EARTH SCIENCES
RESEARCH JOURNAL

Earth Sci. Res. SJ. Vol. 17, No. 1 (June, 2013): 67 - 71

UNIVERSIDAD NACIONAL DE COLOMBIA
SEDE BOGOTÁ
FACULTAD DE CIENCIAS
DEPARTAMENTO DE GEOCIENCIAS
RESEARCH GROUP IN GEOPHYSICS

PALEONTOLOGY

Late Permian brachiopoda fauna in north-western Iran

Mostafa Yousefirad[1], Touran Khamooshi[2] and Rahim Shaabanian[2]

[1] Department of Geology, Faculty of Earth Sciences, Payame Noor University,Tehran, Iran
[2] Department of Geology, Faculty of Earth Sciences, Payame Noor University,Tabriz, Iran
radyousefi@yahoo.com Mobile: 00989183638957

ABSTRACT

The Late Permian marine sequence in the north- west of Iran, in eastern Azerbaijan province in the Zal stratigraphic section, was selected for studying brachiopods. Samples were collected from the Ali Bashi and Jolfa Formation.S. Twenty-seven species from 13 brachiopoda genera were recognised in this study. The recognised fossil community was compared to brachiopod communities in some regions of Iran and the Tethyan region, suggesting the Late Dzhulfian period as the age for the deposits being studied. Recognized brachiopods belonge to the orders Athyris, Rhynconellida, Productida and Strophomenida.
Keywords: brachiopoda, Late Permian, Iran.

RESUMEN

La secuencia marina del Pérmico superior en el noroeste de Irán y el este de Azerbaiyán, sección estatigráfica de Zal, fue seleccionada para este estudio de braquiópodos. Las muestras fueron tomadas en las formaciones Ali Bashi y Jolfa. Se reconocieron 27 especies de 13 géneros de braquiópodos en este análisis. Las muestras recolectadas fueron comparadas con sus similares de otras regiones de Irán y de la región del Tetis, lo que sugirió el período de tardío de Dzhulfan como la proveniencia de estos depósitos. Los braquiópodos reconocidos en este trabajo pertenecen a las familias de Athyris, Rhynconellida, Productida y Strophomenida.
Palabras clave: Braquiópodos, Pérmico Superior, Irán

Record

Manuscript received: 16/11/2012
Accepted for publication: 04/04/2013

1. Introduction

Marine Permian deposits are exposed in many parts of eastern and western Azarbaijan, in north-western Iran (Shabanian and Bagheri 2008) .The Zal stratigraphic section, (40,45' eastern longitude and 38,43' latitude), is located in north -eastern Azerbaijan (Figure 1);. this section is part of the Abade-Jolfa deposit sequence, having a general northwest-southeast trend.. The Permian deposit sequence in the region being studied consisteds of the Vajnan Formation (Baghbani, 1997; Shabanian and Bagheri, 2008) (or Doroud Formation), the Surmaq Formation (Iranian-Japanese research group, 1981), the Jolfa Formation (Parto Azar, 1997) and Ali Bashi Formation (Parto Azar, 1997; Tiechert, 1973). The Permian deposit in the Zal section,(having igneous nonconformity), is located on an igneous rock series before the Permian age and is itself covered by constant transition to Clararia limestone, vermiculite and the Elika Formation,caused by middle and early Trassiac aging.

The 46-meter-thick Ali Bashi Formation was examined in this research to enable a paleontological study of brachiopods.

The Permian sequence in southwest Jolfa was comprehensively studied for the first time by Stepanone et *al.,* in 1969. They divided the Permian and Triassic beds in the Ali Bashi mountain section in to 8 separate stone units;. unitse A and B were from the Guadalupian age, C-D from the Dzulfian age, E transitional stages, F a Paratirolites horizon with early Triassic age and H and G introduced the Elika Formation in to the section being studied. Tiechert *et al.,* then examined the Ali Bashi section and made seminal changes to the divisions of Stepanov *et al.,* (1967);. the according to them, E and F belonged to the highest part of the Permian division, i.e. the Dorashamian stage and they called it the Ali Bashi Formation. Re-examining the section, Parto Azar made some changes in Permian borders and lithostratigraphic unites names. According to him, the lower part of unit A was the Surmaq Formation, the upper part and all of unit B consisted of thes Jolfa Formation and the 52 meters thickness C,D,E, and F were introduced as the Ali Bashi formation . Based upon brachiopod fossils, (cephalopods and condonts), the age of the Jolfa Formation has been classified as being Late Dzhulfian in terms of Permian stages in the Tethyans region (Chen et al., 2005).

