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THE MIDDLE SMITHIAN (EARLY TRIASSIC) AMMONOIDS OF GORNJI BRČELI (SOUTHERN MONTENEGRO)

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Abstract. A rich Early Triassic (Smithian) ammonoid fauna discovered near the village of Gornji Brčeli (southern Montenegro) is unique for the Early Triassic of the western Tethys. The Smithian there is represented by a series of several tens of meters thick brown-red to grey-green marls and clays with intercalated, mica-rich, thin dark grey sandstones, and subordinate occurence of redeposited oolitic limestone. The fossils have been collected as scree material over a few square meters but are considered as contemporaneous since no unnatural association (condensation) was detected. The ammonoid assemblage is represented by 15 species, belonging to the genera *Aspenites*, *Cordillerites*, *Dieneroceras*, *Abrekites*, *Owenites*, *Pseudaspenites*, *Pseudosageceras*, *Truempyceras*, *Wyomingites*, *Hanielites*, *Galfettites*, *Parahedenstroemia*, *Lingyunites* and *Pseudoflemingites*, and can, by the presence of *Owenites zitteli* Smith, be correlated with the late Middle Smithian *Nyamalites angustecostatus* beds of the southern Tethys, the upper *Owenites koeneni* beds of South China or the *Owenites* beds of North America. Taxonomic composition of the ammonoid assemblage shows great similiarity with those of Spiti (India), NW Guangxi (China) and Nevada (USA), but also some with those of Salt Range (Pakistan) and Timor. A markedly dominance of involute, oxycone and platycone morphologies distinguishes the Gornji Brčeli fauna from other contemporaneous faunas and points to specific palaeoecological environmental conditions. Previously, three new species were described from this locality and in the present paper one more is added (*Parahedenstroemia*? *tatjanae*). Two species hitherto considered as synonyms (*Abrekites arthaberi* and *Owenites zitteli*) are revised and treated as valid based on new material from Gornji Brčeli.

Introduction

The Lower Triassic ammonoid fauna of Gornji Brčeli were first described by Petković & Mihailović (1935), who correlated the scarce collected material to the Zone with *Meekoceras gracilitatis*, established by Smith (1932) in North America. After this, the locality was not re-investigated for a long time. In recent years, it was re-examined in detail on several occasions which resulted in the collection of a rich assemblage. First results of these investigations were presented by Đaković (2017), who described three new species from Gornji Brčeli. In the present paper, the complete material is documented, consisting of specimens collected mostly by M. Đaković and some earlier by L. Krystyn, with inclusion of the collection described by Petković & Mihailović (1935).

Regarding the high diversity and geographic uniqueness of this ammonoid fauna of Smithian

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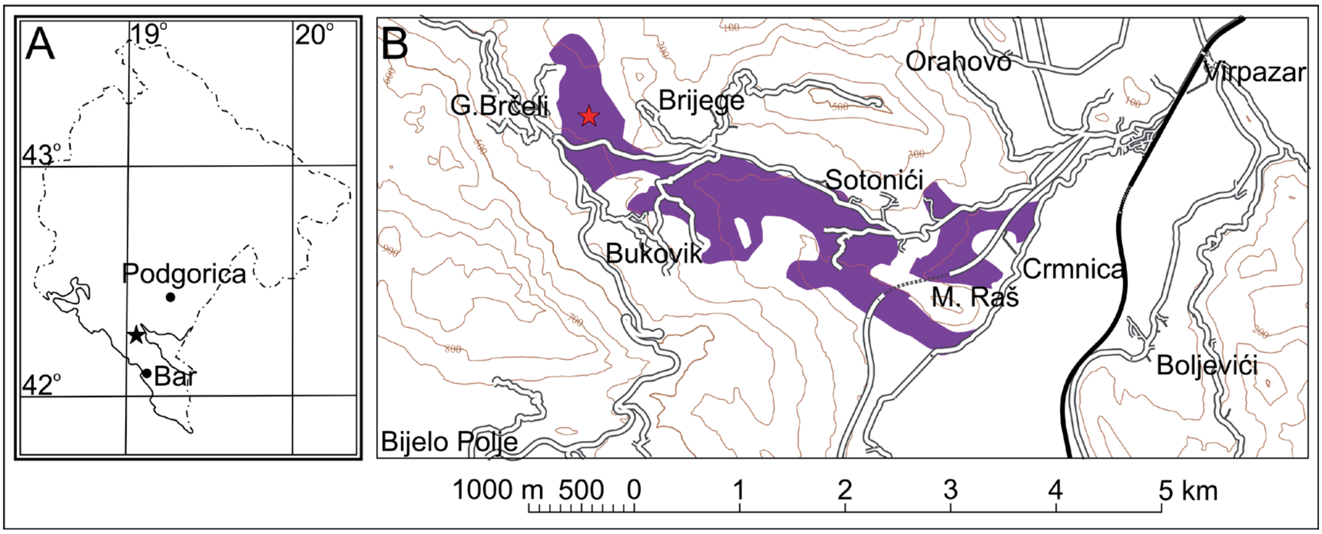


Fig. 1 - A) Map of Montenegro with indication of the studied area (black star, from Đaković 2017), B) Wider Virpazar area with location of the studied section (red star) east of Gornji Brčeli; purple shaded area indicates Lower Triassic sediments, after Mirković et al. (1978).

age within the western Tethys – the next age-equivalent ammonoids are known from the Caucasus (Shevyrev 1995) and from Afganistan (Kummel & Erben 1968) some 2000 to 3000 km to the East – its detailed study seemed therefore highly desirable both for stratigraphic as well as palaeobiogeographic purposes.

Geological setting

In the area of Crmnica, where the locality Gornji Brčeli is situated, Lower Triassic sediments show a total thickness of about 250 m (Pantić-Prodanović 1975) and form part of the Mesozoic succession of the Budva Zone (Krystyn et al. 2019). They are represented by two main lithologies: 1) brown-red and above grey-green clayey-marly sediments with intercalated grey and green sandstones with mica, argillaceous sandstones, and rare interlayers of silty limestone of Smithian age at G. Brčeli and 2) grey to greenish-grey clayey marls with intercalated light-grey often lense-like graded calcarenites (calciturbites?) and subordinate mudstone layers of Spathian age at M. Raš and Limljani (Đaković 2017; Krystyn et al. 2019, fig. 2). Older Triassic rocks are not exposed, whereas the regionally overlying sediments are represented by conglomerates and siliciclastics of Anisian age (Crmnica Conglomerate and Tuđemili Formation; Dimitrijević 1967; Dimitrijević & Dimitrijević 1989).

The age of Lower Triassic sediments in Crmnica area has been previously difficult to determine, because these rocks rarely contain any fossils. A Smithian age has so far been established only for the Gornji Brčeli locality, based on ammonoids (Petković & Mihailović 1935; Đaković 2017). Meanwhile, a Spathian age was identified in several localities on the basis of foraminifera (Pantić-Prodanović 1975), gastropods (Mirković et al. 1978) and conodonts (Krystyn et al. 2014).

Description of the studied section

The position and description of the Gornji Brčeli locality have been given in Đaković (2017). It is situated less than 500 m to the east of the village Gornji Brčeli and about 6 km to the west of the town of Virpazar (Fig. 1). A detailed litho-stratigraphic log of the section has been published and figured in Čađenović (2015, fig. 4) who named the succession (with inclusion of other Budva zone localities) informally as Brčeli clastics.

