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First Record of Aptian- Cenomanian Brachiopods from the Vezk Section (South of Yasuj, Iran)

T. Binazadeh*

Department of Geology, Faculty of Sciences, Shahid Bahonar University, Kerman, Islamic Republic of Iran

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Abstract

Brachiopod faunas from the Aptian- Cenomanian Vezk section in southwestern Iran comprise ten species in six genera, namely *Sellithyris cenomanensis*, *Sellithyris tornacensis*, *Sellithyris phaseolina*, *Phaseolina phaseolina*, *Tropeothyris* sp., *Concinnithyris subundata*, *Kingena arenosa*, *Cyclothyris difformis*, *Cyclothyris* sp. and *Cyclothyris compressa.* All species are recorded for the first time from the lower Cretaceous of Vezk section (South of Yasuj). These deposits are composed of an alternation of green marls and thin layers of yellow shaly or sandy limestone, which overlain by thick bedded black limestone. The thickness of these deposits are 74 meters, which covers the Jurassic sediments, while its upper boundary ends with erosion surface that covered by Neogene deposits. These deposits consist of different fossil groups such as brachiopods, echinoids, corals, gastropods and orbitolinids that confirm the Aptian-Cenomanian ages for these sediments. The fauna assemblages suggest at shallow and suitable environment prevailed during the deposition of the strata.

Keywords: Brachiopods; Aptian; Cenomanian; Yasuj; Iran.

Introduction

Brachiopods are marine organisms which have two shells or valves of different sizes, shape and ornamentation. Brachiopods are benthic organisms, their distribution depends on bathymetry, light, intensity of currents, distance from the shoreline, and the nature of suitable substrates [9]. Brachiopods are marine animals, living on or near the sea bed. Some brachiopods live in burrows but most are attached to rocks or the ocean floor by the pedicle which they use to adjust their position. Other brachiopod species developed spines to stabilise themselves in mud [7]. Brachiopod shell is an organo-mineral structure, mainly comprising low magnesium calcite enclosing a small amount of organic matrix [8]. Brachiopods, also known as 'lamp shells', are marine metazoans that elaborate a bivalved shell, similar to the molluscs of the class Bivalvia [12]. They are adapted to meso-eutrophic environments in shallow- to deep-water settings and occur in heterotrophic, sciophilous assemblages [11]. Brachiopods have a low metabolic rate, low nutrient demands [1] and are able to assimilate dissolved substances during times of low influx of particulate food [14]. Brachiopod dominance may be enhanced by reduced oxygen levels and a low nutrient supply [14]. Although brachiopods are among the most conspicuous and diverse constituents of marine invertebrate faunal elements of the Aptian-Cenomanian sediments in Vezk section, very few

* Corresponding author: Tel: +989177433099; Fax:+987433229311; Email: tayyeb.binazadeh@yahoo.com

studies have been published on this subject (May be no study). Arab et al. (2015) reported five species of the Late Albian- Early Cenomanian brachiopods from Baghin region, west of Kerman. Foladi & Dastanpour (2015) reported ten species of the Middle Cretaceous brachiopods from Estakhrooyeh region. The brachiopods fauna of Vezk section comprises *Sellithyris cenomanensis*, *Sellithyris tornacensis*, *Sellithyris phaseolina*, *Phaseolina phaseolina*, *Tropeothyris* sp., *Concinnithyris subundata*, *Kingena arenosa*, *Cyclothyris difformis*, *Cyclothyris* sp. and *Cyclothyris compressa*. The brachiopods generally confirm the Albian– Cenomanian age suggested by the other fossils, associated with these brachiopods, such as foraminifers. The present paper continues this work and deals with assemblages from the Albian-Cenomanian Yasuj strata, as exposed near the village of Vezk (southwest of Iran; Fig. 1).

