

Viséan and Bashkirian ammonoids from Central Iran

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ABSTRACT:

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Two successions of Carboniferous sedimentary rocks in Central Iran yielded ammonoid assemblages from one horizon each. In the Ramsheh section, a siltstone with *Neoglyphioceras yazdii* n. sp. and *Dombarites* can be assigned to the latest Viséan. The assemblage from the Shesh Angosht Mountain is more diverse with species of the genera *Proshumardites*, *Eumorphoceras*, *Homoceras*, *Glaphyrites*, *Syngastrioceras*, and *Dombarocanites*. This is the first time that the co-occurrence of the genera *Eumorphoceras* and *Homoceras* has been recorded. This fauna contains elements of the South Urals and Central Asian occurrences of Bashkirian ammonoids and suggests close palaeobiogeographic relationships.

Key words: Carboniferous, Viséan, Bashkirian, Central Iran, Carbonate sequence, Ammonoids.

INTRODUCTION

Carboniferous ammonoid assemblages are well known from the South Urals and from Central Asia, and are also rather frequently reported from occurrences in western North Africa. These regions belonged to the large Carboniferous ammonoid province that extended from the North Gondwana shelf in the west (Morocco, Algeria) to the Eastern European Platform (South Urals) and the shelf on the southern side of the Kazakhian Continent. Ammonoid assemblages from the wide region between these occurrences are still rather poorly known and

therefore will become important for a reconstruction of the Carboniferous biogeography.

Carboniferous ammonoids from Iran have rarely been described. A few goniatites ("*Muensteroceras tianshanicum* LIBROVITCH, 1927", "*M. subglobosum* LIBROVITCH, 1927", and "*Merocanites* sp. aff. *M. applanatus* FRECH, 1899") were reported from the Early Viséan rocks of the Shishtu Formation of the Ozbak-Kuh Mountains (WALLISER, 1966). "*Gastrioceras (Branneroceras)* cf. *branneri* (SMITH, 1896)" was described from the Late Namurian to Early Moscovian type section of the Sardar Formation in the Shotori Range (WALLISER, 1966). Beyrichoceratids or reticulocer-

atids of probable Namurian age occur in the Howz-e-Dorah section, Shotori Range (identifications by M. R. HOUSE in YAZDI, 1999). Finally, *Beyrichoceras* sp., *Neogoniatites* sp., *Dombarites liratus* RUZHENCEV & BOGOSLOVSKAYA, 1971, *Proshumardites delapinei* SCHINDEWOLF, 1939, *Glaphyrites anarakensis* KORN, 1999, and *Schartymites* cf. *aravanensis* RUZHENCEV & BOGO-

SLOVSKAYA, 1978 were illustrated from the Anarak section of Central Iran (KORN & al. 1999). These constitute the only records of Carboniferous ammonoid faunas from Iran. In this article, we aim to bridge the gap in the knowledge of Carboniferous ammonoid faunas located between the rich occurrences in the South Urals, Central Asia, and North Africa.

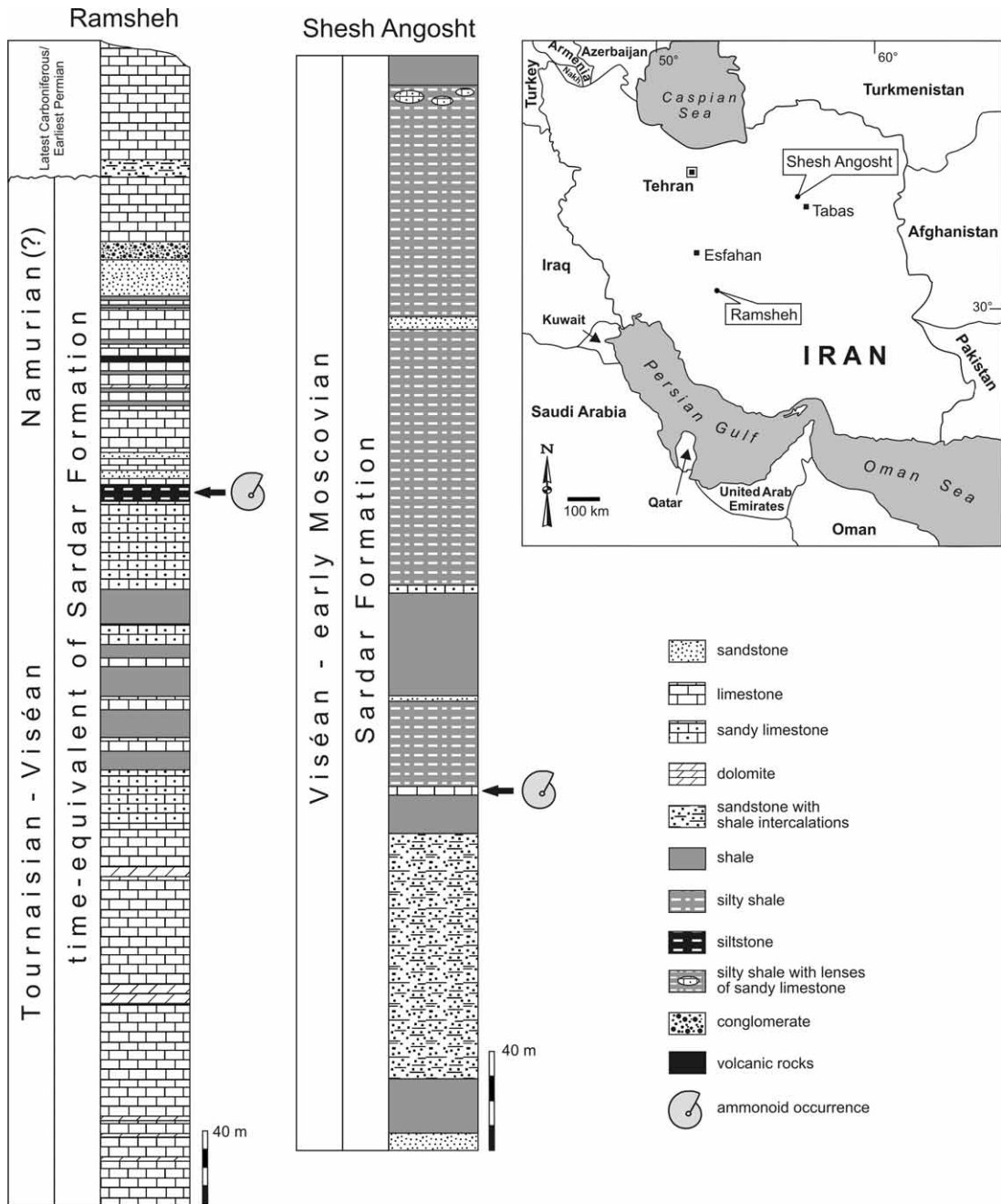


Fig. 1. Map of Iran showing Ramsheh and Shesh Angosht localities and their generalised stratigraphic columns. Horizons with ammonoids indicated by arrows