The total thickness of the section is 35 meters (Fig. 2). Within the lower part (Section A), 21 meters thick, the lithofacies consists of brown-red marls and clays with cm-thin, dark grey, mica-rich and often lenticular, graded (distal turbiditic?) sandstone layers and rare calciturbitide lenses. These in our opinion deeper-water sediments change in the upper part (topmost section A; section B), 13 meters thick, to grey clayey marls with a basal 1 m thick pebbly debris flow bed containing a thick

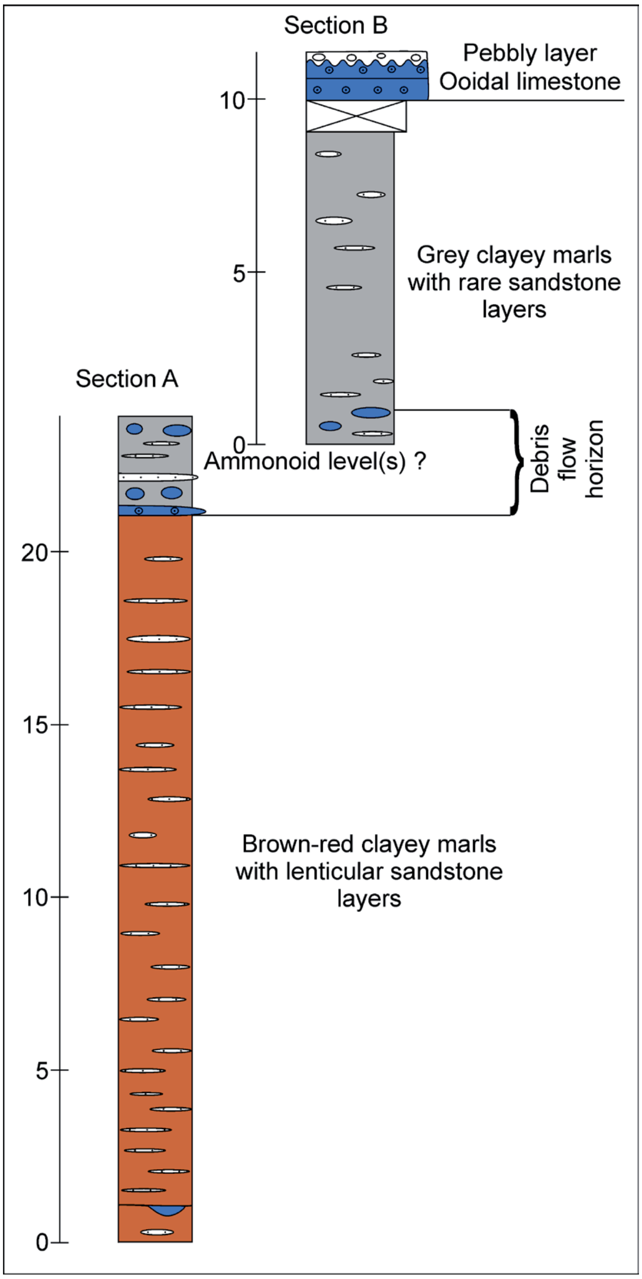


Fig. 2 - Geological column of the studied section. Section B is exposed along slope 150 m to the west of section A.

oolitic limestone lens and well rounded Permian reefal limestone pebbles up to 15 cm in diameter. After a visibility gap interval of 1 m, a more than 1 m thick oolite bed follows overlain by up to 10 cm sized subrounded pebbles of variably mixed, light to dark grey coloured Permian reefal or fusulinid limestone and Lower Triassic (?) grey, mica-rich sandstone. From the top-pebble layer it seems likely that the ooidal limestone too is a glided layer within the marls.

Unfortunately, no upward stratigraphic continuation of the section could be established within the highly vegetated surroundings. The next exposed rocks consist of younger rocks of the Middle Anisian Tuđemili Formation at Brijege (Fig. 1). Stratigraphically next younger Spathian calcarenites and shales near Mali Raš or Limljani (Krystyn et al. 2019), have untill recently not been found in sedimentary contact with Smithian sediments and, throughout the area Lower Triassic rocks are usually exposed in close contact with the Middle Anisian Crmnica Conglomerate (Dimitrijević 1967; Krystyn et al. 2019).

With the exception of *Hanielites* cf. *elegans* and *Galfettites omani*, extracted 1 m above the lower oolitic limestone bed (at 21,5 m), ammonoids have not been found *in situ*. Instead they were collected from a small localized area within the grey marls of the upper part of the several hundred metres long outcrop in between sections A and B. A specific layer (or layers) from which this material is derived could not be identified, but the orographic position directly to the east of section B and the grey colour of the sediment attached to the shells indicate a derivation from the grey-green marls and clays within the debris flow horizon.

Material and methods

The Gornji Brčeli locality has, in recent years, been re-examined on several occasions, that resulted in the collection of a rich ammonoid assemblage of more than 150 specimens. Additionally, material previously collected by the second author and part of the material collected by Petković & Mihailović (1935) have been studied and included in the present paper. Fifteen species belonging to fourteen genera are documented, with one of them new. The earlier introduced new species (Đaković 2017): *Lingyunites tabulatum* (therein described as *Radioceras*? *tabulatum*), *Pseudoflemingites martellii* and *Parahedenstroemia petkovici* are only briefly re-discussed in the present paper with their holotypes refigured. All specimens are stored at the Geological Survey of Montenegro in Podgorica, except for the specimens from the original collection of Petković & Mihailović (1935), which are housed in the Faculty of Mining and Geology in Belgrade.

During repeated visits of the locality, several attempts failed to determine the exact layer (or layers) of the fauna. But according to the above described occurence situation it is assumed that all studied specimens originated from a stratigraphically narrow, contemporaneous horizon timely corresponding to the *Owenites* beds of Middle Smithian age.

Results and discussion

The Gornji Brčeli ammonoid assemblage is represented by 15 species: *Aspenites acutus*, *Cordillerites* cf. *antrum*, *Dieneroceras* sp., *Abrekites arthaberi*,

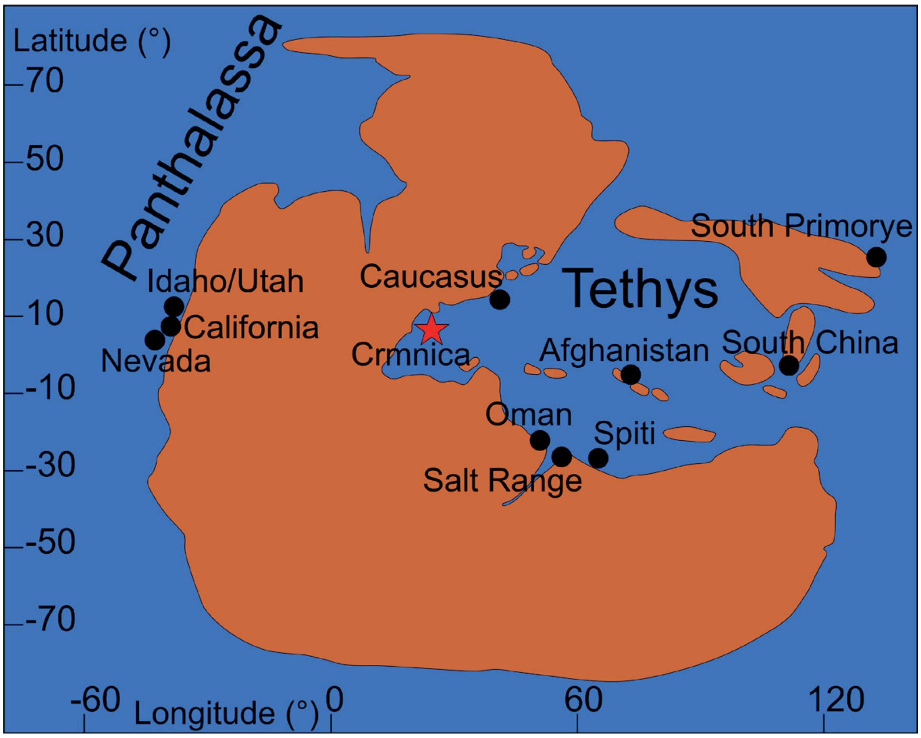


Fig. 3 - Early Triassic palaeogeography (modified after Brayard et al. 2006 and Shigeta et al. 2009) with position of the Crmnica area (red star).