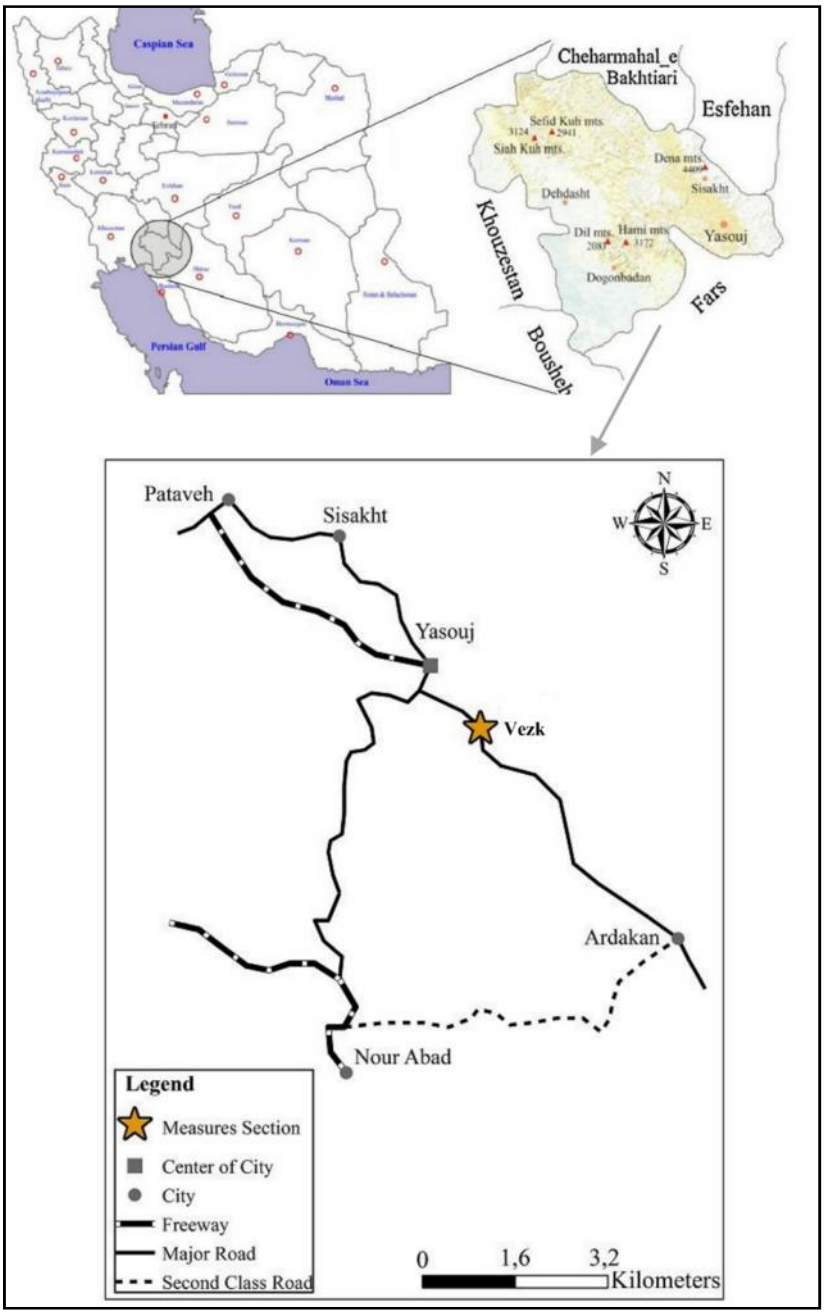

Figure 1. Location map and studied sections of the Albian– Cenomanian strata in Southwestern Iran.

Geological Setting and Stratigraphy

The brachiopods described here have been collected from Albian– Cenomanian strata that crop out at Vezk section, southwest of Yasuj, Iran (Fig. 1). This section is situated about 17 km south of Yasuj city (N 30˚32'53", E 51˚38'43"). The Albian– Cenomanian sediments of Vezk section consist mainly of an alternation of green marls and thin layers of yellow shaly or sandy limestone (Fig. 2) which overlain by thick bedded black limestone, with an abundant benthic foraminifera (*Orbitolina*), echinoids, bivalves, gastropods and corals, most of which confirm an Albian– Cenomanian age for the sediments. The thickness of these deposits are 74 meters, which covers