GEOGRAPHIC AND GEOLOGICAL SETTING

The present paper describes new material that was recently found in the southwest and the northeast of Central Iran. The localities are situated at Ramsheh, approximately 135 km southeast of Esfahan (N 31° 46.657', E 52° 8.630'; Ramsheh in Text-fig. 1) and the western side of the Shesh Angosht Mountain in the Shirgesht region, about 55 km northwest of Tabas (N 33° 58.00', E 56° 45.00'; Shesh Angosht in Text-fig. 1).

The hitherto undescribed Ramsheh succession represents a time equivalent of the Sardar Formation and is characterised by shallow water carbonates, which alternate with sandy limestones, shales, sandstones, and some dolomitic intercalations. Ammonoids from this locality occur in a red 65 cm thick siltstone bed, associated with rhychnonellid brachiopods and crinoid ossicles. The fauna of the underlying sandy limestones is dominated by brachiopods, crinoids, and less abundant corals. The basal carbonates yielded shallow-water conodonts (*Polygnathus inornatus* BRANSON, 1934, *Clydagnathus cavusformis* RHODES, AUSTIN & DRUCE, 1969, *Neopolygnathus communis communis* BRANSON & MEHL, 1934), indicating a Tournaisian age. The ammonoid-bearing horizon of probable latest Viséan age (see below) is overlain by fossiliferous limestones, which alternate with shales, sandstones, and a conglomerate bed. Limestones in the higher part of the section yielded the conodonts *Declinognathodus noduliferus* ELLISON & GRAVES, 1941 and *Rachistognathus muricatus* (DUNN, 1965), which suggest an early Bashkirian age. These Bashkirian strata are unconformably overlain by a thick siliciclastic interval, which, in turn, is overlain by oolitic limestone. This unit is not precisely dated but can be assigned to latest Carboniferous or earliest Permian based on a single element of *Streptognathodus cf. elongatus* GUNNELL, 1933, collected from the uppermost part of the unit.

The interval Viséan to basal Moscovian Sardar Formation is well exposed in the Shirgesht region. The sequence comprises shales and sandstones with a dark grey oolitic limestone unit of 50 centimetres thickness (within bed number 7 in fig. 19 of RUTTNER & al. 1968), which contains fairly well-preserved ammonoids. The horizon is already known to be highly fossiliferous and one specimen was tentatively assigned to the genus *Girtyoceras* by

O.H. WALLISER in RUTTNER & al. (1968). Associated biota are crinoid ossicles, an endemic blastoid (*Iranoblastus nodosus* FLÜGEL), fenestellid bryzoans, spiriferid brachiopods, corals, and holocephalian cochliodontiform teeth and tooth-plates. The fauna is dated as Late Viséan to Serpukhovian based on corals and brachiopods (RUTTNER & al. 1968, p. 57). Conodonts from this level suggest an age range from Serpukhovian to Bashkirian (M. YAZDI, pers. comm., August 2005).

MATERIAL

A total of 23 specimens are available for study. The material is stored in the collections of the University of Esfahan (EUIC numbers).

The Ramsheh section yielded nine specimens preserved in limonite:

<i>Dombarites</i> sp.	5 specimens
<i>Neoglyphioceras yazdii</i> sp. nov.	4 specimens

From the Shesh Angosht section, 14 specimens preserved in an oolitic carbonate bed of 0.50 m thickness are available:

<i>Proshumardites delepinei</i> SCHINDEWOLF, 1939	1 specimen
<i>Glaphyrites uralensis</i> RUZHENCEV & BOGOSLOVSKAYA, 1971	2 specimens
<i>Syngastrioceras dronovi</i> RUZHENCEV & BOGOSLOVSKAYA, 1978	3 specimens
<i>Syngastrioceras</i> sp.	2 specimens
<i>Eumorphoceras</i> sp.	1 specimen
<i>Homoceras</i> sp.	3 specimens
<i>Dombarocanites chancharensis</i> RUZHENCEV & BOGOSLOVSKAYA, 1971	1 specimen

AGE OF THE FAUNAS

Both assemblages can be dated using ammonoid biostratigraphy and the chronostratigraphic scheme. The fauna from Ramsheh suggests a position near the Viséan-Serpukhovian boundary, indicated by the presence of *Neoglyphioceras* and early *Dombarites*.

The fauna from Shesh Angosht, particularly the genus *Homoceras*, suggests a position at the base of the Bashkirian Stage. The presence of *Proshumardites*, *Glaphyrites*, and *Syngastrioceras* do not contradict to this hypothesis (RUZHENCEV & BOGOSLOVSKAYA 1971, 1978). *Dombarocanites*,

however, has never been found in Bashkirian strata. Another unusual component in this fauna is *Eumorphoceras*, which in most places in the world became extinct within the latest Serpukhovian. A co-occurrence of *Eumorphoceras* and *Isohomoceras* has already been reported from the basal Bashkirian in the Aksu section in Tyan' Shan' (Uzbekistan) by NIKOLAEVA (1994). The surprising co-occurrence of *Eumorphoceras* and *Homoceras*, however, cannot be explained with mixing of samples, condensation or redeposition. All share the same type of preservation, sometimes with delicate shell characters preserved, suggesting that they come from one single horizon.

SYSTEMATIC PALAEOONTOLOGY

Descriptive terms of the conch features are adopted from KORN (1988); abbreviations of the conch dimensions are: conch diameter (dm), whorl width (ww), whorl height (wh), umbilical width (uw), and aperture height (ah). A very important conch parameter is the whorl expansion rate (WER). It can be calculated by the algorithm $WER = [dm/(dm-ah)]^2$. The imprint zone rate (IZR) is a ratio, which characterises the whorl overlap. It can be calculated by the following equation: $IZR = (wh-ah)/wh$.

Family **Agathiceratidae** VON ARTHABER, 1911
Dombarites LIBROVITCH, 1957

Dombarites sp.
(Text-figs 2C, 3A)

MATERIAL: Five rather poorly preserved fragmentary juvenile specimens (EUIC 8650 to 8654), with maximum diameter of 12 mm from the Ramsheh section. The specimens are too small for a precise identification.

