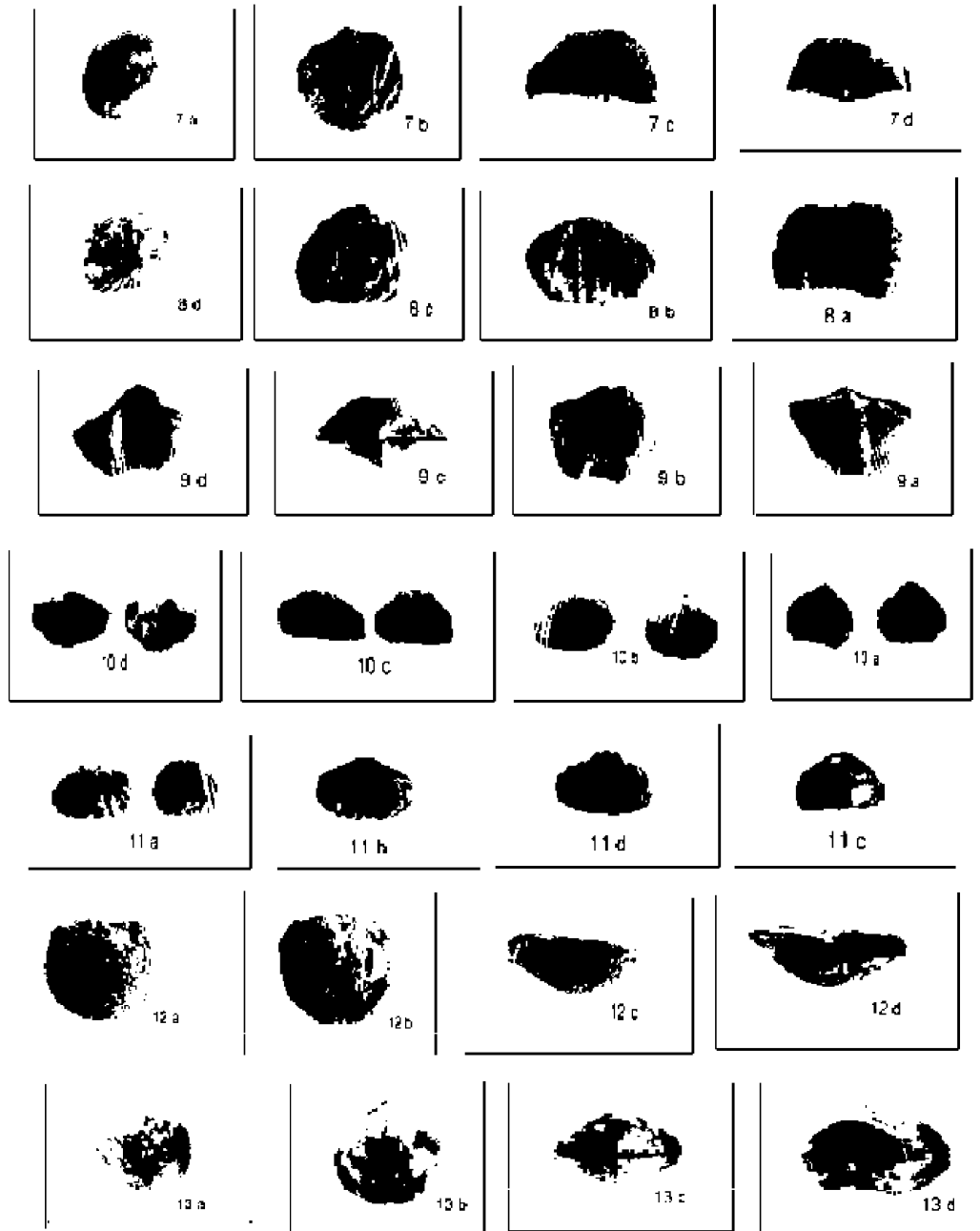
Gastropods, corals and crinoids. Few brachiopod species were recognized at the tope of Giraud Formation including.



Tuye Darvar Region Map

Plate: Dervar section (Famennian)