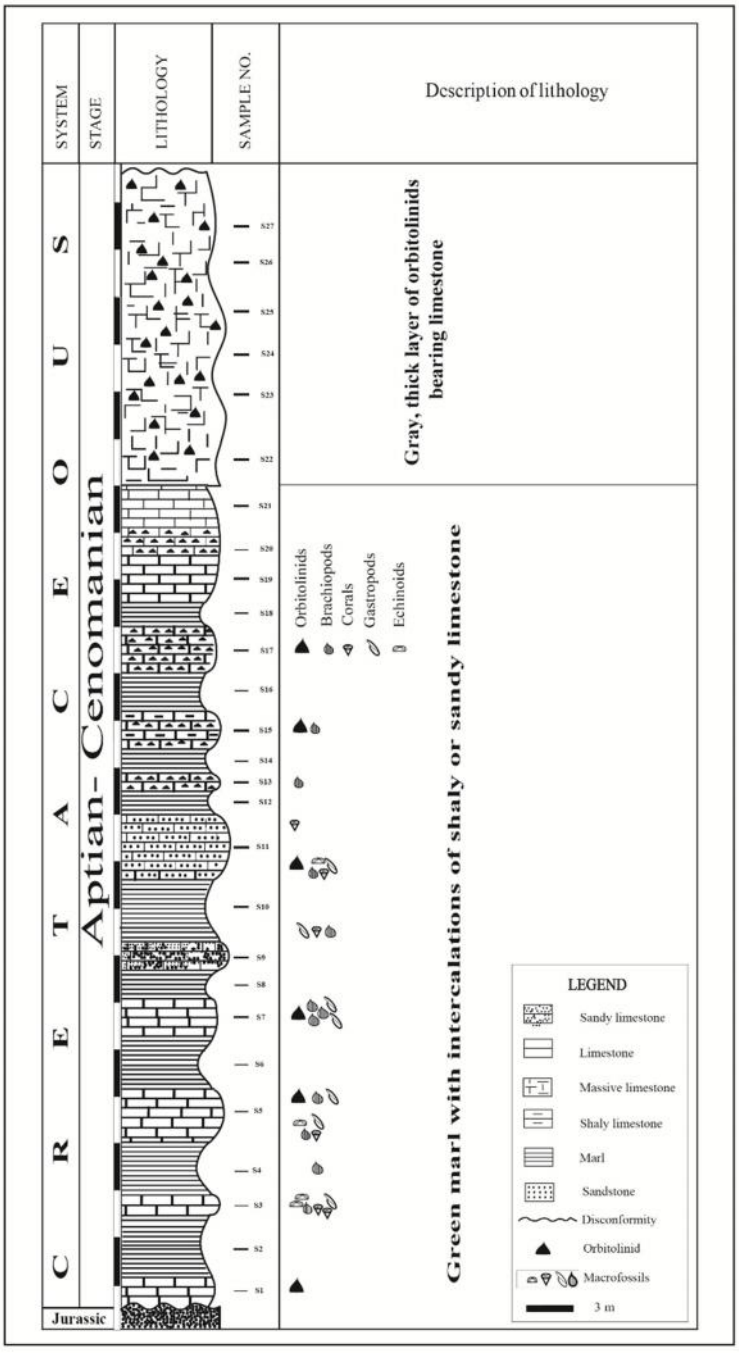

Figure 2. Schematic lithological succession of Albian– Cenomanian strata in Vezk section.

the Jurassic sediments, while its upper boundary ends with erosion surface that covered by Neogene deposits. The Vezk section is a part of the Zagros sedimentary basin which is located in southwestern Yasuj city. The Cretaceous sediments are well-exposed in the studied area.

Materials and Methods

The present material was collected by T. Binazadeh during different field work in Vezk locality. To study the brachiopod fauna of Vezk section, 104 specimens of brachiopods has been collected from marls and thin layers of yellow shaly limestone of this section which belonging to two taxonomical classes were included in this study. About half of the specimens were crushed, distorted, imperfect, or weathered. Well preserved specimens were cleaned, using a mild detergent and whenever necessary by using an ultrasonic vibrator and a preparation needle.

Systematic paleontology

In total, 104 brachiopod specimens have been collected from this section. This biostratigraphic research resulted in to examine 6 genera 10 species of brachiopoda for the first time from this section.

Class **Articulata** Huxley, 1869

Order **Terebratulida** Waagen, 1883

Suborder **Terebratulidina** Waagen, 1883

Superfamily **Terebratuloidea** Gray, 1840

Family **Sellithyrididae** Muir-Wood, 1965

Subfamily **Sellithyridinae** Muir-Wood, 1965

Genus ***Sellithyris*** Middlemiss, 1959

Type species: *Terebratula sella* J. de C. Sowerby, 1823

Sellithyris cenomanensis (Gaspard, 1997)

(Pl. 2, figs. D- F)

1997 *Sellithyris cenomanensis* (Gaspard); Gaspard pl. 1, fig. 9

2010 *Sellithyris cenomanensis* (Gaspard); Arab; Pl. 17, figs. A-J

Material: Nineteen complete specimens and eight five incomplete specimens were recovered.

Description: This species was previously identified by Gaspard (1988) and has been described later by Arab (2010- Pl. 17, figs. A-J). The shell is medium to large in size and pentagonal, biconvex, both valves are equally convex or pedicle valve more convex, with a round, medium to large and circular and mesothyridid foramen. The shell surface is smooth. Lateral margins are inclined antero-ventrally, the surface is marked by major growth lines, and the anterior margin is biplicate.The maximum width and thickness of the shell is to the middle of shell. The lateral commissure is ventrally curved. The beak is suberect. The beak ridges are distinct. The anterior commissure is uniplicate to sulciplicate.

Remarks: The recovered species are similar to those described by Arab (2010). This species differs from other *Sellithyris* species by its pentagonal outline, medium to large in sized, equal convex valves or pedicle valve more convex and suberect foramen. The species described by Arab (2010), have a pentagonalto subcircular outline, permesothyridid foramen in adult, my specimens are pentagonal to subcircular in outline and having mesothyridid foramen.

Age and distribution: This species occurs in the Albian? –lower Cenomanian sediments of Baghinand Basab regions, Kerman, Iran (Arab, 2010). This species is recovered from lower cenomanian sediment of Vezk section, Yasuj, Iran.

Sellithyris tornacensis (diArchiac, 1847)

(Pl. 2, figs. J- L)

1988 *Sellithyris tornacensis* (diArchiac): Owen, p. 104, pl. 6, figs 1-3

1997 *Sellithyris tornacensis* (diArchiac, 1847): Gaspard, pl. 2, fig. 1

2010 *Sellithyris tornacensis* (diArchiac, 1847): Arab, Pl. 16, figs. A-O

Material: Eleven complete specimens and four incomplete specimens were recovered.

Description: This species was previously identified by Owen (1988- p. 104, pl. 6, figs 1-3), Gaspard (1997- pl. 2, fig. 1), and has been described later by Arab (2010- Pl. 16, figs. A-O). Shell is medium to large in size, biconvex and pedicle valve more convex and Pentagonal to oval in outline. The maximum width and thickness are situated at about mid length. The beak is suberect. Foramen is medium, circular and permesothyridid. The beak ridges are poorly developed. The lateral commissure ventrally curved. The Shell surface is smooth. The anterior commissure is uniplicate to sulciplicate.

Remarks: This is a distinctive species. The outline and beak characters of this section species are approximately similar to those from Baghin and Basab, which are described by Arab (2010). The species described by Arab (2010), have a pentagonal to elongate- oval outline, large size, large foramen and erect to suberect beak, my specimens are pentagonal to oval in outline, medium to large in size, medium foramen and having suberect beak.