DESCRIPTION: The globular specimens have an almost completely closed umbilicus. Some of them show remains of the shell that is ornamented with delicate spiral lines. The suture line of specimen EUIC 8650 is characteristic of a juvenile specimen of *Dombarites*: The external lobe is Y-shaped, there is a rather narrow ventrolateral saddle with subangular top, and an adventive lobe with distinctly curved flanks (Text-fig. 3A).

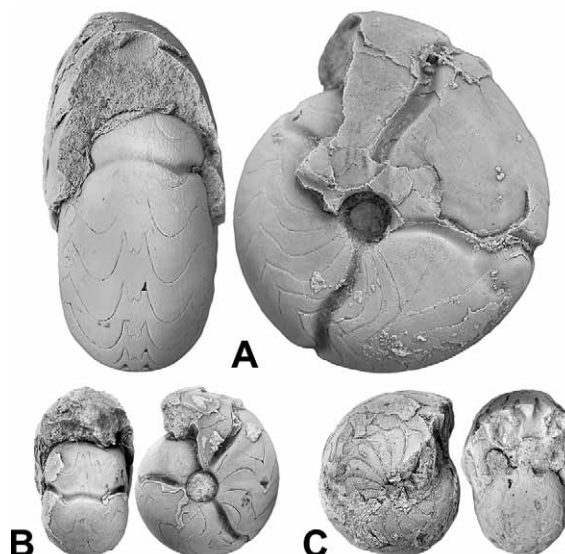


Fig. 2. Late Viséan ammonoids from the Ramsheh section. A – *Neoglyphioceras yazdii* sp. nov., holotype EUIC 8656, dorsal and lateral views; $\times 2$. B – *Neoglyphioceras yazdii* sp. nov., paratype EUIC 8657, dorsal and lateral views; $\times 2$. C – *Dombarites* sp., specimen EUIC 8650, lateral and dorsal views; $\times 2$

Proshumardites RAUSER-TSCHERNOUSSOWA, 1928

Proshumardites delepinei SCHINDEWOLF, 1939
(Text-figs 4A, 5)

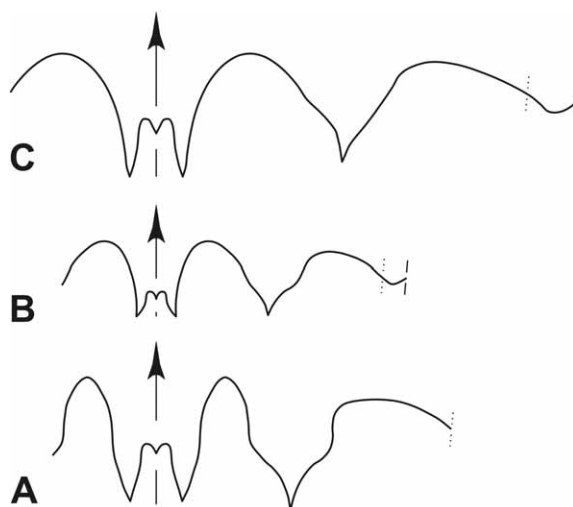


Fig. 3. Suture lines of ammonoids from the Ramsheh section. A – *Dombarites* sp., specimen EUIC 8650, at 11.1 mm dm, 5.7 mm wh; $\times 5$. B – *Neoglyphioceras yazdii* sp. nov., paratype EUIC 8657, at 9.9 mm dm, 6.9 mm ww, 3.9 mm wh; $\times 5$. C – *Neoglyphioceras yazdii* sp. nov., holotype EUIC 8656, at 19.6 mm dm, 10.9 mm ww, 8.5 mm wh; $\times 5$

1939 *Proshumardites delepinei* n. sp.; SCHINDEWOLF, p. 429, text-fig. 2.

1971 *Proshumardites delepinei*; RUZHENCEV & BOGOSLOVSKAYA, p. 242, pl. 21, figs. 1, 2. (for more synonymy)

MATERIAL: One rather well-preserved specimen with 27.5 mm diameter from the Shesh Angosht section.

DESCRIPTION: Specimen EUIC 8655 allows the description of a number of conch, ornament, and suture characters (Text-fig. 4A). The conch is pachyconic with a very narrow umbilicus and a low aper-

ture (WER = 1.56). Flanks and venter are broadly rounded. The specimen is fully septate but largely covered with shell. The ornament consists of about 65 fine spiral lines that are much thinner than their interspaces, and extremely fine growth lines with an almost linear course. The suture line of the specimen (Text-fig. 5) has a rather wide external lobe (width/depth ratio = 0.82) with a high median saddle (0.82 of external lobe depth); its flanks are sinuous with a subangular inflexion. The two prongs of the external lobe are slightly asymmetric and lanceolate. The adventive lobe is subdivided into three secondary lobes with almost the same shape and depth.