Several reports have been concerned with the palaeontology of foraminifera, corals, brachiopods, conodonts and cephalopods of the Ali Bashi Formation and formations from the same stage in Alborz and Abade. First information to be published on Iran's brachiopods dates back to 1916, (Stayonav). Stayonav *et al.,* (1916) released a comprehensive report on the Permian and Permo-Triassic border in the Ali Bashi section

in southern Jolfa and studied its brachiopods. Restudying the Ali Bashi section, Tiechert *et al.,* (1973) and Baud (2008) introduced many of its macrofossils, including brachiopods. An Iranian-Japanese research group (Iranian-Japanese research group, 1981) introduced brachiopods from the Hambast Formation in Abade; and research into Late Permian brachiopods was published by Fantini-Sistin, in1965, Fantini-Sistini & Glaus in, 1966 and Angiolini in, 2010. Biostratigraphy and event stratigraphy in Iran around the Permian-Triassic boundary (PTB) has been published by Kozur (2007).

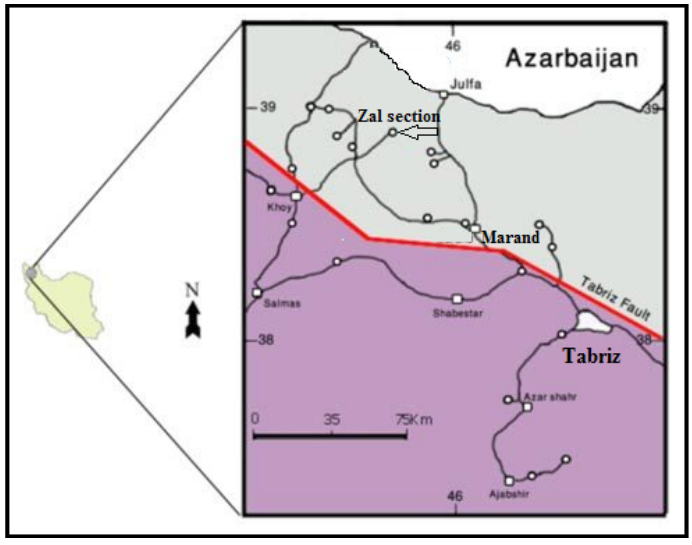


Figure 1: Position of study area

The present research was aimed at introducing Late Permian brachiopods in stratigraphic section so as to determine their age and stratigraphic correlation as well as stratigraphically examining the value of recognising brachiopod fossils (Figure 2).

Methodology

Systematic sampling was used for recognising and studying Permian brachiopods in the Zal Stratigraphic Section,; 60 samples were collected, along with corals and bryozoans, 13 genera and 27 species being recognised in the 15-meter thicksection. An attempt was made to determine change in their age and size, based on brachiopods.

Discussion

The Ali Bashi Formation in the Zal stratigraphic section is 50 meters thicks and includes thin layers of limestone, shale, marl and middle layers of limestone (Khamooshi 2012). An accurate field study has revealsed brachiopod, separate rugose and colonial coral , bryozoan, crinoids and cephalopod macrofossil frequency;. 27 species f rom 13 genera regarding Late Permian brachiopod s were recognized in the present research work, Theost significant brachiopod families, in terms of frequency and variety, included Productida, Strophomenida, Rhynconellida and Athyris.

Studies were based upon external shell features , including shell, length, thickness and width, examining features such as pedicle valve, brachial valve, hinge line, foramen development or non-development, delthyrium (notch) status , shell shape, umbo (posterior extremity) shape, commissure line shape, existence or non-existence of fold and sulcus , their development and type of decoration . According to brachiopod stratigraphic dispersion in the Zal stratigraphic section and comparison to a recognized Late Permian fossil community in Iran and other parts of the Tethyan region , Late Dzhulfian to Dorashamian has been introduced as the age of the Ali Bashi Formation. This research resulted in 13 genera and 27 species belonging to 5 different families being recognized, as follows:

Spinomarginifera helica(Abich), *S.spinicilicata*(Arthaber), *Orthotetina* cf. persica (Schewien)

Orthotetina cf. *persica* (Schewien), *O.eusarkos, O. ex.gr eusarkos, Araxilevis intermedius* (Abich)

Tschernyschewia typica (Stoyanow), *Compresoproductus dzhulfensis* (Stoyanow), *Permophricodothyris ovata* (Pavlova), *Araxathyris protea* (Abich), *A . quadrilobata* (Abich)

A. lata (Grunt), *A. lata minor* (Grunt), *A. araxensis* (Grunt), *A. araxensis minor* (Grunt),

A. aff. *ogbinensis, , Wellerella dorashamensis,*(Sokolskaja), *Psedowellerella araxensis* (Sokolskaja) , Haydenella sp.

Figure 2: A chart of brachiopod biozonation in the Zal section and stratigraphic column for the Zal section

Brachiopods, in terms of biostratigraphy value, can be categorized into two assemblage areas (Figure 2):

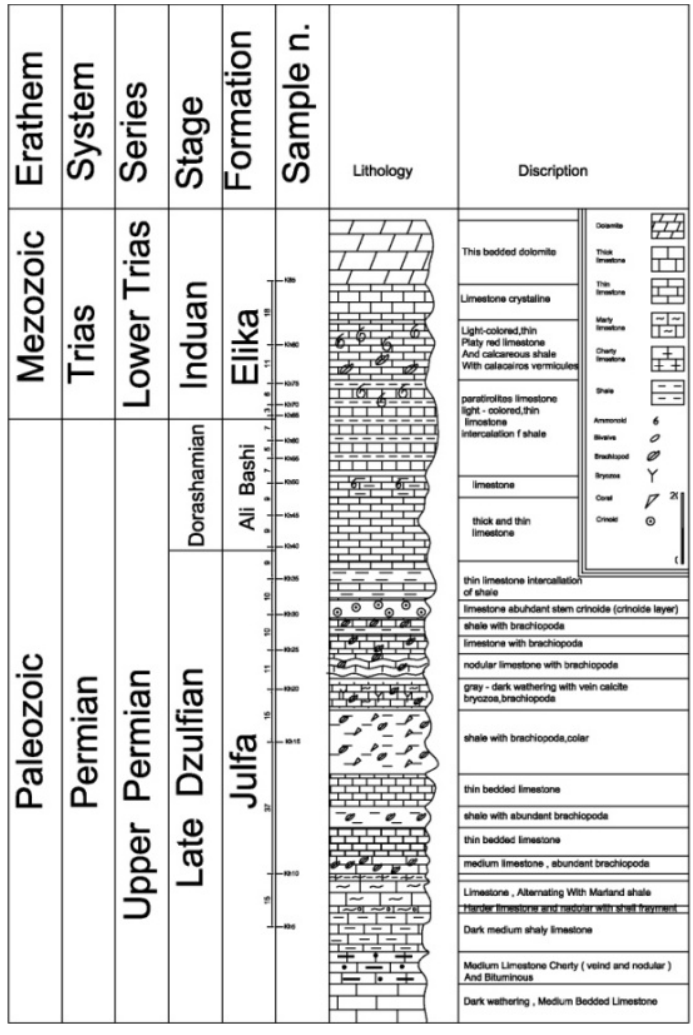


Figure 2. Stratigraphic column of the Zal section

The Araxilevis – Orthotetina assemblage biozone

This biota association was 10 metrs thick. The zone began with the appearance of Araxilevis, Tschernyschewia, Spinomarginifera and end with appearance of Compresoproductus, Orthotetina. The biozons had many huge brachiopods, among which Productidae and Arthotetins were remarkable.

some of the most frequently recognized productidae are given below:

Spinomarginifera helica(Abich , 1878), *Araxilevis intermedius* (Abich, 1878), *Tschernyschewia typica* (Stoyanow, 1910), *Haydenella* sp., *Compresoproductus dzhulfensis* (Stoyanow,..).

Huge (Araxilevis) and moderate productida, such as Tschernyschewia, Compresoproductus, and huge *Orthotetina* such as Orthotetina eusarkos (Abich), along with the coral *Plentamplexus leptoconicus* (Abich 1878) and the crinoid *Erisocrinus araxensis* (Yakovlev and Ivanov, 1965) represent significant fossils from this biota association.