Age and distribution: This species described from lower Cenomanian in Britain and northen Europe [18] and also, occurs in the Baghin and Basab regions

(Albian? – lower Cenomanian). In the Vezk section, this species determine the lower Cenomanian age for the sediments.

Sellithyris phaseolina (Valenciennes in Lamarck, 1819)

(Pl. 2, figs. G- I)

1988 *Sellithyris phaseolina* (Valenciennes in Lamarck); Owen, pl. 6, figs 7-9

2010 *Sellithyris phaseolina* (Lamarck, 1819); Arab, Pl. 18, figs. A-L

Material: Four complete specimens of various sizes and seven incomplete specimens are found.

Description: This species was previously identified by Owen (1988– pl. 6, figs 7-9), Gaspard (1997- p. 149, pl. 1, fig. 5) and has been described later by Arab (2010- Pl. 18, figs. A-L). Shell medium-sized to large. The outline is subcircular to oval. The shell is biconvex, both valves are more or less equally

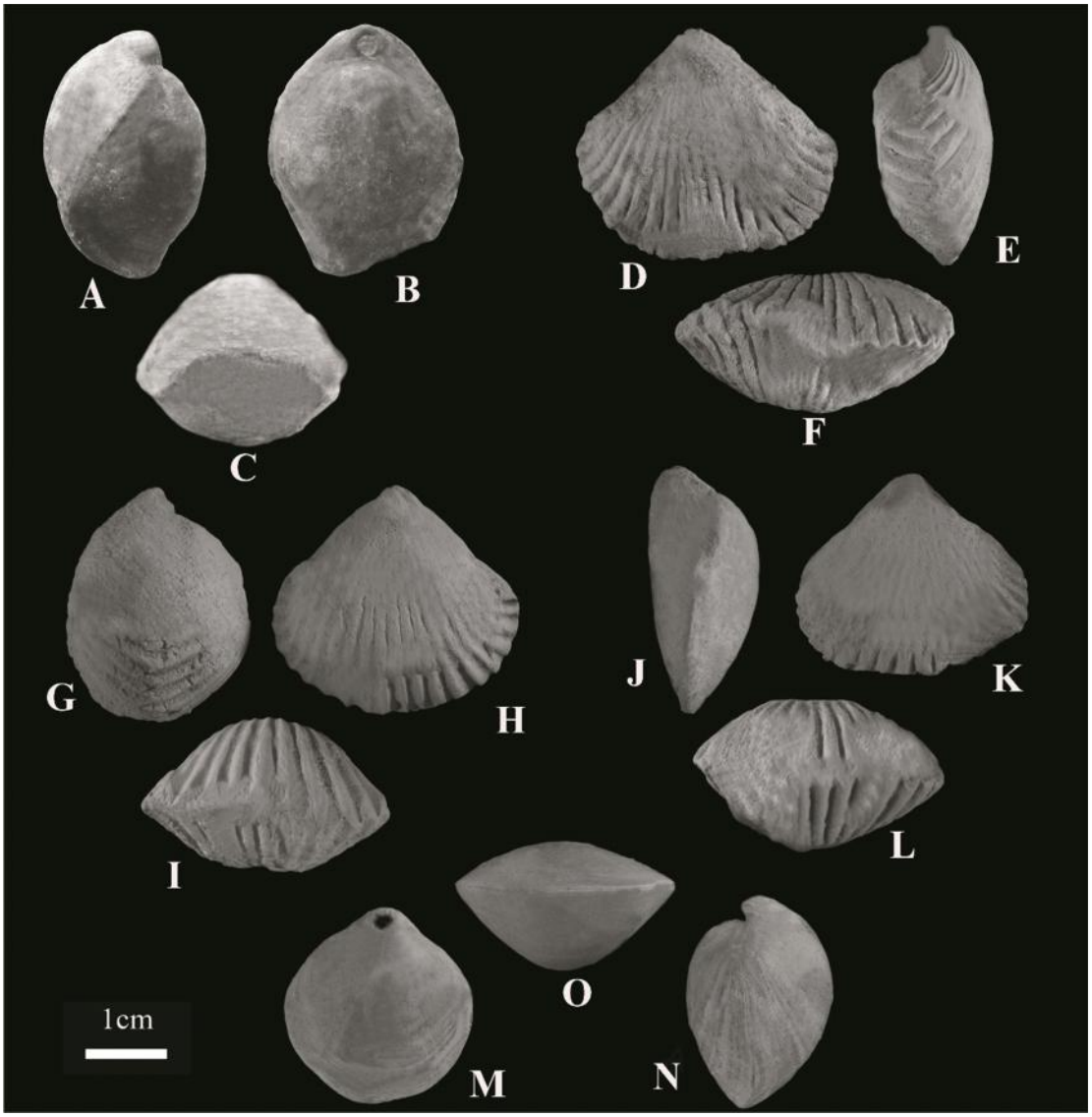

Plate 1
Fig. A- C: *Concinnithyris subundata*
Fig. D- F: *Cyclothyris compressa*
Fig. G- I: *Cyclothyris difformis*
Fig. J- L: *Cyclothyris* sp.
Fig. M- O: *Kingena arenosa*

biconvex or pedicle valve more convex. The maximum thickness is at about mid-length. Lateral commissure is ventrally curved. The beak is erect to suberect. Foramen large, circular and mesothyridid. Beak ridges are poorly developed. Shell surface is smooth. Anterior commissure is usually uniplicate to sulciplicate.