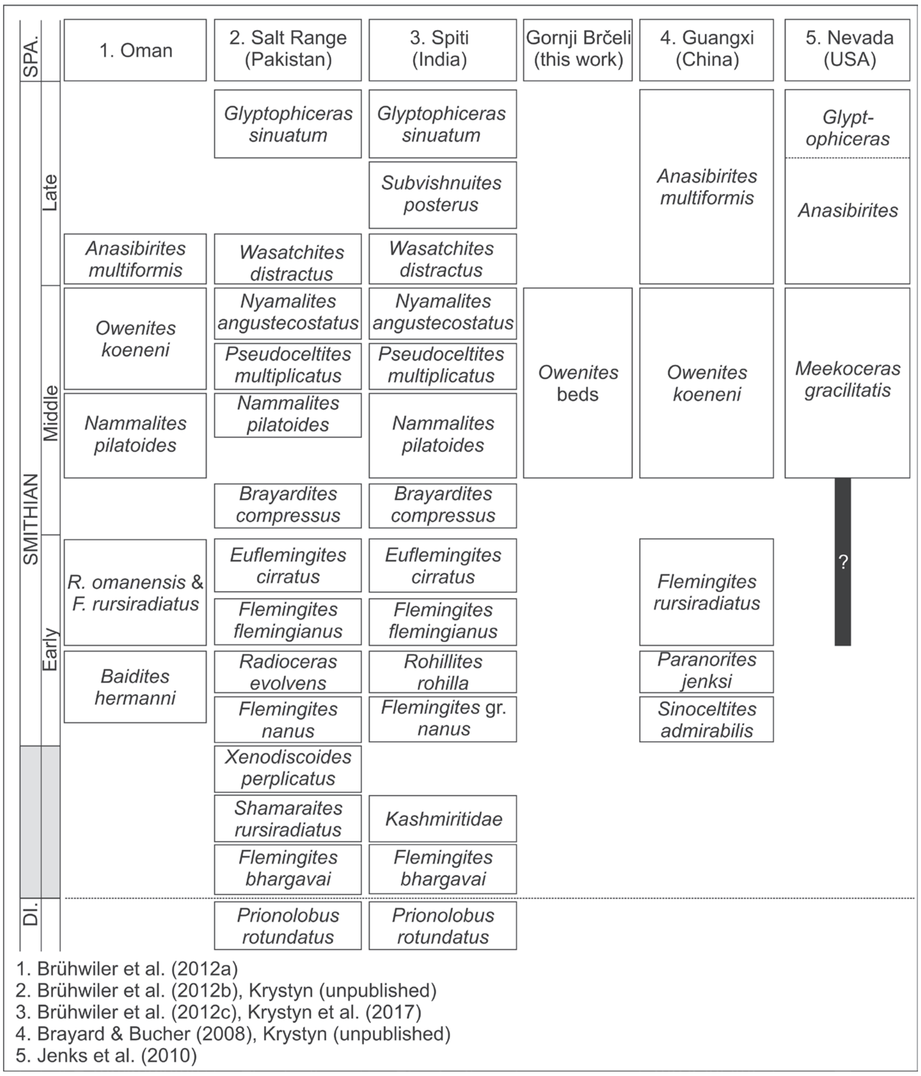
Owenites zitteli, *Pseudaspenites* cf. *layeriformis*, *Pseudosageceras multilobatum*, *Truempyceras compressum*, *Wyomingites* cf. *aplanatus*, *Hanielites* cf. *elegans*, *Galfettites omani*, *Parahedenstroemia petkovici*, *Parahedenstroemia*? *tatjanae* n. sp., *Lingyunites tabulatum* and *Pseudoflemingites martellii*. Three species (*Lingyunites tabulatum*, *Pseudoflemingites martellii* and *Parahedenstroemia petkovici*) have been earlier described by Đaković (2017), while one more (*Parahedenstroemia*? *tatjanae* n. sp.) is introduced in the present paper. Due to the rich collections two species of Smith (1932) could be revised and re-instated as valid species: the first is *Abrekites arthaberi* (24 specimens), which Smith (1932) assigned to the genus *Meekoceras*; the second one is *Owenites zitteli* (19 specimens) which represents in Gornji Brčeli a distinct, consistently more compressed entity compared to *O. koeneni* with which it has been merged by many authors after Smith.

All open-marine Early Triassic ammonoid assemblages of Europe, from Albania (Arthaber 1911), Greece (Renz & Renz 1948) and Romania (Grădinaru 2000), are different and of Spathian age, thus younger than the fauna from Gornji Brčeli. Composition of the latter also clearly indicates that it cannot be correlated with the Spathian *Tirolites* and *Dinarites* faunas of Europe.

With a clear Smithian age, the Gornji Brčeli site displays the oldest Triassic ammonoid association found in the European part of the Tethys. The locality is also the westernmost locality so far discovered with ammonoids of Smithian age within the Tethys, as already indicated by Petković & Mihailović (1935) and Đaković (2017) (Fig. 3). All the species described in the present paper, except for *Pseudosageceras multilobatum*, are new for the Early Triassic of Montenegro. The composition of the ammonoid assemblage is most similar to to the NIM (North Indian Margin = Salt Range - Pakistan, Brühwiler et al. 2012b and Spiti - India, Brühwiler et al. 2012c), NW Guangxi (China, Brayard & Bucher 2008) and Nevada (USA, Jenks et al. 2010), and it also shows great similarity with Timor (Jattiot et al. 2020).

Based on the occurrence of the genus *Owenites* the fauna can be correlated to the low-latitude *Owenites* beds of the Tethys and North America. In higher biostratigraphic resolution, the presence of *Aspenites acutus*, *Galfettites omani*, *Truempyceras compressum* and *Hanielites* cf. *elegans*, could indicate correspondance with the *Nammalites pilatoides* beds as known from Oman (Brühwiler et al. 2012a), Salt Range (Pakistan, Brühwiler et al. 2012b) and Spiti (India, Brühwiler et al. 2012c), as well as with the *Hanielites* horizon of the lower *Owenites koeneni* beds in Guangxi (China, Brayard & Bucher 2008) (Fig. 4). *Dieneroceras* sp. occurs in the *Pseudoceltites multiplicatus* beds of Salt Range (Pakistan, Brühwiler et al. 2012b, therein described as *Dieneroceras* sp. indet. A). Other

Fig. 4 - General Smithian ammonoid correlation chart of Brühwiler et al. (2012b) with position of the Gornji Brčeli fauna.



species indicate also older (Early Smithian) levels, i.e. *Pseudoflemingites martellii* pointing to the *Shamaraites rursiradiatus* beds of Salt Range (Pakistan, in Brühwiler et al. 2012b, described as *Pseudoflemingites* cf. *timorensis*); *Cordillerites antrum* is only known from the *Kashmirites kapila* beds of Guangxi (China, Brayard & Bucher 2008); *Wyomingites aplanatus* is present in the *Flemingites rursiradiatus* beds of Guangxi (China, Brayard and Bucher 2008) and *Lingyunites tabulatum* is most probably represented in the *Inyoites beaverensis* beds of Utah (Brayard et al. 2013, therein described as *Wailiceras* cf. *aemulus*). *Parahedenstroemia*? *tatjanae* n. sp. seems to be present in the Dienerian of South Primorye in a part of the material named as *Parahedenstroemia kiparisovae* by Shigeta & Zakharov (2009). *Wyomingites aplanatus* is also present in the topmost part of *Meekoceras gracilitatis* Zone of Nevada (USA, Jenks et al. 2010) and for other species like *Abrekites arthaberi* and *Owenites zitteli*, a revison of the material described by Smith (1932) is needed. Therefore and due to the unclear precise stratigraphic occurrence it seems more appropriate to assign the Gornji Brčeli fauna to the *Owenites* beds in general.

The Gornji Brčeli ammonoid assemblage is strikingly dominated by smooth, involute oxycone and platycone forms whereas evolute and/or sculptured species are rare and represented by only a few specimens (Fig. 5). According to palaeocological interpretations given by Westermann (1996), the ammonoid association of Gornji Brčeli would indicate an environment not deeper than 50 m, with forms that mostly swam horizontally, i.e. they were nektic, classified by this author as *Gyronites* and *Hedenstroemia* faunas. Đaković (2017) interpreted the Gornji Brčeli fauna as deposited on a calm deeper part of the shelf, within a terrigeneous environment where the mud-filled body chambers were compacted