Permophricodothyris – Araxathyrisa assemblage biozone:

This biota association was 12 metres thick. This biozone began with the appearance of *Compresoproductus dzhulfensis* (Stoyanow), *Orthotetina eusarkos* (Abich) Other brachiopodS from this biota association were: *Compresoproductus dzhulfensis* (Stoyanow), *Araxilevis intermedius* (Abich), *Tschernyschychewia typica* (Abich), *Permophricodothyris ovate* (Pavlova). *Spinomarginifera helica* (Abich, *Araxathyris araxensis* minor (Grunt), *Araxathyris* cf. protea (Abich) and *Araxathyris quadriloba* (Abich; coral type *Pleramplexus leptoconicus* (Abich) has also been found in this biota association(Figure 3).

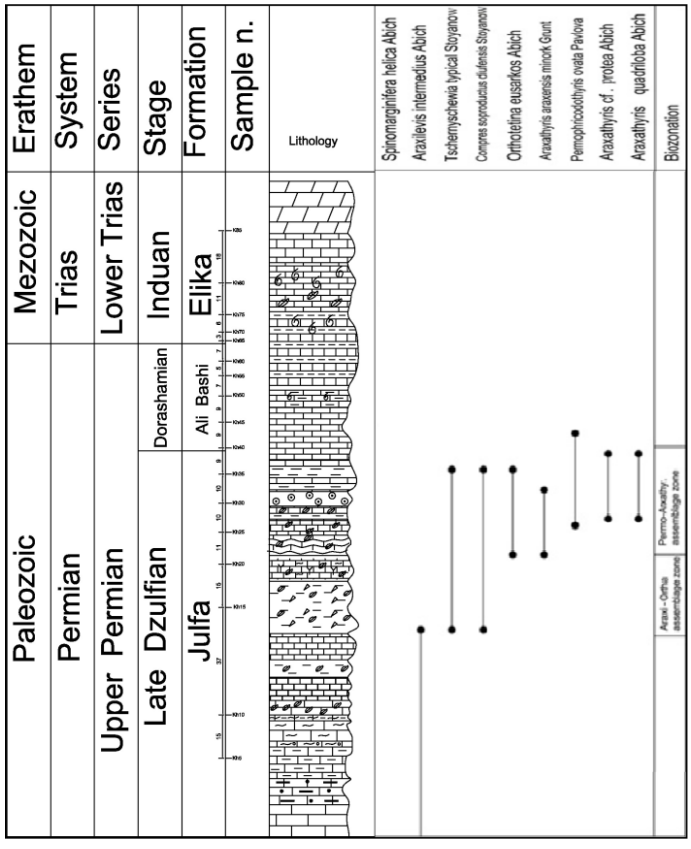


Figure 3. Biozonation of the Zal section based on brachiopod fauna

Systematic classification of brachiopods

13 genera and 27 species were recognized In this research in the Zal section (Plates 1-5). Comparing the recognized fossil community with other brachiopod communities other parts of Iran and Tethyan region suggested Late Dzulfian as of the age of deposits being studied. Differen Late Permian brachiopod genera were found in the Zal section. Some of the recognized species and genera were as followi (based on Moore, 1965):

Phylum Brachiopoda
Class Articulata Huxley , 1869
Order Spiriferida Waagen .1883
Suborder Athyrididina Boucot, Johnson&Staton,1964
Superfamily Athyridacea Mcoy, 1844
Subfamily Spirigerellinae Grunt, 1955
Genus Araxathyris quadriloba, Abich,1878.

Description:

Shell shape was convex-convex, dimensions beng almost the same, its width a little being a little bit more than its length, The pedicle valve had a sulcus lying from the umbo to the front side, and the brachial valve had a huge, lifted-up fold. The commissure line was uniplicate. The most sulcus depression was in the front 1/3 of the shell. It was 3.1 cm thick, 3.9 cm long and 3.2 cm wide.

Geographical spread: Shahreza, Caucus, Alborz – Balade.