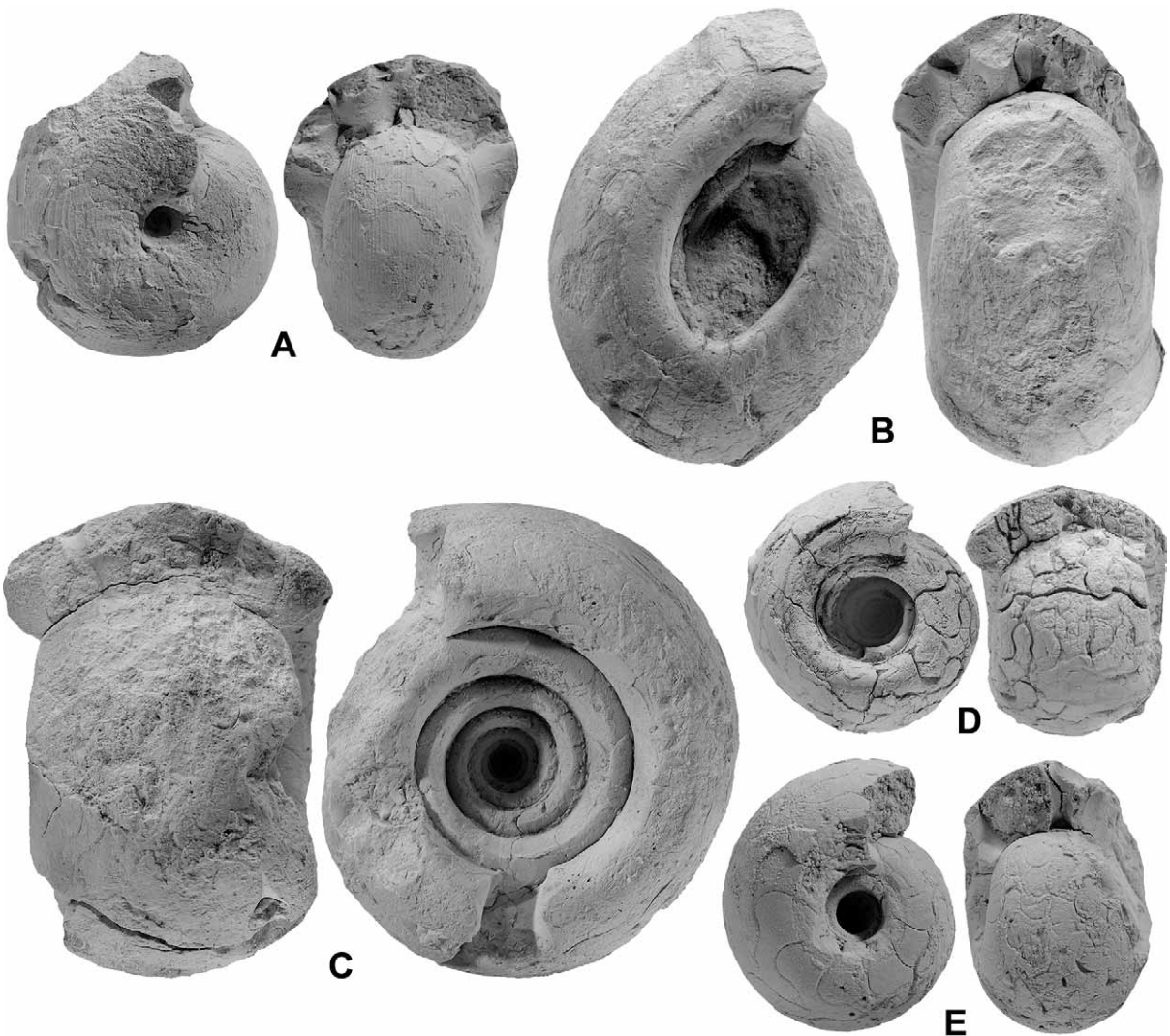


Fig. 4. Early Bashkirian ammonoids from the Shesh Angosht section. A – *Proshumardites delepinei* SCHINDEWOLF, 1939, specimen EUIC 8655, lateral and dorsal views; $\times 1.5$. B – *Glaphyrites uralensis* RUZHENCEV & BOGOSLOVSKAYA, 1971, specimen EUIC 8660, lateral and dorsal views; $\times 1$. C – *Syngastrioceras dronovi* RUZHENCEV & BOGOSLOVSKAYA, 1978, specimen EUIC 8661, dorsal and lateral views; $\times 1$. D – *Syngastrioceras dronovi* RUZHENCEV & BOGOSLOVSKAYA, 1978, specimen EUIC 8662, lateral and dorsal views; $\times 1$. E – *Syngastrioceras* sp., specimen EUIC 8663, lateral and dorsal views; $\times 1$

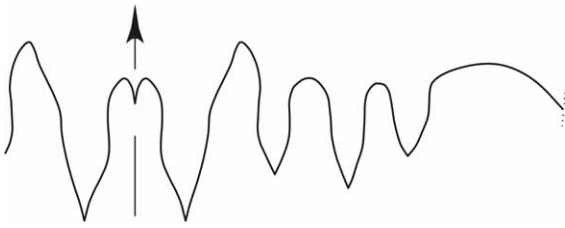


Fig. 5. Suture line of *Proshumardites delepinei* SCHINDEWOLF, 1939, specimen EUIC 8655 from the Shesh Angosht section, at 24.6 mm dm, 18.2 mm ww, 12.6 mm wh; $\times 3$

Dimensions in mm and ratios:

	dm	ww	wh	uw	ah
EUIC 8655	27.7	21.0	13.1	2.85	5.5
	23.2	16.4	11.6	2.55	–
	ww/dm	ww/wh	uw/dm	WER	IZR
	0.76	1.60	0.10	1.56	0.58
	0.71	1.41	0.11	–	–

Family **Neoglyphioceratidae** PLUMMER & SCOTT, 1937

Neoglyphioceras BRÜNING, 1923

Neoglyphioceras yazdii sp. nov.
(Text-figs 2A, B, 3B, C)

DERIVATION OF NAME: In honour of Dr. Mehdi YAZDI (University of Esfahan), in recognition of his studies on the stratigraphy of Middle – Late Palaeozoic rocks of Iran.

HOLOTYPE: Specimen EUIC 8656; illustrated in Text-fig. 2A.

TYPE LOCALITY AND HORIZON: Ramsheh section, 135 km southeast of Esfahan (Central Iran); siltstone horizon in the unit equivalent to the Sardar Formation (probably latest Viséan).

DIAGNOSIS: Species of *Neoglyphioceras* with thinly pachyconic conch ($ww/dm = 0.64$) at 10 mm dm and thickly discoidal conch ($ww/dm = 0.50$) at 20 mm dm. Umbilicus very narrow (0.14 at 10 mm dm; 0.12 at 20 mm dm); aperture low ($WER = 1.55$). Ornament with 60–70 spiral lines; steinkern with deep biconvex constrictions. Suture line with V-shaped external lobe with strongly diverging flanks, wide parabolic ventrolateral saddle, and wide, V-shaped adventive lobe.

MATERIAL: Four specimens are available from the Ramsheh section; they are preserved as limonitic steinkerns. Two of them are crushed, but another two (specimens EUIC 8656 and 8657) are well-preserved and allow study of conch shape and suture line.

DESCRIPTION: Holotype EUIC 8656 is the best preserved of the available specimens; it has a 24 mm conch diameter and has a portion (half of the whorl) of the body chamber preserved. Its thickness is half of the conch diameter, and its umbilicus is very narrow ($uw/dm = 0.12$). Shell remains are not preserved, but some ornament features are impressed on the steinkern. There are about 60–70 faint traces of spiral lines from umbilicus to umbilicus. The last volution has four slightly irregularly spaced constrictions, which are strongly biconvex in their course. In some places on the body chamber, there are irregular pit-like deepenings in the steinkern surface, evidence for repaired shell damage (Text-fig. 2A).