Remarks: The species illustrated by Owen (1988) are smaller than my specimens. The species described by Arab (2010) has a subpentagonal, subcircular to oval outline, both valve subequivalve and equally biconvex. The species described by Arab (2010) have a variable shapes in outline, medium to large and

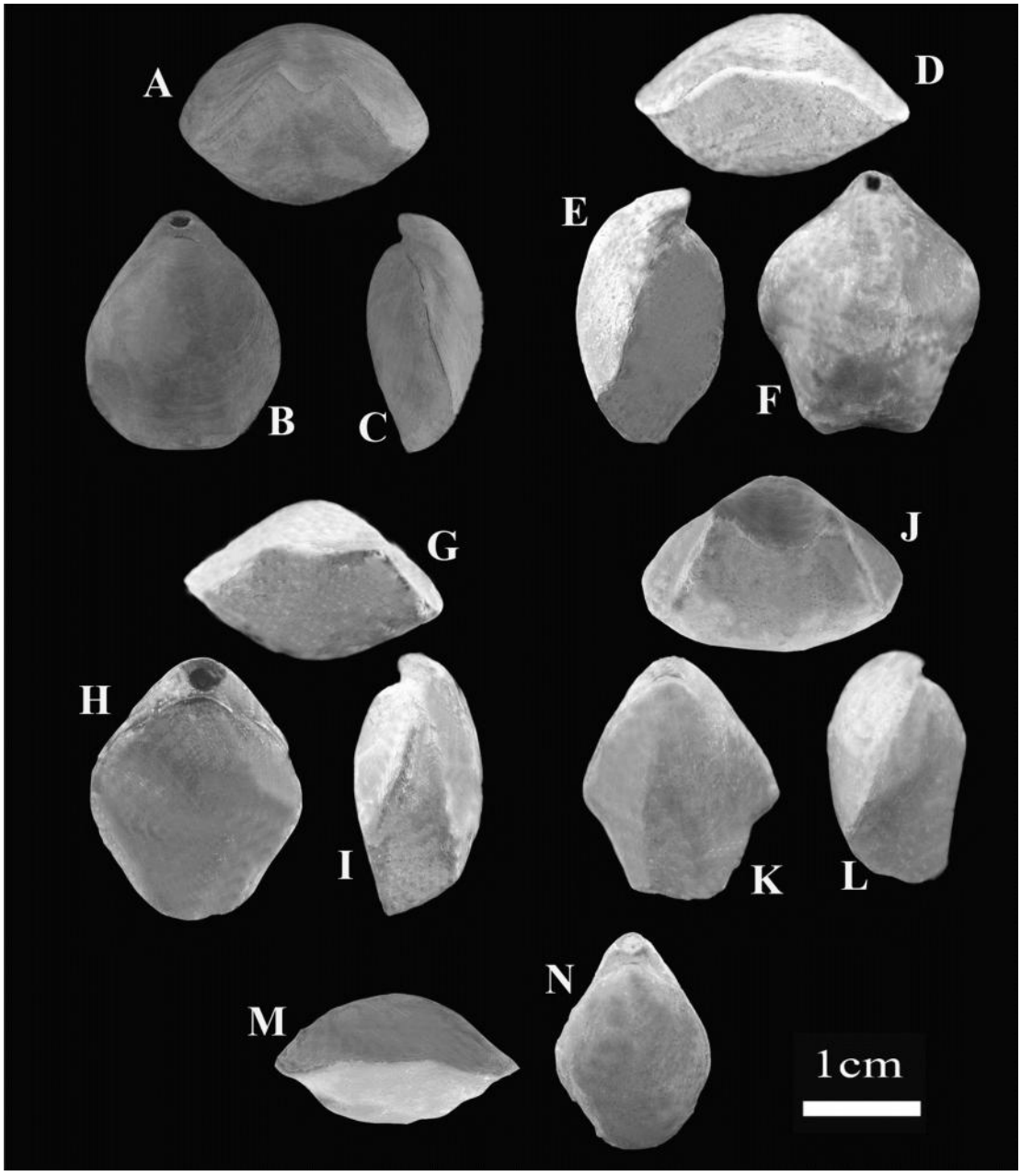

Plate 2
Fig. A- C: *Phaseolina phaseolina*
Fig. D- F: *Sellithyris cenomanensis*
Fig. G- I: *Sellithyris phaseolina*
Fig. J- L: *Sellithyris tornacensis*
Fig. M, N: *Trepeothyris* sp.

permesothyridid foramen and suberec beak, my specimens are subcircular to oval in outline, large and mesothyridid foramen and erect to suberect beak.

Age and distribution: This species occurs in the Albian?– lower Cenomanian age for the sediments of Baghin and Basab regions [2]. In the Vezk section, this species determine the lower Cenomanian age for the sediments.