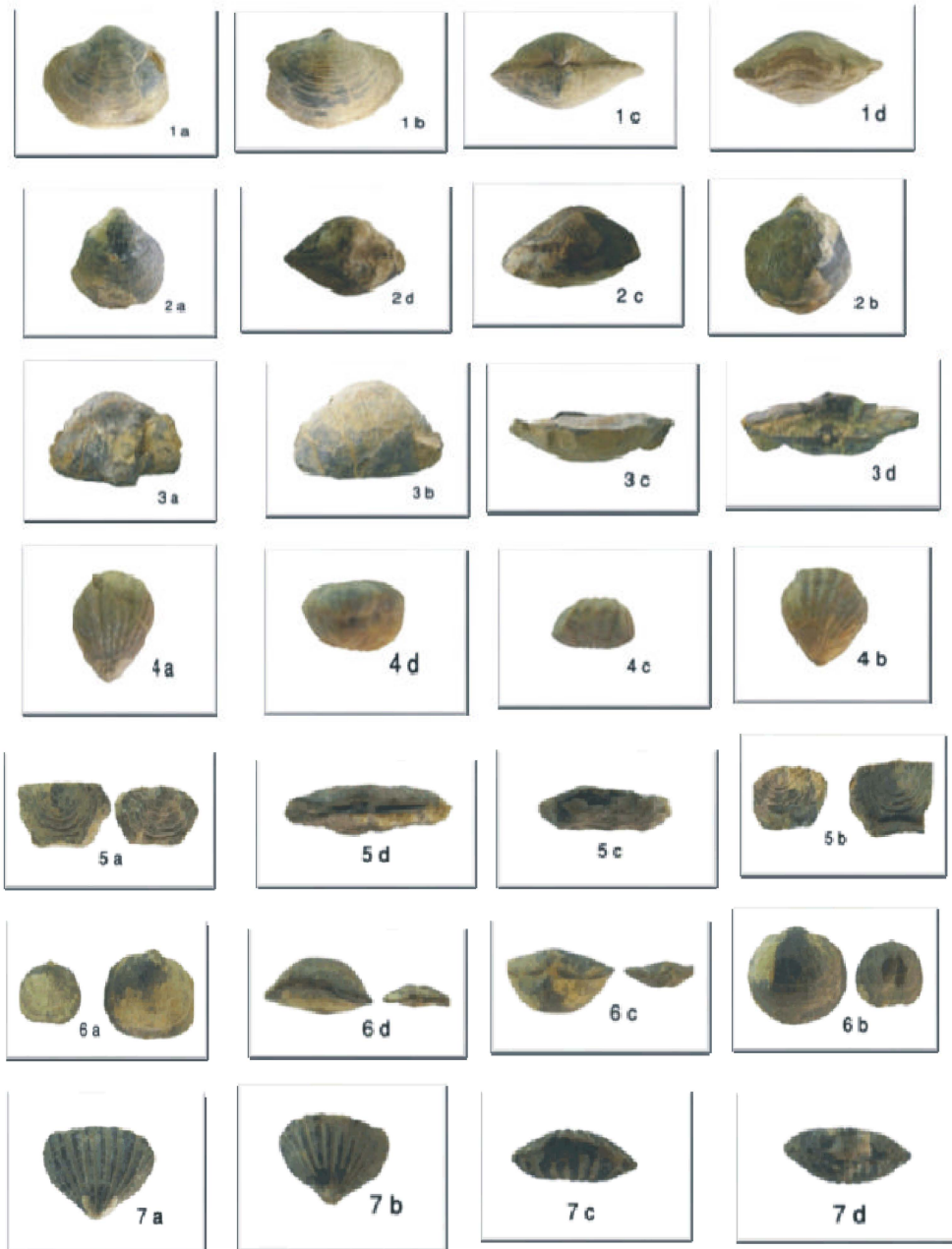
- 1-(a-d)= *Athyris tau*, Famennian
- 2-(a-d)= *Buxtonia singularis*, Famennian
- 3-(a-d)= *Centrorhynchus charakensis*, Famennian
- 4-(a-d)= *Cleiothyridina coloradensis*, Famennian
- 5-(a-d)= *Composite globosa*, Famennian
- 6-(a-d)= *Dimitria seminoi*, Famennian



Tuye Darvar Region Map

Plate: Dervar section (Famennian)

- 7-(a-d)= *Mesoplica praelonga*, Famennian
- 8-(a-d)= *Paurogastroderhynchus nalivkini*, famennian
- 9-(a-d)= *Prospira struniana*, Fmennian
- 10-(a-d)= *Ptychomaletoechia omaliusiy*, Fmennian
- 11-(a-d)= *Ptychomaletoechia* sp, Famennian
- 12-(a-d)= *Spinocarinfera* sp, Famennian
- 13-(a-d)= *Toryniferella echimulata*, Famennian



Tuye Darvar Region Map

Plate: beresh Darvar (Tournaisian)

1. (a-d)= *Athyris lamellosa*, Tournaisian
2. (a-d)= *Composita mekala*, Tournaisian
3. (a-d)= *Delepinea conoides*, Tournaisian
4. (a-d)= *Hemiplethorhynchus*, Tournaisian
5. (a-d)= *Leptagonia analoga*, Tournaisian
6. (a-d)= *Rhipidiomella michelini*, Tournaisian
7. (a-d)= *Rossirhynchus adamantinus*, Tournaisian



Tuye Darvar Region Map

Plate:beresh Darvar(Tournaisian)