Order Strophomenida Opik, 1934
Suborder Strophomenidina Opik ,1934
Superfamily Davidsonicea King, 1850
Family Meekellidae Stehli, 1954(lamp shell)
Subfamily Meekellinae Stehli, 1954
Genus Orthotetina eusarkos Abich, 1878

Description:

Shell shape was convex – convex, with direct hinge line. The delthyrium coud be seen. Interarea was obvious. The commissure line was plain. Decorations were thorny. It was 2.3 cm thick, 4 cm long and 5 cm wide.

Suborder Productidina Waagen, 1883
Superfamily Productacea Gray, 1840
Subfamily Marginiferidae Stehli, 1954
Subfamily Marginiferinae Stehli, 1954
Genus *Spinomarginifera helica* Abich,1878
PL1, ig 2a-2e.

Description:

Shell shape was concave – convex, its width beinggreater more than its length.Raised umbo.Pedicle was little and compressed and the ears not distinct. Sulcus waas replaced, brachial valve depressed and edged at the front. Rear decoration was thorny. The shell was 1 cm thick, 1.7 cm long and 1.8 cm wide.
Geographical spread:
Shahreza, Jolfa, Balade, Zal

Suborder Productidina Waagen, 1883
Superfamily Productacea Gray, 1840
Subfamily Marginiferidae Stehli, 1954
Subfamily Marginiferinae Stehli, 1954
Genus *Araxilevis intermedius*. Abich, 1878

Description:

Shell shape was convex – convex. Pedicle valve had sulcus from umbo to the end of the shell. Brachial valve was convex, hinge line curved, commissure line antiplicate, umbo raised, development line delicate and unicentric. The shell was 2.5 thick, 4.4 long and 4.2 wide.

Suborder Productidina Waagen, 1883
Superfamily Productacea Gray, 1840
Family Productidae Gray, 1840
Genus: *Tschernyschewia typical Stoyanow, 1910*

Description:

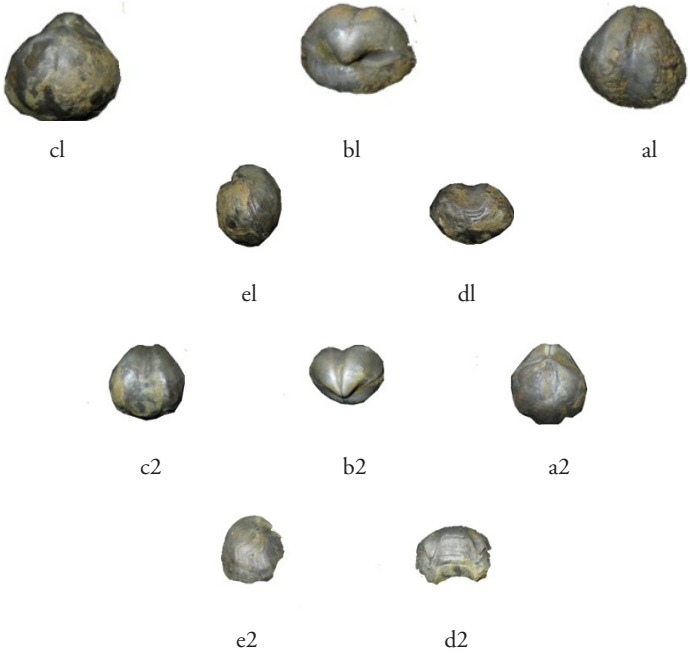
The shell was convex – concave and large. Umbo was convex and raised. Hinge line was direct, the beak obvious, and decorations had radial lines and were thorny. The shell is 2 cm thick, 3.5 long and 4 cm wide.

Suborder Productidina Waagen , 1883
Superfamily Productacea Gray , 1840
Subfamily Margiferidae Stehli , 1954
Subfamily Margiferinae Stehli , 1954
Genus: *Araxilevis intermedius, (Abich,1878)*

Description:

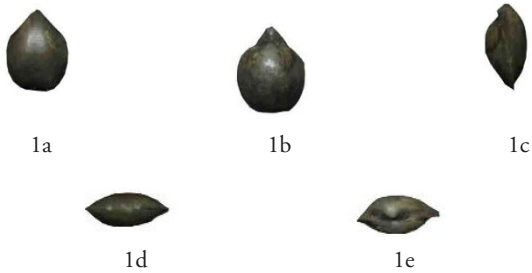
The shell was convex – convex. Pedicle valve had sulcus from umbo to the end of the shell. Brachial valve was convex, hinge line curved, commissure line antiplicate, umbo raised and , development line unicentric and delicate. The shell was 2.5 cm thick, 4.4 cm long and 4.2 cm wide.