Genus ***Phaseolina*** Gaspard, 1988

Phaseolina phaseolina (Lamarck, 1819)

(Pl. 2, figs. A- C)

1988. *Phaseolina phaseolina* (Lamarck) – Gaspard, p. 163, pl. 18. Fig. 9

2006. *Phaseolina phaseolina* (Lamarck) – Lee & Smirnova in Kaesler, H. 2065, fig. 1364(4a–d)

Material and occurrence: Two complete specimens and six incomplete specimens are found.

Description: The shell is Medium to large sized, biconvex and subcircular to oval in outline. Beak is suberect. The ventral beak is variably curved, influencing the foramen shape. The foramen is medium-sized to large mesothyrid, and small deltidium. There is a sulciplicate anterior commissure. The shell is smooth with fine radial capillae near the margins. Dorsal valve with a small bilobate cardinal process, a short and narrow loop.

Remark: In this species, the lateral margins are slightly inclined and the anterior margin less deeply biplicate than in *S. cenomanensis*. The species described by Gaspard (2014), have a medium size, pentagonal to subcircular outline, meso- to permesothyrid and large foramen, my specimens are Medium to large sized, subcircular to oval in outline and having mesothyridid, medium foramen.

Age and distribution: Gaspard (2014) has recorded this species from Cenomanian under the name *phaseolina phaseolina* (Lamarck). This species is recovered from upper cenomanian sediments of Vezk section, Yasuj, Iran.

Genus ***Tropeothyris*** Smirnova, 1972

Type species: *Trepeothyris kugusemi* Smirnova, 1972

***Tropeothyris* sp.**

(Pl. 2, figs. M- N)

Material: Three complete specimens and five nearly complete specimens were recovered.

Description: The shell is medium-sized and subcircular to oval in outline. The shell is biconvex, ventral valve more convex and dorsal valve gently convex. The maximum width and thickness is situated at mid-length. The lateral commissure is straight toward pedicle valve. The beak is suberect. Pedicle foramen is medium, circular and permesothyridid. Beak ridges are poorly developed. Shell surface is smooth. Anterior commissure is uniplicate.

Remarks: The specimens are very similar to those figured by Arab (2010). *Tropeothyris vectis* is pentagonal to broadly oval in outline, beak suberect, foramen large and a shallow sulcus starts at about mid-length. *Tropeothyris* sp. is large-sized and subcircular to oval in outline, beak issuberect, foramen is medium, circular, permesothyridid and the anterior commissure is uniplicate. Both species are ventri-biconvex and the dorsal valve gently curved.

Age and distribution: This species recovered from Albian? – lower Cenomanian of Baghin and Basab sediments of Kerman, Iran.In the Vezk section, this species determine the upper Albian? age for the sediments.

Family **Gibbithyrididae** Muir-Wood, 1965

Subfamily **Gibbithyridinae** Muir-Wood, 1965

Genus ***Concinnithyris*** Sahni, 1929

Type species: *Terebratulaobesa* J. de C. Sowerby 1823

Concinnithyris subundata (J. Sowerby, 1813)

(Pl. 1, figs. A- C)

1988 *Concinnithyris subundata* (J. Sowerby); Owen, p. 132, pl. 6, figs 16- 18; pl. 15, figs 1- 18; pl. 16, figs 1- 15

1997 *Concinnithyris subundata* (J. Sowerby, 1813); Gaspard, p. 150, pl. 1, fig. 19

2005 *Concinnithyris subundata* (J. Sowerby, 1813); Bitner & Motchurova-Dekova, p. 527, figs 3 A- H, 4, 5

2010 *Concinnithyris subundata* (J. Sowerby, 1813); Arab, Pl. 21, figs A- L

Material: Seven complete and two incomplete specimens were recovered.

Description. This species was previously identified by Owen (1988– pl. 6, figs 7-9), Gaspard (1997- p. 150, pl. 1, fig. 19), Bitner & Motchurova- Dekova (2005, p. 527, figs 3 A-H, 4, 5) and has been described later by Arab (2010- Pl. 21, figs A-L). Medium-sized shell, ventri-biconvex. Outline variable, from subcircular to subpentagonal. Maximum width at about mid-length; maximum thickness in posterior third. Beak ridges short, rounded, distinct only posteriorly. Umbo suberect to incurved with an epithyrid, subcircular foramen of large size. Symphytium not exposed. Anterior commissure rectimarginate to slightly uniplicate. Shell surface is smooth.

Remarks. In outline and umbonal characters, the Bulgarian material matches well that assigned to *Concinnithyris subundata* by Owen (1988).This species differs from *Concinnithyris obesa*, by its

uniplicate anterior commissure, less biconvexity of the shell and subpentagonal, elongated oval to subcircular in outline. The outline and beak characters of this section species are similar to those from Baghin and Basab, which are described by Arab (2010).

Occurrence

This species described from the Cenomanian of Great England and France (Gaspard, 1997) and also, occurs in the Albian?– lower Cenomanian Baghin and Basab regions (Arab, 2010).In the Vezk section, this species determine the lower Cenomanian age for the sediments.

Superfamily Kingenoidae Elliott, 1948

Family Kingenidae Elliott, 1948

Subfamily Kingeninae Elliott, 1948

Genus ***Kingena*** Davidson, 1852

Kingena arenosa (d'Archiac, 1846)

(Pl. 1, figs. M- O)

1970 *Kingena arenosa* (d'Archiac) – Owen, p. 55, pl. 4, figs. 1–7

1972 *Kingena arenosa* (d'Archiac) – Popiel-Barczyk, p. 121, pl. 2, figs. 1–3; fig. 1a–c

Material: Three complete and two incomplete specimens are found.