The suture line of the holotype has a V-shaped external lobe with strongly diverging, concave flanks (Text-fig. 3C). At half height, the width is 0.62 of the depth; the median saddle has a height of 0.40 of the external lobe depth. Towards the flank follows a wide parabolic ventrolateral saddle, and then a wide V-shaped adventive lobe with sinuous ventral flank.

The smaller paratype EUIC 8657 is fully septate and has, at 11 mm diameter, a thicker conch ($ww/dm = 0.60$) and a slightly more opened umbilicus (Text-fig. 2B). It also shows very faint traces of spiral ornament, and three constrictions are arranged 120 degrees apart. They have an indistinct dorsolateral projection, a more pronounced ventrolateral projection, and a shallow ventral sinus. The suture line of paratype EUIC 8657 has an outline that differs from the larger specimen particularly in its more curved flanks of the adventive lobe (Text-fig. 3B).

Dimensions in mm and ratios:

	dm	ww	wh	uw	ah
HT EUIC 8656	23.8	–	12.1	2.9	4.8
	21.4	10.7	10.3	2.6	–
PT EUIC 8657	11.6	7.0	5.3	1.7	2.5
	9.9	6.3	4.3	–	–
	ww/dm	ww/wh	uw/dm	WER	IZR
HT EUIC 8656	–	–	0.12	1.57	0.60
	0.50	1.04	0.12	–	–
PT EUIC 8657	0.59	1.33	0.14	1.62	0.52
	0.64	1.47	–	–	–

DISCUSSION: *Neoglyphioceras yazdii* sp. nov. differs from most species of the genus by its small umbilicus ($uw/dm = 0.12$ at 20 mm dm), which in most of the species is 0.25–0.30 of the conch diameter. *N. sinuosum* RUZHENCEV & BOGOSLOVSKAYA, 1971 and *N. litvinovitchae* RUZHENCEV & BOGOSLOVSKAYA, 1971 are similar, but the former does not have deep constrictions, and the latter has much more curved constrictions and a narrower, subacute ventrolateral saddle. The narrowly umbilicate specimens identified as *N. caneyanum* (GIRTY, 1909) by RUZHENCEV & BOGOSLOVSKAYA (1971, pl. 35, figs. 7-10) have a narrower umbilicus than the original material described by GIRTY (1909) and GORDON (1965). However, these specimens have a much higher aperture ($WER = 1.90$) than *Neoglyphioceras yazdii* ($WER = 1.55$).

Family **Glaphyritidae** RUZHENCEV, 1936
Glaphyrites RUZHENCEV, 1936

Glaphyrites uralensis RUZHENCEV &
BOGOSLOVSKAYA, 1971
(Text-figs 4B, 6)

1971. *Glaphyrites uralensis* n. sp.; RUZHENCEV & BOGOSLOVSKAYA, p. 290, pl. 31, figs 5-7.

HOLOTYPE: Specimen PIN No. 455/36765, illustrated by RUZHENCEV & BOGOSLOVSKAYA (1971) in pl. 31, fig. 7.

TYPE LOCALITY AND HORIZON: Kiya River, South Urals; late Serpukhovian Nm1c2 zone of RUZHENCEV & BOGOSLOVSKAYA (1971).

MATERIAL: One distorted large specimen and one small whorl fragment from the Shesh Angosht section.

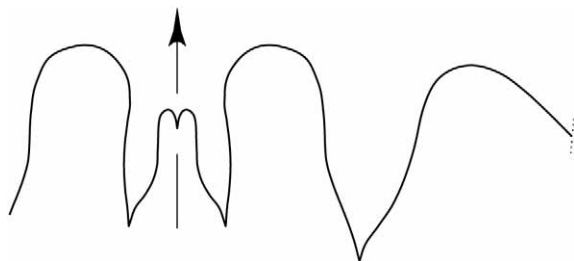


Fig. 6. Suture line of *Glaphyrites uralensis* RUZHENCEV & BOGOSLOVSKAYA, 1971, specimen EUIC 8660 from the Shesh Angosht section, at 35.3 mm ww, 11.5 mm wh; $\times 2$

DESCRIPTION: The slightly crushed specimen EUIC 8660 allows the study of conch morphology that is characteristic for *Glaphyrites*. The rather wide umbilicus has a steep wall that is bordered by a subangular margin from the flanks (Text-fig. 4B). The suture line of the specimen has a slightly inflated external lobe that has, at half depth, a width of 0.57 of the total depth (Text-fig. 6). The median saddle reaches a height of 0.57 of the external lobe depth. The ventrolateral saddle is broadly rounded, and the adventive lobe is deep V-shaped with slightly curved flanks.

Dimensions in mm (of the distorted specimen) and ratios:

	dm	ww	wh	uw	ah
EUIC 8660	62.8	38.1	17.0	26.3	11.1
	52.6	33.8	16.5	22.3	–
	ww/dm	ww/wh	uw/dm	WER	IZR
	0.61	2.24	0.42	1.48	0.35
	0.64	2.05	0.42	–	–

Syngastrioceras Librovitch, 1938

Syngastrioceras dronovi RUZHENCEV &
BOGOSLOVSKAYA, 1978
(Text-figs 4C, D, 7A, B)

1978. *Syngastrioceras dronovi* n. sp.; RUZHENCEV & BOGOSLOVSKAYA, p. 153, pl. 5, figs 3, 4.

HOLOTYPE: Specimen PIN No. 2992/12, illustrated by RUZHENCEV & BOGOSLOVSKAYA (1978) in pl. 5, fig. 3.

TYPE LOCALITY AND HORIZON: Pshart River Basin, Pamirs; early Bashkirian Nm2a2 zone of RUZHENCEV & BOGOSLOVSKAYA (1978).

MATERIAL: Three specimens from the Shesh Angosht section, of which two are well-preserved phragmocones, 35 and 73 mm in diameter, and one is a whorl fragment.