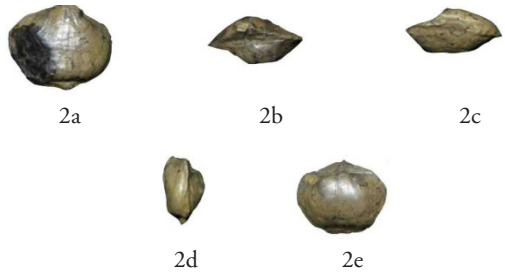
Plate 1



1: *Araxathyris quadrilobata*(Abich, 1878). 1a: dorsal, 1b: posterior, 1c: ventral, 1d: lateral, 1e: anterior.
2: *Araxathyris cf. protea* (Abich, 1878). 2a: ventral, 2b: posterior, 2c: dorsal, 2d: lateral, 2e: anterior.

Plate 2



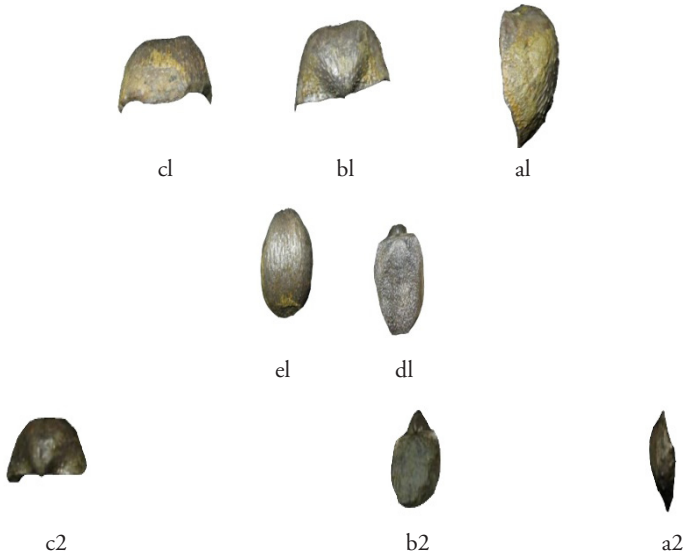


1.*Araxathyris araxensis minor* (Grunt 1965).1a:ventral, 1b:dorsal, 1c:lateral, 1e:posterior.
2.*Orthotetina eusarkos* (Abich 1878). 2a:ventral, 2b:posterior, 2c:anterior, 2d:lateral, 2e:dorsal.

Plate 3

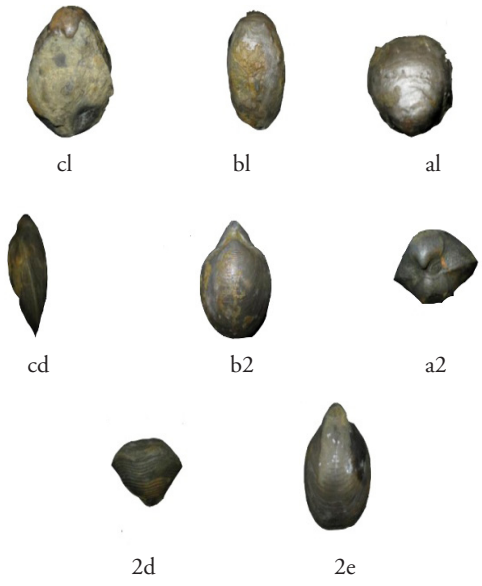
1.: *Spinomarginifera helica* (Abich, 1878).1a: dorsal, 1b: lateral, 1c: ventral, 1d: anterior, 1e: posterior.
2.: *Araxilevis intermedius* (Abich, 1878). 2a: anterior, 2b: lateral, 2c: venteral,,2d: dorsal, 2e: posterior.

Plate 4



1.: *Tschernyschewia typica* (Stoyanow,1910), 1a: anterior, 1b: posterior, 1c: lateral, 1d: ventral, 1e:Dorsal.
2.: *Haydenella* sp,. 2a: posterior, 2b: dorsal, 2c: lateral.