8. (a-d)= *Tomiproductus elegantulus*, Tournaisian
9. (a-d)= *Tomiproductus vaughani*, Tournaisian
10. (a-d)= *Tylothyris planimedia*, Tournaisian
11. (a-d)= *Unispirifer missouriensis*, Tournaisian
12. (a-d)= *Unispirifer tornacensis*, Tournaisian
13. (a-d)= *Unispirifer* sp, Tournaisian
14. (a-d)= *Cleiothridina kusbassica*, Tournaisian

Toryniferella echinulata, Prospira struniana, Cleiothyridina coloradensis, Composita globosa, Athyris tau, Nalivkin 1937, Paurogastroderhynchus nalivkini, centrorhynchus charakensis, Mesoplica praelonga, Spinocarinfera sp, Buxtonia singularis.

Brachiopods those are reported from the late Famennian (Strunian just below the D-C boundary) of other areas of eastern Alburz and central Iran. (Kerman and Esfahan) and Afghanistan, are present here: *Prospira struniana, Composita globosa, Toryniferella echinulata, Nalivkini, 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 Famennian 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 megala, Hemiplethorhynchus crassus, Rossirhynchus adamantinus, Tomiproductus elegantulus, Tomiproductus vaughani, Leptagonia analoga, Rhipidiomella michelini.

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

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

CONCLUSION

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

REFERENCES

- House *et al.* 2000. Klapper *et al.*, 1993. Discussion about The base of Famennian is recognized at the base of *Palmatolepis triangularis* conodont zone.
- Paproth, E., R. Feist and G. Flaijs, 1991. Decision on the Devonian- Carboniferous boundary stratotype, Episodes, 14/4: 331-336.
- Yazdi, 1999;2000. Gholamalian *et al.*, 2009. The studied of disconformity between Famennian and Tournaisian stages of Central and Eastern Iran such as Howze-e-Dorah and Kal-e-Sardar.
- Mosadegh, Hossein, Kebriaeezade, Mohammad Reza and seyid Mahmud Hosseinejad, 2003. Biostratigraphic properties and Devonian – Carboniferous transit sedimentology (Geirud and Mubarak formations) in eastern alburz: Introduction of Hangenberg biotic event, 9th Geology community congress of Iran- Tehran nicolin and.
- Aserto, 1966. Studied of Giraud formation and Mubarak formation, B member is simultaneous with Mubarak limestone.
- Stepanoph, 1967. Consider Mubarak limestone formation from upper Tournaisian which regard to the investigated Brachiopoda in this research, its beginning is from lower Tournaisian, because it is the continuation of late Famennian and there isn't gap of stratigraphy.
- Nicollin, J.P. and D. Brice, 2004. Biostratigraphical value of some strunian (Devonian, Uppermost Famennian) productidina, Rhynchonellida, Spiriferida, Spiriferidina Brachiopods, Geobios, V, 34: 437-453.
- Bagheri, *et al.*, J. Went, J. Hayer and A.R. Karimi-Bavandpur, 2002. Stratigraphy and depositional environment of Devonian, pp: 665-7443.
- Gaetani, M., 1968. Lower Carboniferous brachiopods from central Elburz, Iran, Riv. *et al.* paleont., V, pp: 74.
- Rzhonsnitskaya, M.A.B. Memedov, 2000. Devonian stages boundaries in the southern Transcaucasus, Cour. Forsch. Inst. Srnchenberg, Ni. 242, pp: 187-207.
- Jean Rievre denise Brice, 2000. systematic, biostatigraphy and biogeography of four Famennian spiriferid brachiopods from Morocco.
- Kebriaeezade, Mohammad Reza, 2004. Brachiopoda role in biozonation of eastern alburz late Devonian sequences, research plan of Payame Noor University.
- Chen, Q. and G.R. Shi, 1998. Latest Devonian (Famennian) to earliest carboniferous (Tournaisian) Brachiopods from the bachu formation of the tarim basin, Xin Jiang province northwest china, 7: 10.
- Brice D., A.F. De l'apparent, J. Pillet. *et al.* Iradj Yassini, 1974, Etude de deux gisements paleozoiques (silurienet, Devonien) de l'Elburz oriental (IRAN).
- Jafarian, M.A., 2000, Late Devnian Index Brachiopoda of northeast Esfahan in Correlation with other regions.
- Caplan, M.L. and R.M. Bustin, 1999. Devonian-Carboniferous Hangenberg mass extinction event, widespread organic- rich Mud rock and anoxia: causes and consequences, palaeo, N, 148: 187-207.
- Gaetani, M., 1964. *Rossirhynchus adamantinus* gen. n., sp. n. from the tournaisian f central Alburz, Iran (Rhynchonellida), Riv. *et al.* Paleont, V.LLX, N, 4:637-48.