DESCRIPTION: The best-preserved specimen EUIC 8661, which is fully septate at 73 mm diameter, displays a cadyconic conch with a wide umbilicus ($uw/dm = 0.50$) and a strongly depressed whorl cross section (ww/wh almost 3.00). The umbilical wall is oblique, and a suban-

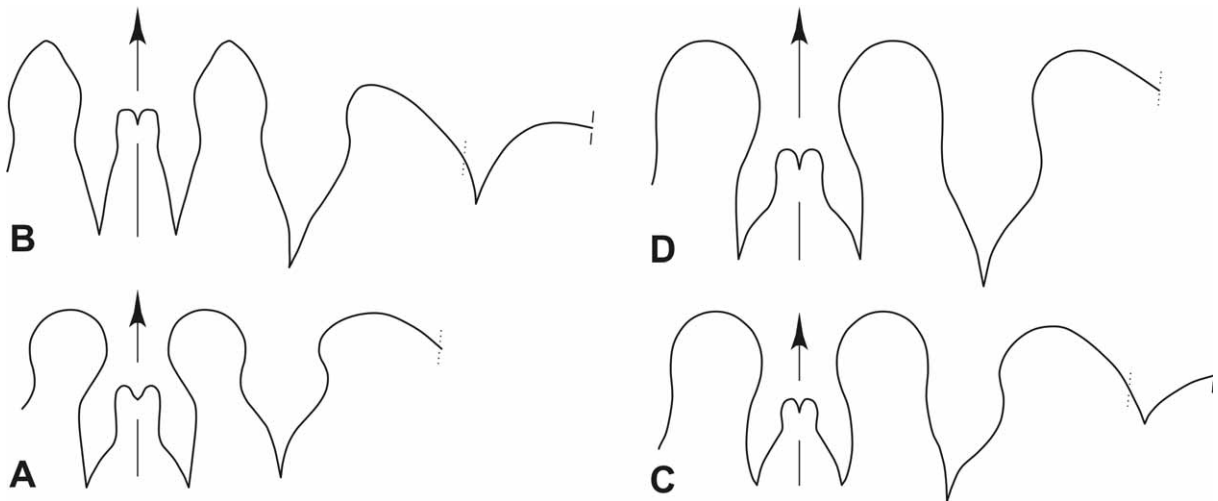


Fig. 7. Suture lines of *Syngastrioceras* from the Ramsheh section. A – *Syngastrioceras dronovi* RUZHENCEV & BOGOSLOVSKAYA, 1978, specimen EUIC 8662, at 21.8 mm ww, 8.0 mm wh; $\times 3$. B – *Syngastrioceras dronovi* RUZHENCEV & BOGOSLOVSKAYA, 1978, specimen EUIC 8661 (reversed), at 72.5 mm dm, 51.4 mm ww, 17.1 mm wh; $\times 1.5$. C – *Syngastrioceras* sp., specimen EUIC 8663, at 22.4 mm dm, 18.2 mm ww, 9.5 mm wh; $\times 3$. D – *Syngastrioceras* sp., specimen EUIC 8664, at 23.2 mm ww; $\times 3$

gular margin separates it from the broadly rounded venter (Text-fig. 4C).

The suture line of specimen EUIC 8661 has, at 72.5 mm conch diameter, an outline with a number of distinct characters (Text-fig. 7B). The general shape of the external lobe is Y-shaped with a width/height ratio (measured at half depth) of 0.64. Its prongs are elongated lanceolate and pouched; the median saddle has a height of 0.64 of the external lobe depth. The narrow ventrolateral saddle is constricted at about half height, and its upper portion is tectiform and subacute. The adventive lobe appears dorsally declined; it is inflated ventrally and dorsally. Near the umbilical margin follows a narrow, strongly asymmetric dorsolateral saddle.

Specimen EUIC 8662 is a rather well preserved specimen of intermediate size (Text-fig. 4D). It is pachyconic at 35 mm conch diameter ($ww/dm = 0.76$) with a rather wide umbilicus ($uw/dm = 0.42$). The margin of the umbilicus is angular, and the umbilical wall is slightly convex. The suture line of the specimen, drawn at 21 mm whorl height, has a strongly pouched external lobe that is wide at its base and constricted in the upper part (Text-fig. 7A). The two prongs are lanceolate with a long apex. The proportions of the external lobe are: width (at half depth) = 0.62, height of median saddle = 0.57 of the external lobe depth. The bulb-shaped ventrolateral saddle is ventrally inclined and its top is broadly rounded. The adventive lobe is slightly asymmetric and strongly inflated.

Dimensions in mm and ratios:

	dm	ww	wh	uw	ah
EUIC 8661	72.7	51.5	17.2	36.5	12.5
	60.7	42.4	15.5	31.1	–
EUIC 8662	34.8	26.5	10.5	14.5	5.7
	29.7	24.3	9.1	12.0	–
	ww/dm	ww/wh	uw/dm	WER	IZR
EUIC 8661	0.71	2.99	0.50	1.46	0.27
	0.70	2.73	0.51	–	–
EUIC 8662	0.76	2.52	0.42	1.43	0.46
	0.82	2.67	0.40	–	–

DISCUSSION: The Iranian specimens closely resemble, in their conch shape and their suture line, the specimens described and figured by RUZHENCEV & BOGOSLOVSKAYA (1978) from Central Asia. Particularly the ontogenetic trends of conch modification, e.g., the opening of the umbilicus are very similar and justify the determination.

Syngastrioceras sp.
(Text-figs 4E, 7C, D)

MATERIAL: Two phragmocones from the Shesh Angosht section, of which one is complete with 27 mm diameter. The second is a fragmentary specimen of about the same size. The material is too incomplete for a specific determination.

DESCRIPTION: Specimen EUIC 8663 (Text-fig.

4E) is the better preserved of the two; it is a fully septate, thickly pachyconic and narrowly umbilicate conch with a maximum diameter of 27 mm (ww/dm = 0.77, uw/dm = 0.24). Flanks and venter are broadly rounded, and the umbilicus is bordered by a rounded margin. The aperture is rather low (WER = 1.76). The steinkern is smooth and does not show any traces of ornament or constrictions.

The suture line of specimen EUIC 8664 shows the markedly constricted external lobe that is pouched in the lower half. Measured at half height, it has a width of only 0.46 of the lobe depth (Text-fig. 7D). The median saddle has exactly half the height of the external lobe depth. The prongs of the external lobe are elongated, drop-shaped with sharp terminations. The bulb-shaped ventrolateral saddle is broadly rounded, and the asymmetric, pouched adventive lobe has strongly sinuous flanks. The smaller specimen EUIC 8663 has a similar suture line, but the pouching of the external and adventive lobe is less developed. In both specimens the adventive lobe is deeper than the external lobe (Text-fig. 7C, D).