Plate 5



1.: *Sarytchevinella diulfensis* (or Compresoproductus dahulfensis lamp shell) (Stoyanow,1910). 1a: dorsal, 1b: venteral, 2c: posterior.
2.: *Permophricodothyris ovate* (Pavlova,1965). 2a: lateral, 2b: dorsal, 2c : posterior, 2d: anterior, 2e: Ventral

Conclusion

Field study led to 27 species from 13 genera being examined, thereby revealsing that brachiopods havingglarge shells, belonging to the Productidae and Spiriferida families, likePermian- Sphaeroidothyris, Araxilevis and Orthotetina, were more frequent and the shells were bigger in the lower and middle parts of the sequence being studied.

The shells become smaller towards the headof the sequence, that shapes having small shells belonging to the Athyrisd and Rhynconellida families (like werella and psedowerella) were more frequent during the Late Dzhulfian and Dorashamian ages.

The studies indicated that changes in brachiopod frequency and dimensions suggested their dependency upon deep environmental changes. Based upon brachiopods, stratigraphic dispersion, the sequence being studied was determind to be Late Permian to Dorashamian in terms of Tethyans Permian stage.

Acknowledgement

The authors gratefully acknowledge the financial and other support of this research, provided by Payame Noor University,Tehran, Iran. Authors would like to thank reviewers for their structured comments which improved the manuscript.

References

Angiolini,L.,Carabelli,L.,Nicora,A.,Crasquin-Soleau,S.,Marcoux,J. and Rettori,R.2005, Brachiopoda and other fossils from the Permian-Triassic boundary beds of the Antalya Nappes(Sw Taurus,Turkey). Geobios,40:715-729.

Baghbani, D. 1997. Correlation chart of selected Permian strata from Iran. Pemophiles, 30:24-25.

Baud, A. 2008. Correlation of Upper Permian localities in the Kuh-e-Ali Bashi area, NW Iran: old collections, old and new data. Permophiles 52,6–11.

Chen, Z.,Campia,M.,J.,Shi,R.G.and Kaiho ,K.,2005, Post-extinction Brachiopoda fauna from the Late Permian Wuchiapingian Coal series of South China ,Acta Paloentologica Polanica, 50(2):343-363.

Fantini Sestini ,N., 1965,The geology of the upper Djaerud and Lar Valley (North Iran); II.Paleontology;Bryozoans , brachiopods and mollusks form Ruteh Limestone (Permian). Riv.Ital .Paleont .Stratiger.,71(3):773-787.

Fantini Sestini ,N.1966,Milano-Brachiopods from the UpperPermian Nessen Formation(North Iran)-V.72-n.4.

Fantini Sestini,N.and Glaus,M.,1966, Brachiopods from the Upper Permian Nessen Formation (north Iran):Riv.ital.Paleont stratigr.V.72,n4,p.887.923.

Iranian-Japanes Reserch Group,1981, The Permian and the lower Triassic systems in Abadeh Region.Central Iran-Mem.Fac.Sci.,Kyoto uni V.,So .p.61-133.

Khamooshi, T,2012, Biostratigaphy and chemostratigraphy of Permotriassic sequence in the Zal section in the south julfa,Estherrn Azarbaijan province,Payame noor university,pp 182.

Kozur, H.W. 2007. Biostratigraphy and event stratigraphy in Iran around the Permian-Triassic boundary (PTB); implications for the causes of the PTB biotic crisis; Environmental and biotic changes during the Paleozoic-Mesozoic transition. Global and Planetary Change 55, 155–176.

Partoazar, H.,1997, Permian system in Iran.Geological Survey of Iran,p.1-340.

Shabanian. R. and Bagheri, M., 2008, Permian in Northwest of Iran, Permophiles, N.51, P 28-31.

Stoyanow,A.A.,1910,On the character of the boundary of Paiaeozoic and Mesozoic near Djulfa:Zapiski Peterb.mineral. obshch.,ser.2,ch.47,p.61-135.

Stepanov ,L.D.,Golshani, F.and Stoklin ,J. 1967, Upper Permian and Permian-Triassic boundary in North Iran.Geological Survey of Iran ,Report,12:72+XVplate.

Teichert,C.,Kummel,B. and Sweet, W., 1973, Permian – Triassic Strata, Kuh-e-Ali Bashi , North Western Iran .Bull.Mus.Zool.,145(8):359-472.