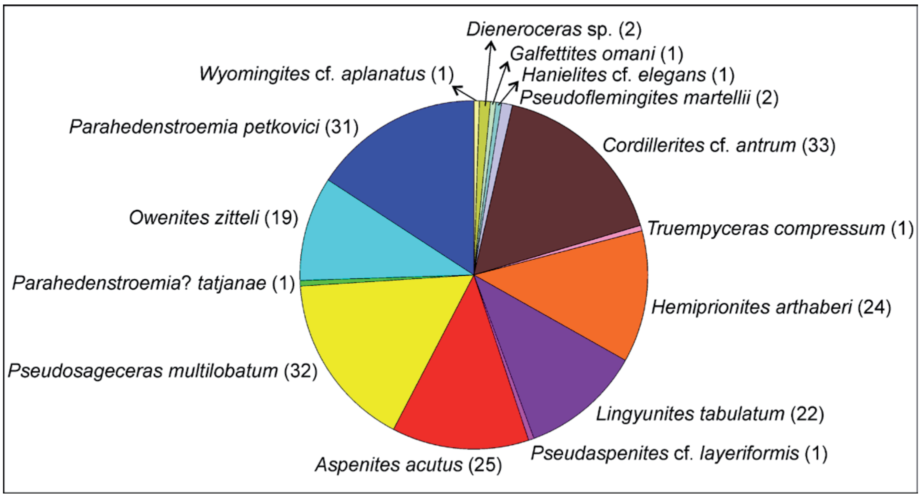


Fig. 5 - Diagram showing total number of specimens of each species in Gornji Brčeli ammonoid assemblage, dominated by involute oxycone forms.

and flattened during early diagenesis. The now general absence of body chambers could indicate leaching by winnowing, transport and redeposition into deeper water. Transport by sea currents as described by Lukeneder (2015) for an ammonoid mass concentration in the Triassic of Turkey, but also redeposition by submarine gliding as indicated by the closely related debris flow pebbles are both likely mechanisms. Lukeneder (2015) interpreted an intact preservation such as with Gornji Brčeli, as hint for a rather short transport, but this may also apply to a possible longer transport within a muddy debris flow. Relativelly uniform size of most of the specimens, where most of them are up to 3 cm in diameter, is another indication for transport by currents. All of this would indicate that the studied fauna represents at least an semi-autochthonous assemblage, with most forms living originally in a similar deeper-open shelf environment (Westermann 1996) but have been transported into deeper water before burial.

The Gornji Brčeli fauna is here compared with the time equivalent ammonoids (*Nammalites pilatoides*, *Pseudoceltites multiplicatus* and *Nyamalites angustecostatus* beds sensu Brühwiler et al. 2012b) of the Upper Ceratite Limestone of Salt Range, which by its facies and the rich shelly fauna has been identified as relatively shallow shelfal environment by the Pakistani-Japanese Research group (1985). The Upper Ceratite Limestone fauna is dominated by moderately involute to evolute forms, while involute ones being very rare (Fig. 6). Following Westermann (1996) it may be concluded that the Salt Range fauna reflects a shelfal habitat, as is also indicated by the sedimentary facies, while that of Gornji Brčeli indicates deeper and more offshore environment.

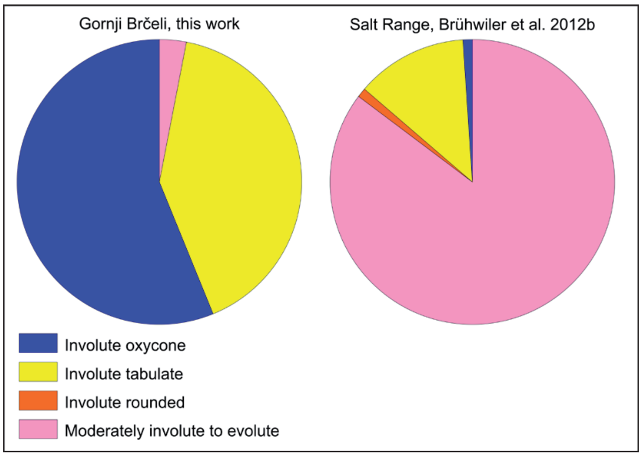


Fig. 6 - Statistical diagram showing the comparison of ammonoid morpho groups between Gornji Brčeli (this work) and Salt Range (Brühwiler et al. 2012b).

Systematic Palaeontology

Systematic descriptions follow the classification given by Brayard & Bucher (2008), as well as by Brühwiler et al. (2012a, b). For all specimens wherever measurements were possible dimensions of the diameter of the shell (D), whorl height (H), whorl width (W) and umbilical diameter (U) are given in millimeters, and for H/D, W/D and U/D in percentages of D.

Each specimen has an inventory number, which consists of abbreviations for the locality, number of the specimen and the abbreviation for the year when the specimen was found (e. g. GBR 7/11). Specimens collected by the second author

Fig. 7 - A-C) *Hanielites* cf. *elegans* Welter, GBR 1/13; D-G) Holotype of *Lingyunites tabulatum* (Đaković), RGF MZ 207. All pictures natural size, unless indicated differently.

contain additional labels (e. g. GBR LK 10/90), while the specimens provided by the Faculty of Mining and Geology in Belgrade have their own separate inventory numbers (e. g. RGF MZ 207).

Class **CEPHALOPODA** Cuvier, 1797
Subclass **AMMONOIDEA** Zittel, 1884
Order **Ceratitida** Hyatt, 1884
Superfamily Xenodiscaceae Frech, 1902
Family Kashmiritidae Spath, 1934
Genus *Hanielites* Welter, 1922

Type species: *Hanielites elegans* Welter, 1922

Hanielites cf. ***elegans*** Welter, 1922

Fig. 7A-C

1922 *Hanielites elegans* nov. gen. et sp. Welter, p. 145, pl. 14: 7-11.
1959 *Hanielites evolutus* sp. nov. Chao, p. 280, pl. 37: 8-12.
1959 *Hanielites elegans* var. *involutus* var. nov. Chao, p. 281, pl. 37: 4-6.
1959 *Hanielites rotulus* sp. nov. Chao, p. 281, pl. 37: 12-15.
1959 *Owenites kwangiensis* sp. nov. Chao, p. 250, pl. 22: 1-2, 5-6..
2008 *Hanielites elegans* - Brayard & Bucher, p. 19, pl. 4: 1-5.
2012c *Hanielites elegans* - Brühwiler et al., p. 132, fig. 14 J-L.
2020 *Hanielites elegans* - Jattiot et. al., p. 12, pl. 5: AF-AK.

Material: One poorly preserved specimen.

Description. Shell slightly involute, elliptical, platycone. Whorl section subquardratic, with maximum thickness near the venter. Venter subangular, with a small keel, and rounded ventral shoulder. Flanks are straight and parallel to each other. Umbilicus is not preserved. Ornamentation consists of transverse ribs, which disappear in the transition from flanks to the venter. Suture line is not preserved.

Dimensions:

Inv. number	D	H	W	U	H/D	W/D	U/D
GBR 1/13	13.9	x	5	x	x	35.97	x

Remarks. The single specimen is most similar to *Hanielites elegans*, which was described in a large number of papers, but because the specimen from Gornji Brčeli is poorly preserved, i.e. the umbilicus and suture line are missing, it can not be assigned to this species with certainty.

Occurrence. *Hanielites elegans* is known from the Middle Smithian of Timor (Welter 1922; Jattiot et al. 2020), the *Hanielites* horizon of the *Owenites koeneni* beds in China (Chao 1959; Brayard & Bucher 2008) and the *Escarguelites* horizon of the *Nammalites pilatoides* beds in India (Brühwiler et al. 2012c).

Superfamily Meekocerataceae Waagen, 1895
Family Gyronitidae Waagen, 1895
Genus *Lingyunites* Chao, 1950

Type species: *Lingyunites discoides* Chao, 1950

Lingyunites tabulatum (Đaković, 2017)

Fig. 7D-G

v 1935 *Meekoceras (Koninckites) vetustus* - Petković & Mihailović, p. 257, pl. 1: 1-5.
? 2013 *Wailiceras* cf. *aemulus* - Brayard et al., p. 171, fig. 33 A-E.
2017 *Radioceras*? *tabulatum* n. sp. Đaković, p. 98, fig. 3-4.

Material: 22 specimens.

Description. Involute, ellitical and platycone form, with subrectangular whorl section, tabulate venter and ceratitic suture line. For a detailed description see Đaković (2017).

Remarks. The species described by Đaković (2017) as *Radioceras*? *tabulatum* is in the present paper considered to belong to the genus *Lingyunites*, documented by Chao (1959) and Brayard & Bucher (2008) from China. Ornamentation and the suture line of the species are consistent with this genus. *Lingyunites tabulatum* differs from *Lingyunites discoides*, described by Chao (1959) in having tabulate venter, and also slightly different ornamentation and shape of suture line. *Wailiceras* cf. *aemulus*, described by Brayard et al. (2013) from Utah, probably belongs to *Lingyunites tabulatum*, based on the description of the venter, ventral shoulders and ornamentation. The shape of suture line is also very similiar, but the auxiliary series is slightly different, which may be due to poor preservation of specimens described by Brayard et al. (2013). The genus *Lingyunites* is in the present paper considered to belong to the family Gyronitidae, based on the characteristics of the shell and the shape of the suture line, which are very similar to other genera belonging to this family, e.g. *Radioceras*.