Dimensions in mm and ratios:

	dm	ww	wh	uw	ah
EUIC 8663	27.1	-	-	-	6.65
	24.2	18.7	10.5	5.8	-
	ww/dm	ww/wh	uw/dm	WER	IZR
	-	-	-	1.76	-
	0.77	1.78	0.24	-	-

Family **Girtyoceratidae** WEDEKIND, 1918

Eumorphoceras GIRTY, 1909

Eumorphoceras sp.
(Text-figs 8, 10B)

MATERIAL: One fragment of a very large individual from the Shesh Angosht section. The specimen represents the first record of the co-occurrence of *Eumorphoceras* and *Homoceras*.

DESCRIPTION: Specimen EUIC 8665 is a septate whorl fragment with 76 mm whorl height, which means that the diameter of the complete specimen was certainly larger than 220 mm. Its shape suggests a lenticular conch with subacute venter and a very narrow umbilicus. The suture line is that of an adult girtyoceratid, with a wide, V-shaped external lobe and a narrowly rounded, asymmetric ventrolateral

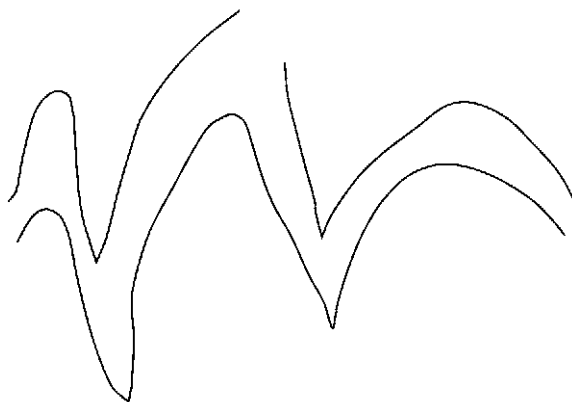


Fig. 8. Suture line of *Eumorphoceras* sp., specimen EUIC 8665 from the Shesh Angosht section, at 48.5 mm ww, ca. 75 mm wh; × 1

saddle (Text-fig. 8). The adventive lobe is much smaller than the external lobe.

Family **Homoceratidae** SPATH, 1934

Homoceras HYATT, 1884

Homoceras sp.
(Text-figs 9, 10A, C)

MATERIAL: Three specimens from the Shesh Angosht section, of which one is a rather complete mature conch, 127 mm in diameter. One whorl fragment of an even larger specimen with a phragmocone whorl height of 51 mm, and one fragmentary specimen, 65 mm in diameter are available.

Dimensions in mm and ratios:

	dm	ww	wh	uw	ah
EUIC 8666	127.5	50.5	60.4	24.8	29.5
	105.9	41.3	38.4	20.4	-
EUIC 8667	-	43.2	51.1	-	27.8
	ww/dm	ww/wh	uw/dm	WER	IZR
EUIC 8666	0.40	0.84	0.19	1.60	0.51
	0.39	1.08	0.19	-	-
EUIC 8667	-	0.84	-	-	0.46



Fig. 9. Suture line of *Homoceras* sp., specimen EUIC 8667 from the Shesh Angosht section, at 42.0 mm ww, 49.5 mm wh; × 1

DESCRIPTION: Specimen EUC 8666 (Text-fig. 10A) is a lenticular conch with 127 mm diameter, which shows a subacute venter at the beginning of the last whorl. The venter becomes completely acute half a whorl later. The umbilicus has almost one fifth of the conch diameter; its steep wall is bordered by a rounded margin from the flanks. Ornament is not preserved.

Fragment EUC 8667 (Text-fig. 10C) belongs to an even larger specimen; the mature diameter must have been more than 160 mm. It is a fully septate fragment with 51 mm whorl height and shows the transition from the subacute to acute venter. The suture line of the specimen is characteristic of *Homoceras* with the wide V-shaped external lobe (width of the lobe 1.12 of its depth),