Description: This species was previously identified by Owen (1970- p. 55, pl. 4, figs. 1–7). The shell is large sized, biconvex and triangular-pentagonal in outline. The maximum thickness of the shell are situated at the middle of the length. The short suberect umbo is truncated by the medium circular foramen. The anterior margin is rectimarginate to sulcate or faintly uniplicate. The surface is granular, even ''finely spiky'' in some shells, ornamented with numerous small nodules. The shell has straight lateral margins and a rectimarginate to faintly uniplicate anterior margin. Distinct growth lines mark the anterior half of the shell.

Remarks: The recovered species are similar to those described by Gaspard (2014). The species described by Gaspard (2014), have a Medium to large size, oval-pentagonal outline and large circular foramen, my specimens are large- sized, triangular-Pentagonal in outline and medium foramen

Age and distribution: This species occurs in the middle Cenomanian sediments of the North Germany [17]. This species is recovered from lower Cenomanian sediment of Vezk section, Yasuj, Iran.

Order **Rhynchonellida** Kuhn, 1949

Superfamily **Hemithiridoidea** Rzhonsnitskaya, 1956

Family **Cyclothyrididae** Makridin, 1955

Subfamily **Cyclothyridinae** Makridin, 1955

Genus ***Cyclothyris*** M'Coy, 1844

Type species: *Terebratulala tissima* J. de C. Sowerby, 1840

Cyclothyris difformis (Valenciennes in Lamarck, 1819)

(Pl. 1, figs. G- I)

1988 *Cyclothyris difformis* (Valenciennes in Lamarck); Owen, p. 84, pl. 1, figs 13- 15, pl. 2, figs 4- 6 , figs 10- 15

1997 *Cyclothyris difformis* (Valenciennes in Lamarck); Gaspard, p. 146, pl. 1, fig. 15

2010 *Cyclothyris difformis* (Valenciennes in Lamarck); Arab, Pl. 23, figs. A- O

Material: Four complete specimens and seven crashed specimens were recovered.

Description: This species was previously identified by Owen (1988- p. 84, pl. 1, figs 13-15, pl. 2, figs 4-6 , figs 10-15), Gaspard (1997-p. 146, pl.1, fig. 15),and has been described later by Arab (2010- Pl. 23, figs. A-O).Shell large-sized, Pentagonal to oval in outline and moderately to strongly biconvex, both valves equally convex. The maximum thickness of the shell are situated at the middle of the length and the maximum width is nearly to the anterior margin at the middle of the length. The lateral commissure of most specimens apparently straight and in some specimens is slightly curved toward the pedicle valve (bent). The ventral valve may not show any folding. The beak is straight to suberect. The foramen is large, circular and hypothyridid. The beak ridges are distinct and sharp. The shell surface is ornaments with 20-25 costae on either valve and growth lines are invisible. The anterior commissure is asymmetrical.

Remarks: The recovered species are similar to those described by Arab (2010). *Cyclothyris difformis* obtained from Baghin, Iran [2] and in this section confirms considerable variability than other regions the species were known *Cyclothyris difformis* has different number of ribs on either valve in different area. The species illustrated by Owen (1988) has slightly incurved beak, well-marked uniplicate anterior commissure and about 40-45 costae on either valve. The species described by Arab (2010), have a medium to large-sized, variable outline and medium to large foramen, my specimens are large-sized, Pentagonal to oval in outline and large foramen.

Age and distribution: This species occurs in the Lower Chalk (Cenomanian) from the Glauconitic Marls of Compton Bay (Isle of Wight) the Snowdon Hill, Chard, Somerset, England [18]. It has also recovered from Albian? - lower Cenomanian of the

Baghin and Basab regions in Iran. This species show a lower Cenomanian age in Vezk section, Yasuj, Iran.

Cyclothyris compressa (Valenciennes in Lamarck, 1819)

(Pl. 1, figs. D- F)

1988. *Cyclothyris compressa* (Valenciennes in Lamarck); Owen, p. 86, pl. 3, figs 16- 21

1997 *Cyclothyris compressa* (Lamarck, 1819); Gaspard, p. 147, pl.1, fig. 11

2010 *Cyclothyris compressa* (Lamarck, 1819); Arab, Pl. 24, figs. D- I

Material: Three complete specimens and two crashed specimens were recovered.

Description: Large *Cyclothyris*. The shell is subtriangular in outline and biconvex, brachial valve is more convex and pedicle valve is convex only in its posterior part. The maximum width and thickness are situated in the mid of the length. The lateral commissure is straight. There is no fold on the brachial valve and the shallow sulcus is developing nearly on the pedicle valve. The beak is short, slender and slightly suberect. Beak ridges are sharply defined, leaving a flattened space between them and the hinge line. The foramen is medium, circular and hypothyridid. The ornaments of the shells are about 22- 26 costae on the either valve and the growth lines are invisible. The anterior commissure is asymmetrical.