Occurrence. The species is probably present in the Middle Smithian *Flemingites* beds of Utah.

Genus *Abrekites* Shigeta & Zakharov, 2009

Type species: *Abrekites editus* Shigeta & Zakharov, 2009

Abrekites arthaberi (Smith, 1932)

Fig. 8

1932 *Meekoceras arthaberi* n. sp. Smith, p. 56, pl. 32: 26-33.
1935 *Meekoceras gracilitatis* - Petković & Mihailović, p. 254, pl. 2: 1-2.

Material: 24 specimens.

Description. Shell involute, elliptical, platycone. Whorl section subrectangular, with maximum thickness in the middle of the section or near the umbilicus. Venter tabulate, with angular ventral shoulders. Flanks are slightly convex. Umbilicus is small in comparison to the rest of the shell, rounded, deep, with angular shoulders. Surface of the shell seems to be smooth, without ornamentation; only in some specimens ornamentation consists of fine, slightly convex growth lines or weak radial ribs. Suture line is ceratitic, with three broad saddles, of which the second lateral saddle is slightly phylloid and asymmetrical, and small auxiliary series.

Dimensions:

Inv. number	D	H	W	U	H/D	W/D	U/D
GBR 6/11	x	x	x	3.1	x	x	x
GBR 7/11	22.1	15.7	7	3.6	71.04	31.67	16.29
GBR 8/11	x	18.5	9.3	3.7	x	x	x
GBR 9/11	20.6	12.4	6.4	2.6	60.19	31.07	12.62
GBR 10/11	19.9	11.3	5.9	3.7	56.78	29.65	18.59
GBR 11/11	48.2	28	12	5.2	58.09	24.9	10.79
GBR 12/11	42.9	25.1	12.3	4	58.51	28.67	9.32
GBR 13/11	x	x	x	2.9	x	x	x
GBR 14/11	24.1	14.8	7.5	3.3	61.41	31.12	13.69
GBR 15/11	x	x	x	3.8	x	x	x
GBR 16/11	x	x	x	3.5	x	x	x
GBR 17/11	x	x	7	4	x	x	x
GBR 18/11	x	x	x	3.6	x	x	x
GBR 19/11	22.2	12.3	6.3	4.4	55.41	28.38	19.82
GBR 20/11	x	23.6	12.6	x	x	x	x
GBR 7/14	x	17.7	9	x	x	x	x
GBR 8/14	x	x	6.8	2.7	x	x	x
GBR LK 21/90	x	18.7	8.4	3	x	x	x
GBR LK 22/90	29.5	17	8.8	3.6	57.63	29.83	12.2
GBR LK 23/90	x	22	11.3	x	x	x	x
GBR LK 24/90	22.3	13	x	2.9	28.3	x	13.01
GBR LK 25/90	x	16.4	x	3.6	x	x	x
GBR LK 26/90	32.7	17.3	8.8	4.6	52.91	26.91	14.07
GBR LK 27/90	x	16.7	x	4.4	x	x	x

Remarks. Based on the characteristics of the shell and the suture line, this species should be assigned to the genus *Abrekites*, although Smith (1932) considered it to belong to *Meekoceras*. Specimens from Gornji Brčeli are very similar to figures and description given by Smith, except that some specimens have weak ribs that were not described by the author. Dagys & Ermakova (1990) consider this species, as well as some others described by Smith (i.e. *Meekoceras elkoense*, *M. cristatum* and *M. sylvanum*) as varying ontogenetic states in the development of *Meekoceras gracilitatis*. Although this opinion is justifiable for other species mentioned by the above authors, the suture line of this species is clearly different from *M. gracilitatis* specimens of the same size, i.e. at same ontogenetic stage. Also, specimens described by Petković & Mihailović (1935) as *M. gracilitatis*, should be assigned to *Abrekites arthaberi*. Unfortunatelly, these specimens are missing in the collection of Faculty of Mining and Geology in Belgrade, prohibiting a revision.

Abrekites arthaberi differs from other species of the genus in the shape of the suture line, deeper umbilicus with angular shoulders and greater involution, even in smaller specimens. *Abrekites* has so far been known only from Early Smithian of South Primorye (Shigeta & Zakharov 2009), but the similar characters of the specimens from Gornji Brčeli suggest an inclusion in this genus. *Abrekites* is in the present

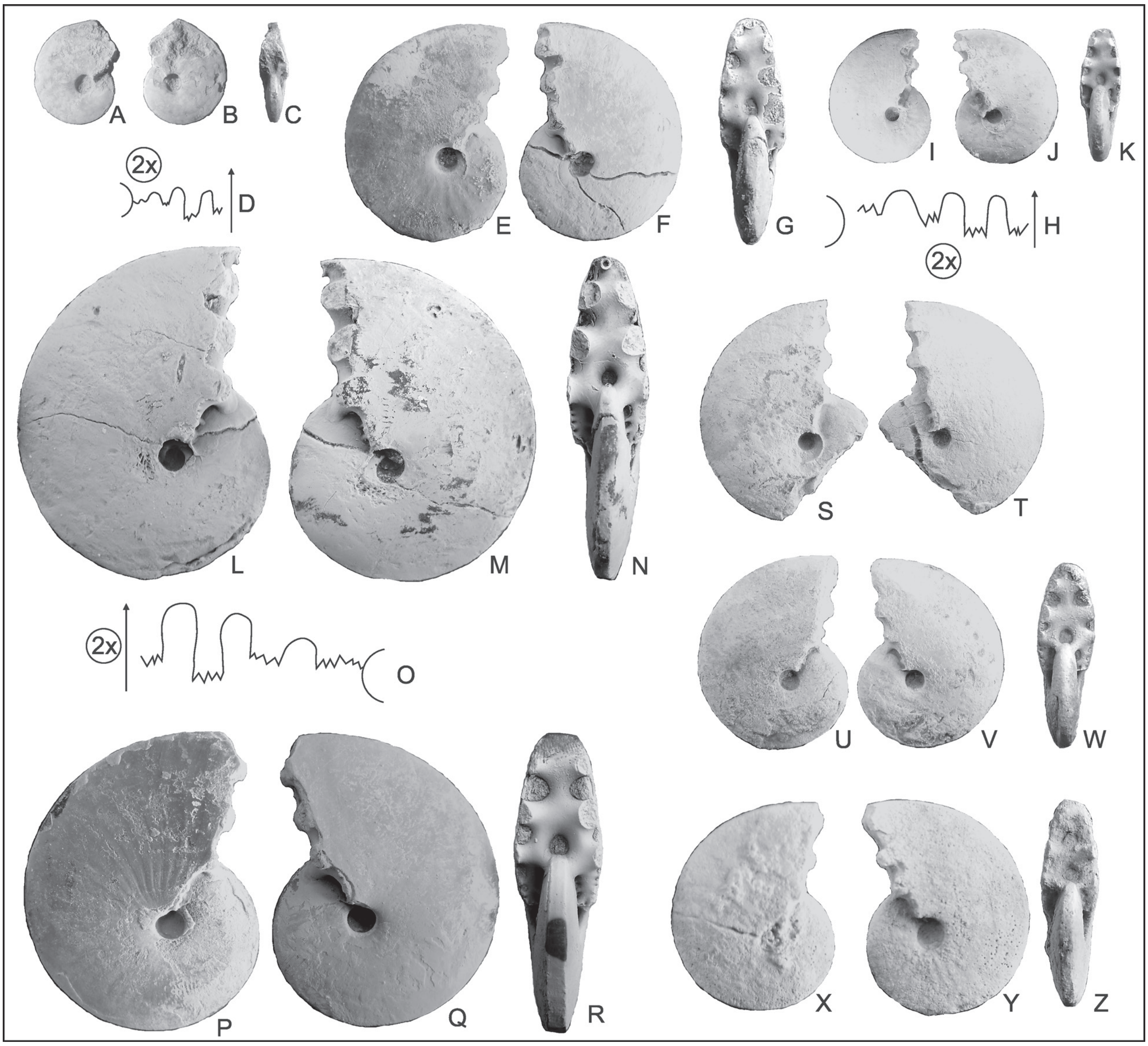


Fig. 8 - *Abrekites arthaberi* (Smith), A-D) GBR 6/11; E-H) GBR 8/11; I-K) GBR 9/11; L-O) GBR 11/11; P-R) GBR 12/11; S-T) GBR LK 21/90; U-W) GBR LK 22/90; X-Z) GBR LK 26/90. All pictures natural size, unless indicated differently.

paper considered to belong to the family Gyronitidae, based on the characteristics of the shell and the shape of the suture line though it also shares characters with the Mullericeratidae sensu Ware & Bucher (2018).