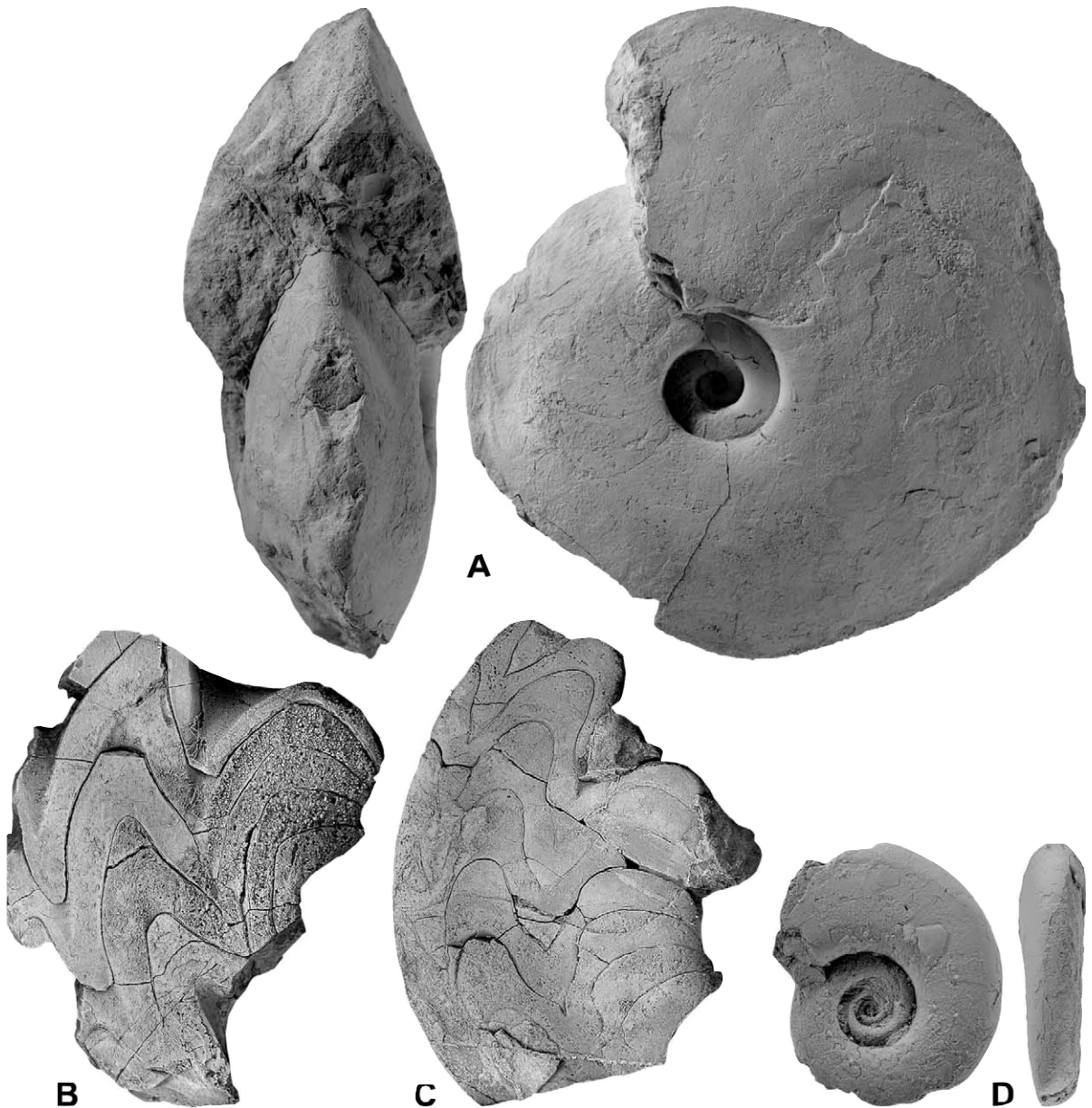


Fig. 10. Early Bashkirian ammonoids from the Shesh Angosht section. A – *Homoceras* sp., specimen EUC 8666, dorsal and lateral views; $\times 0.75$. B – *Eumorphoceras* sp., specimen EUC 8665, lateral view; $\times 0.75$. C – *Homoceras* sp., specimen EUC 8667, lateral view; $\times 1$. D – *Dombarocanites chancharensis* Ruzhencev & Bogoslovskaya, 1971, specimen EUC 8668, lateral and ventral views; $\times 1$

the asymmetric and broadly rounded ventrolateral saddle, and the V-shaped and slightly pouched adventive lobe. The median saddle has slightly more than half of the height of the external lobe depth (Text-fig. 9).

DISCUSSION: The material cannot be identified to a distinct species, because species of *Homoceras* have an indistinct oxyconic adult stage. From the suture line and the conch shape, however, it is clear that the Iranian specimens belongs to this genus.

Family **Prolecanitidae** HYATT, 1884
Dombarocanites RUZHENCEV, 1949

Dombarocanites chancharensis RUZHENCEV &
BOGOSLOVSKAYA, 1971
(Text-figs 10D, 11)

1971. *Dombarocanites chancharensis* n. sp.; RUZHENCEV & BOGOSLOVSKAYA, p. 132, pl. 1, figs 5-7.

HOLOTYPE: Specimen PIN No. 455/12, illustrated by RUZHENCEV & BOGOSLOVSKAYA (1971) in pl. 31, fig. 7.

TYPE LOCALITY AND HORIZON: Dombar Hills, South Urals; Serpukhovian Nm1b2 zone of RUZHENCEV & BOGOSLOVSKAYA (1971).

MATERIAL: One well preserved specimen of little more than 20 mm diameter.

DESCRIPTION: The specimen has a very narrow conch and a moderately wide umbilicus. The shell surface is smooth except for fine growth lines that possess a prominent dorsolateral projection and turn back on the flanks towards a deep ventral sinus (Text-fig. 10D). The suture line of the specimen is characteristic for the intermediate growth stage

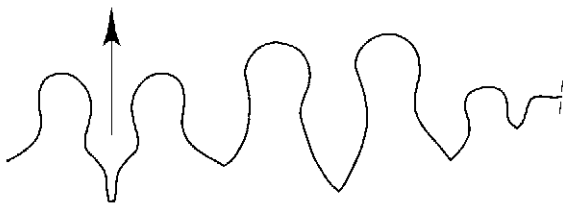


Fig. 11. Suture line of *Dombarocanites chancharensis* RUZHENCEV & BOGOSLOVSKAYA, 1971, specimen EUIC 8668 from the Shesh Angosht section, at 20.3 mm dm, 5.7 mm ww, 9.6 mm wh; $\times 6$

(Text-fig. 11). It has a narrow bottle-shaped external lobe and four subacute lobes on the flank, of which the second is strongest pouched.

Dimensions in mm and ratios:

	dm	ww	wh	uw	ah
EUIC 8668	20.2	5.2	8.8	6.7	–
	ww/dm	ww/wh	uw/dm	WER	IZR
	0.26	0.59	0.33	–	–

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REFERENCES

- KORN, D. 1988. Die Goniatiten des Kulmplattenkalkes (Cephalopoda, Ammonoidea; Unterkarbon; Rheinisches Schiefergebirge). *Geologie und Paläontologie in Westfalen*, **11**, 1-293.
- KORN, D., KAUFMANN, B., WENDT, J. & KARIMI BAVANDPOUR, A. 1999. Carboniferous ammonoids from Anarak (central Iran). *Abhandlungen der Geologischen Bundesanstalt*, **54**, 337-344.
- NIKOLAEVA, S.V. 1994. Ammonoid biostratigraphy for the proposed mid-Carboniferous boundary stratotype, Aksu River, South Tien-Shan, Central Asia. *Annales de la Société Géologique de Belgique*, **116** (2), 265-273.
- RUTTNER, A.W., NABAVI, M.H. & HAJIAN, J. 1968. Geology of the Shirgesht area (Tabas area, east Iran). *Geological Survey of Iran, Reports*, **4**, 1-133.
- RUZHENCEV, V.E. & BOGOSLOVSKAYA, M.F. 1971. Namyurskiy etap v evolyutsii ammonoidey. Rannenamyurskie ammonoidei. *Trudy Paleontologicheskogo Instituta Akademiyi Nauk SSSR*, **133**, 1-382. Moskva.
- 1978. Namyurskiy etap v evolyutsii ammonoidey. Pozdnenamyurskie ammonoidei. *Trudy Paleontologicheskogo Instituta Akademiyi Nauk SSSR*, **167**, 1-336. Moskva.
- SCHINDEWOLF, O.H. 1939. Zur Kenntnis von *Pericleites* RENZ und verwandter paläozoischer Ammonoiten.

Jahrbuch der Preußischen Geologischen Landesanstalt,
59, 423-455.

WALLISER, O.H. 1966. Preliminary notes on Devonian,
Lower and Upper Carboniferous goniatites in Iran.

Geological Survey of Iran, Reports, **6**, 7-24.

YAZDI, M. 1999. Late Devonian–Carboniferous conodonts from eastern Iran. *Rivista Italiana di Paleontologia e Stratigrafia*, **105**, 167-200.

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