Remarks: Gaspard (2014) illustrated that the species has been sometimes misidentified, its represents have a winged shell, somewhat flat and transverse, ornamented by 32 to 38 strong angular costae and the beak is suberect. Arab (2010) described that the shell of *Cyclothyris compressa* (Baghain & Basab) is subtriangular to subpentagonal in outline, the valve ornaments by about 24- 26 costae and the beak is suberect to erect.

Age and distribution: This species also occurs in the lower to middle Cenomanian sediments of the Dobrevacuka locality near Beloslav in Bulgaria [4] and from Albian? – lower Cenomanian sediments of Baghin region, Iran [2]. This species is recovered from cenomanian sediment of Vezk section, Yasuj, Iran.

***Cyclothyris* sp.**

(Pl. 1, figs. J- L)

Material. Five crushed specimens.

Description: Small to medium-sized, oval to subpentagonal *Cyclothyris*, with 45 relatively sharp ribs on each valve. The shell is transversely oval in outline. The shell is gently biconvex, brachial valve is more convex. There is not folding on the brachial valve and the sulcus is poorly developed on the pedicle valve. The beak is straight. The Beak- ridges are distinct. Deltidial plates, visible in a single specimen, form wing-like extension around small to medium-sized foramen. The foramen is circular and hypothyridid. The lateral commissure is straight to curve toward the pedicle valve. Anterior commissure is asymmetrical.

Remarks: The ornament suggests some similarity to members of the group of *Cyclothyris latissima*. This species differs from other *Cyclothyris* species by having transversely oval to subpentagonal outline, gently biconvex shell, straight beak, and about 45 costellae on either valve. The Baghin specimens [2] are similar to my species by their outline, the size and the gently convexity of the valves, but number of ribs of Baghin species are smaller than ones Vezk (Yasuj, Iran) species.

Age and distribution: This species recovered from Albian?– lower Cenomanian sediments of Baghin and Basab regions, Kerman, Iran, from Late Jurassic- Early Cretaceous sediments of Spitsbergen [15]. In the Vezk section, this species determine the Aptian age for the sediments.

Results

The Albian– Cenomanian brachiopod fauna from the Vezk section (Yasuj, southwestern Iran) comprises members of four families, of which the Cyclothyrididae and Sellithyrididae constitutes the main group. All taxa, with the exception of *Cyclothyris*, are here recorded for the first time from Bulgaria, although all have been described previously from western and central Europe. The Cenomanian transgression, documented from across the globe, provided relatively stable, shallow-water conditions and low facies diversity [13], which explains why the taxonomic composition of brachiopod faunas is closely similar. Brachiopods are facies sensitive and their distribution is controlled by facies change. Rhynchonelloids are rare or absent in marly facies, while terebratuloids prefer marly sediments, of which the present paper provides another example [4]. The Early Cenomanian was a period during which numerous species originated; among these are such taxa as *Concinnithyris subundata* and *Kingena arenosa* described herein. The abundance of *C. compressa* indicates the basal upper Cenomanian, while the association of *Ph. phaseolina* is indicative of the upper Cenomanian. Brachiopods (and other fossils such as echinoids, corals and orbitolinids) indisate the Aptian-Cenomanian ages for these sediments. The fauna assemblages suggest at shallow and suitable environment prevailed during the deposition of the strata.

Discussion

Brachiopods are mainly of Boreal and/or Tethyan origin, with some being cosmopolitan [9]. A biochronological scheme for brachiopods does not yet exist. However, as a result of their palaeogeographical distribution, some brachiopod species or associations are potentially reliable markers in some neritic facies [9]. *S. cenomanensis*, because of their abundance, are good markers in the detrital facies of the middle Cenomanian while *K. arenosa* is present in more limestone facies. Similarly, *C. compressa* indicates the basal upper Cenomanian, while *Ph. Phaseolina* –with its abundance and wide distribution– indicates the upper Cenomanian. The lower Cenomanian lithostratigraphical units appear less fossiliferous than those of the middle and upper Cenomanian. Brachiopods also provide data on palaeoenvironmental conditions and ecosystem evolution by their adaptability to changes within the environment [9].

The large costate rhynchonellids (*C. compressa*) indicate agitated waters, even in deltaic conditions (*C. compressa*), with coarse detrital sediments. The association with corals, echinoids and orbitolinids, indicate a shallow marine even littoral environment. Rhynchonellid brachiopods (genus *Cyclothyris*) are reported from the Late Aptian- Early Cenomanian time interval deposits in Kerman region [2 & 5]. This genus has previously been reported from the other parts of the world (e.g. Europe). The identified rhynchonellids are found in the shaly limestone layers and they indicate a shallow environment and suitable conditions during the deposition of these strata. According to Owen (1962), various species of *Cyclothyris* begin with the appearance of *Cyclothyris antidicotoma* (Sowerby), *Cyclothyris latissima* (Sowerby) and *Cyclothyris depressa* (Sowerby) in late Aptian and terminated with *Cyclothyris compressa* (Valenciennes in Lamarck) in late Cenomanian. The bulk of the brachiopods fauna belongs to the order Terebratulida (80 %), with only few representive of the Rhynchonellida (20 %). The relative abundances at the family are: Sellithyrididae (66%), Gibbithyrididae (9%), Kingenidae (5%) and Cyclothyrididae (20%). The *Sellithyris* genus alone accounts for about 77% of the Sellithyrididae family.

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