Occurrence. Smith (1932) described this species from the Middle Smithian *Meekoceras gracilitatis* Zone of Idaho.

Family Galfetitidae Brühwiler & Bucher, 2012a
Genus *Galfetites* Brayard & Bucher, 2008

Type species: *Galfettites simplicitatis* Brayard & Bucher, 2008.

Galfettites omani Brühwiler & Bucher, 2012a
Fig. 9A-D

2012a *Galfettites omani* n. sp. Brühwiler & Bucher, p. 27, pl. 14: 6-8.
2012c *Galfettites omani* - Brühwiler et al., p. 137, fig. 17 A-AD.
2020 *Galfettites omani* - Jattiot et. al., p. 18, pl. 7: J-M.

Material: One specimen.

Description. Shell moderately evolute, elliptical, very compressed, platycone. Whorls section subrectangular, with maximum thickness in the middle of the section. Venter tabulate, with angular ventral shoulders. Flanks are slightly convex. Umbilicus wide, taking almost one half of the shell, shallow and with rounded shoulders. Surface smooth, without ornamentation. Suture line ceratitic, very simple.

Dimensions:

Inv. number	D	H	W	U	H/D	W/D	U/D
GBR 12/14	23.5	9.2	5.3	9.1	39.15	22.55	38.72

Remarks. Although the specimen from Gornji Brčeli is missing radial folds, other characteristics (tabulate venter, wide and shallow umbilicus, simple suture line) indicate that it belongs to the species *Galfettites omani*.

Occurrence. The species is known from the Middle Smithian *Nammalites pilatoides* beds of Oman (Brühwiler et al. 2012a) and India (Brühwiler et al. 2012c) and the Late Smithian *Anasibirites* fauna of Timor (Jattiot et al. 2020).

Family Dieneroceratidae Kummel, 1952
Genus *Dieneroceras* Spath, 1934

Type species: *Ophiceras dieneri* Hyatt & Smith, 1905

Dieneroceras sp.

Fig. 9E-F

2012b *Dieneroceras* sp. indet. A - Brühwiler & Bucher, p. 81, fig. 66 A-E.

Material: Two poorly preserved specimens.

Description. Specimens are compressed and strongly crushed. The shell is evolute, circular in shape, flanks are straight. Whorl section due to flattening not preserved, but the venter may have been flat according to the still visible short-rounded ventral edge. Umbilicus wide, taking almost one half of the shell, shallow. Surface smooth, without ornamentation. Suture line is not preserved.

Remarks. Described specimens have general characteristics of the genus *Dieneroceras*, but their poor preservation hinders a specific determination. They are best compared with the specimens described as *Dieneroceras* sp. indet. A by Brühwiler and Bucher (2012b) from Smithian of Salt Range, Pakistan. The specimens have inventory numbers GBR 4/11 and GBR 5/11.

Occurrence. The species has been described from the Middle Smithian *Pseudoceltites multiplicatus* beds of Pakistan (Brühwiler et al. 2012b).

Genus *Wyomingites* Hyatt, 1900

Type species: *Meekoceras aplanatum* White, 1879

Wyomingites cf. ***aplanatus*** (White, 1879)

Fig. 9G-J

1880 *Meekoceras aplanatum* - White, p. 112, pl. 31: 1.
1905 *Meekoceras (Gyronites) aplanatum* - Hyatt and Smith, p. 146, pl. 11: 1-14; pl. 64: 17-22; pl. 77: 1-2.
1932 *Flemingites aplanatus* - Smith, p. 51, pl. 11: 1-14; pl. 22: 1-23; pl. 39: 1-2; pl. 64: 17-32.
2008 *Wyomingites aplanatus* - Brayard and Bucher, p. 42, pl. 16: 1-3.

Material: One specimen.

Description. Shell moderately evolute, elliptical, compressed, platycone. Whorl section subrectangular, with maximum thickness near the umbilicus. Venter rounded at first, but becomes tabulate later, with angular ventral shoulders. Flanks are straight and almost parallel. Umbilicus wide, taking one third of the shell, shallow and with rounded shoulders. Ornamentation consists of very strong radial folds. Suture line is ceratitic, very simple.

Dimensions:

Inv. number	D	H	W	U	H/D	W/D	U/D
GBR 1/11	12.3	5.1	3.6	4.5	41.46	29.27	36.59

Remarks. Described specimen is most similar to the description given by Smith (1932), and figures of suture lines and shells of juvenile forms given by the author. However, the specimen from Gornji Brčeli has more oval cross-section than other specimens of this species and also much stronger ribs. The only other strongly ribbed specimen is shown in Brayard & Bucher (2008). Therefore, this specimen is determined as *Wyomingites* cf. *aplanatus*.

Occurrence. *Wyomingites aplanatus* seems as long-ranging as it is known from Early Smithian *Flemingites rursiradiatus* beds of China (Brayard & Bucher 2008) and also from topmost Middle Smithian *Meekoceras gracilitatis* zone of Nevada (Jenks et al. 2010).

Family Flemingitidae Hyatt, 1900
Genus *Pseudoflemingites* Spath, 1930

Type species: *Ophiceras nopscanum* Welter, 1922

Pseudoflemingites martellii Đaković, 2017

Fig. 9K-N

2012b *Pseudoflemingites* cf. *timorensis* - Brühwiler and Bucher, p. 78, fig. 61 A-J.
2017 *Pseudoflemingites martellii* n. sp. Đaković, p. 101, fig. 5.

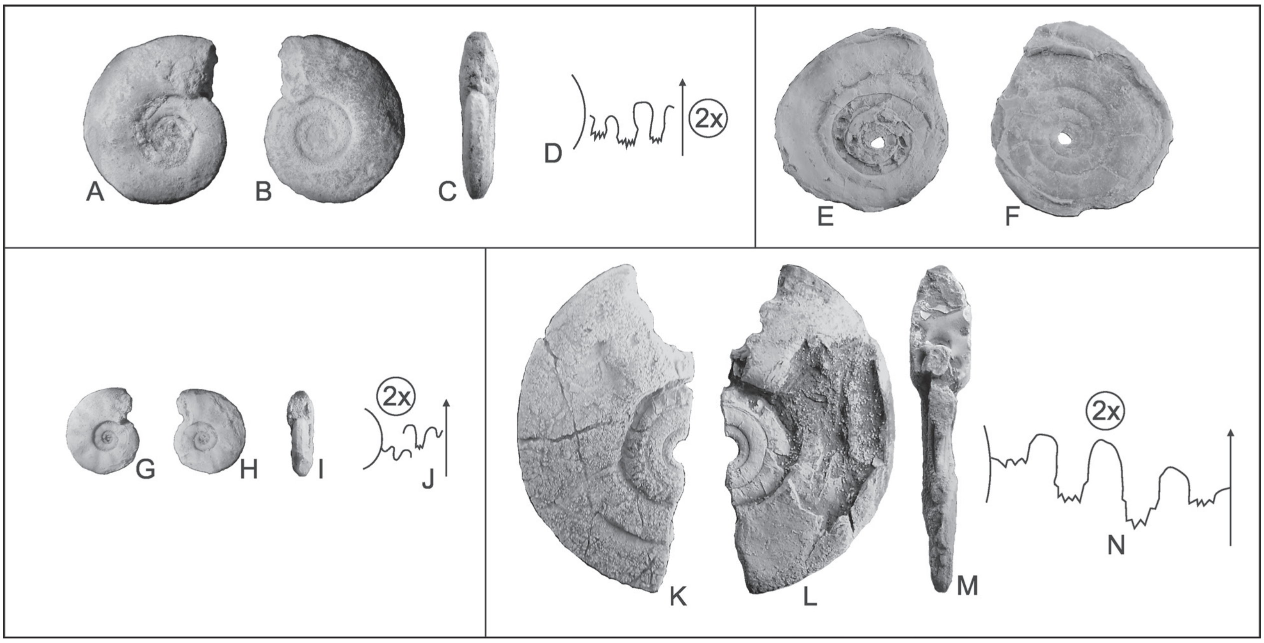


Fig. 9 - A-D) *Galfettites omani* Brühwiler & Bucher, GBR 12/14; E-F) *Dieneroceras* sp., GBR 4/11; G-J) *Wyomingites* cf. *aplanatus* (White), GBR 1/11; K-N) Holotype of *Pseudoflemingites martellii* Đaković, GBR 11/14. All pictures natural size, unless indicated differently.

Material: Two poorly preserved specimens.

Description. Moderately evolute, ellitical and compressed form, with subrectangular to elliptical whorl section, rounded venter, strong ribs on the umbilicus and ceratitic suture line. For a detailed description see Đaković (2017).

Occurrence. Brühwiler & Bucher (2012b) described this species from the Early Smithian *Shamaraites rursiradiatus* beds of Salt Range (Pakistan).

Family Arctoceratidae Arthaber, 1911
Genus *Truempyceras* Brühwiler & Bucher, 2012b

Type species: *Anasibirites pluriformis* Guex, 1978

Truempyceras compressum Brühwiler et al., 2012c
Fig. 10A-D

2012c *Truempyceras compressum* sp. nov. Brühwiler et al, p. 148, fig. 29: A-AA.
2020 *Truempyceras compressum* - Jattiot et. al., p. 47, pl. 23: AD-AT.

Material: One partially preserved specimen.

Description. Shell moderately involute, elliptical, platycone. Whorl section trapezoidal, with maximum thickness near the umbilicus. Venter tabulate, with angular ventral shoulders. Flanks are slightly convex. Umbilicus is small in comparison to the rest of the shell, rounded, deep, with angular shoulders. Ornamentation consists of weak radial folds. Suture line is ceratitic, very simple, with bifid first lateral lobe, indented other lobes and slightly phylloid sadles.

Dimensions:

Inv. number	D	H	W	U	H/D	W/D	U/D
GBR 10/14	x	7.9	5	x	x	x	x

Remarks. Although the specimen from Gornji Brčeli is a juvenile form, the characteristics of the shell and suture line indicate that it belongs to the species described by Brühwiler et al. (2012c).

Occurrence. The species is known from the Middle Smithian *Truempyceras* horizon of the *Nammalites pilatoides* beds of India (Brühwiler et al. 2012c) and *Owenites* fauna of Timor (Jattiot et al. 2020).

Family Paranannitidae Tozer, 1971
Genus *Owenites* Hyatt & Smith, 1905

Type species: *Owenites koeneni* Hyatt & Smith, 1905

Owenites zitteli Smith, 1932
Fig. 10E-U

1932 *Owenites zitteli* n. sp. Smith, p. 101, pl. 52: 1-3.

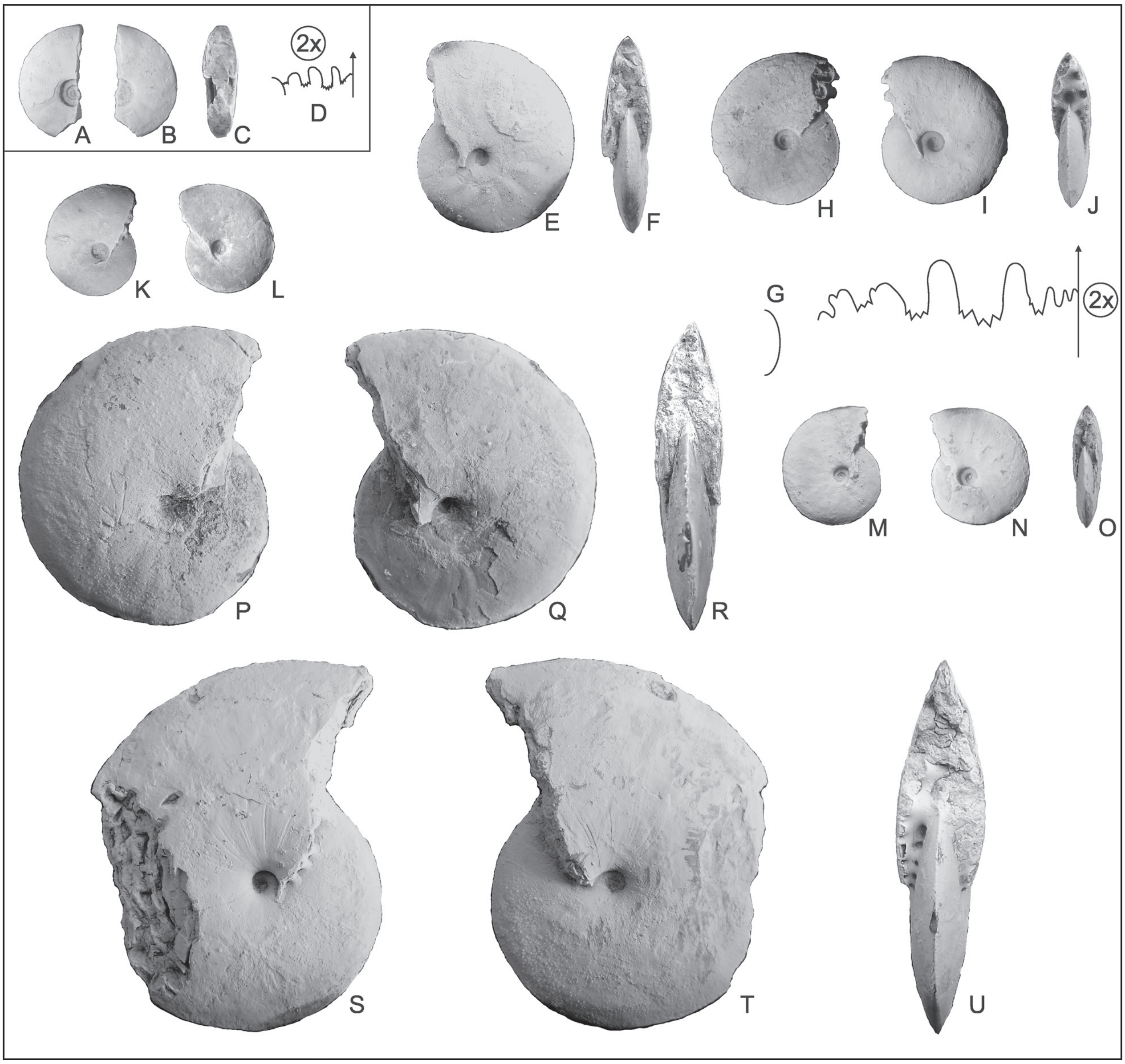


Fig. 10 - A-D) *Truempyceras compressum* Brühwiler et al., GBR 10/14; E-U) *Owenites zitteli* Smith, E-F: GBR 89/11; G: GBR 91/11; K-L: GBR 95/11; I-J: GBR 98/11; M-O: GBR 107/11; P-R: GBR 21/14; S-U: GBR LK 43/90. All pictures natural size, unless indicated differently.

Material: 19 specimens.

Description. Shell involute, elliptical to almost round in shape, compressed, flat oxycone with acute keel. Whorl section lenticular, with maximum width at the middle of the section. Ventre acute, sharp, whereas the flanks are convex. Umbilicus small, round and shallow, with rounded shoulders. Ornamentation consists of weak, biconcave growth lines, and in some specimens biconcave folds. Suture line ceratitic, very complex, with broad, indented lobes and well individualized auxiliary series.

Remarks. Many authors consider the species *Owenites zitteli*, described by Smith (1932), as a synonym of *Owenites koeneni* following Kummel & Steele (1962). But Shigeta & Nguyen (2014, fig. 96) showed in a morphometric comparison of a large *O. koeneni* collection from Vietnam with the holotype of *O. zitteli* clear morphological differences between the two forms. And both, the holotype in Smith (1932), as well as all of the specimens from Gornji Brčeli are definitely more compressed than those of *Owenites koeneni* described elsewhere (Kummel & Steele 1962; Brayard & Bucher 2008; Brühwiler & Bucher

2012a; Brayard et al. 2013; Shigeta & Nguyen 2014). Therefore and following Smith (1932), the species *Owenites zitteli* is in the present paper maintained as a separate species.

Occurrence. Smith (1932) described this species from the Middle Smithian *Owenites* Subzone of the *Meekoceras gracilitatis* Zone of California.

Dimensions:

Inv.br.	D	H	W	U	H/D	W/D	U/D
GBR 89/11	29.8	16.8	7.2	3.3	56.38	24.16	11.07
GBR 91/11	x	x	x	5.9	x	x	x
GBR 95/11	23.5	12.3	5.7	4.3	52.34	24.26	18.3
GBR 96/11	x	23.5	8	5.1	x	x	x
GBR 97/11	x	21.6	8.4	x	x	x	x
GBR 98/11	17.7	9.3	4.8	2.5	52.54	27.12	14.12
GBR 103/11	24.3	14.1	6.3	x	58.02	25.93	x
GBR 104/11	x	x	x	x	x	x	x
GBR 105/11	x	9.5	4.3	3.4	x	x	x
GBR 107/11	18.6	9.7	4.4	3.4	52.15	23.66	18.28
GBR 109/11	x	x	3.8	3.4	x	x	x
GBR 111/11	35.5	20.4	7.9	4.2	57.46	22.25	11.83
GBR 112/11	19.5	11.2	5	3.4	57.44	25.64	17.44
GBR 114/11	18.6	10.3	4.4	x	55.38	23.66	x
GBR 20/14	18.6	10.3	4.4	3	55.38	23.66	16.13
GBR 21/14	48.1	27	10.6	4.2	56.13	22.04	8.73
GBR LK 42/90	x	28.2	10.9	x	x	x	x
GBR LK 43/90	60.7	35	13.6	4.3	57.66	22.41	7.08
GBR LK 44/90	25.7	13.5	6.6	3.5	52.53	25.68	13.62

Superfamily Sageceratаceae Hyatt, 1884
Family Hedenstroemiidae Waagen, 1895
Genus *Parahedenstroemia* Spath, 1934

Type species: *Hedenstroemia acuta* Krafft, 1909

Parahedenstroemia petkovici Đaković, 2017

Fig. 11A-D

2017 *Parahedenstroemia petkovici* n. sp. Đaković, p. 101, fig. 6.

Material: 31 specimens.

Description. Involute, elliptical form, oxycone with an acute keel, having lenticular whorl section and acute, keeled venter. Umbilicus is round and deep, with angular shoulders. Suture line is ceratitic, with a small adventious element in the external lobe, indented lobes and slightly phylloid saddles. For a detailed description see Đaković (2017).

Remarks. The species differs from other species of the genus by the phylloid-elongated saddles.

Occurrence. Middle Smithian *Owenites* beds of Gornji Brčeli in southern Montenegro.

Parahedenstroemia? tatjanae n. sp.

Fig. 11E-G

non 1935 *Pseudosageceras multilobatum* - Petković & Mihailović, p. 259, pl. 3: 1-3.
p ? 2009 *Parahedenstroemia kiparisovae* Shigeta & Zakharov sp. nov., p. 137, fig. 127: 2, fig. 128: 1-10; non fig. 127: 1, fig. 128: 11-14.

Derivation of name: Named after Tatjana Motrenko-Simić, a Medical Doctor working in Montenegro, specialized in In-Vitro Fertilization.

Holotype: RGF MZ 210 (Fig. 11E-G), Middle Smithian *Owenites* beds of Gornji Brčeli in southern Montenegro.

Material: One specimen from the original collection of Petković & Mihailović (1935).

Diagnosis: *Parahedenstroemia*? species with a small, shallow umbilicus, all-time acute venter and distinct suture line.

Description. Shell involute, elliptical, compressed, oxycone, with an acute keel. Whorl section lenticular, with maximum thickness in the middle of the section. Venter is acute and keeled, flanks are convex. Umbilicus is small and shallow, with rounded shoulders. Shell surface smooth. Suture line is ceratitic, with indented lobes and narrowly oval saddles, and with well-individualized auxiliary series.

Dimensions:

Inv. number	D	H	W	U	H/D	W/D	U/D
RGF MZ 210	x	x	10.8	3.5	x	x	x

Remarks. *Parahedenstroemia*? *tatjanae* n. sp. differs from other species of the genus, in particular from *Parahedenstroemia petkovici* in the shape of the non-phylloid suture line and lenticular whorl section, and from the type species *Parahedenstroemia acuta* by broader whorls and an open umbilicus. *Parahedenstroemia*? *tatjanae* n. sp. also differs from similar species of the genus *Hedenstroemia*, i.e. *Hedenstroemia evoluta* and *Hedenstroemia kossmati*, while having a comparable suture line, by the different venter and shape of the shell (see Brühwiler & Bucher 2012b, Brayard et al. 2013). *Hedenstroemia hedenstroemi* has a similar suture line and venter, but a wider umbilicus and overall a different shape of the shell (see Dagys & Ermakova 1990).

Parahedenstroemia? *tatjanae* n. sp., otherwise, is in form of the shell and the shape of the suture line most similar to the "juvenile" paratypes of *Parahedenstroemia kiparisovae* described by Shigeta & Zakharov (2009: fig. 127: 2, fig. 128: 1-10). However, the holotype of this species (Shigeta & Zakharov 2009: fig. 127: 1, fig. 128: 11-14) has a rounded venter and a suture with differing phylloid saddles and may thus be kept separate both on the species- and generic level. Regarding the paratypes of *Parahedenstromia kiparisovae* here as con-specicific with *Parahedenstromia*? *tatjanae*, it also seams arguable that *Parahedenstroemia*? *tatjanae* n. sp., together with the paratypes of *Parahedenstromia kiparisovae* actually represent a new genus; nevetheless, because of the lack of sufficient material, they are described as *Parahedenstroemia*?.

Occurrence. Except for the Middle Smithian of Gornji Brčeli in southern Montenegro, the species is probably present in the Dienerian of South Primorye (Shigeta & Zakharov 2009).

Genus *Pseudosageceras* Diener, 1895

Type species: *Pseudosageceras* sp. indet. Diener, 1895

Pseudosageceras multilobatum Noetling, 1905

Fig. 11H-Q

1905 *Pseudosageceras intermontanum* sp. nov. Hyatt & Smith, p. 99, pl 4: 1-3, pl. 5: 1-6, pl. 63: 1-2.
1909 *Pseudosageceras multilobatum* - Krafft & Diener, p. 145, pl. 21: 5.
1911 *Pseudosageceras drinense* Arthaber, p. 201, pl. 17: 6-7.
1929 *Psudosageceras intermontanum* Mathews, p. 3, pl. 1: 18-22.
1932 *Pseudosageceras multilobatum* - Smith, p. 87, pl. 4: 1-3, pl. 5: 1-6, pl. 25: 7-16, pl. 60: 32, pl.63: 1-6.
non 1935 *Pseudosageceras multilobatum* - Petković & Mihailović, p. 259, pl. 3: 1-3.
1959 *Pseudosageceras multilobatum* - Chao, p.183, pl. 1: 9, 12.
1959 *Pseudosageceras curvatum* sp. nov. Chao, p.185, pl. 1: 13-14.
1959 *Pseudosageceras tsotengense* sp. nov. Chao, p.184, pl. 1: 7-8.
1968 *Pseudosageceras multilobatum* - Shevyrev, p. 791, pl. 1: 1-2.
1978 *Pseudosageceras multilobatum* - Weitschat & Lehmann, p. 95, pl. 10: 2.
1994 *Pseudosageceras multilobatum* - Tozer, p. 83, pl. 18: 1.
2008 *Pseudosageceras multilobatum* - Brayard & Bucher, p. 70, pl. 37: 1-5.
2012a *Pseudosageceras multilobatum* - Brühwiler & Bucher, p. 47, pl. 26: 4.
2012b *Pseudosageceras multilobatum* - Brühwiler & Bucher, p. 109, fig. 95 A-N.
2020 *Pseudosageceras multilobatum* - Jattiot et. al., p. 60, pl. 31: A-W.

Material: 32 specimens.

Description. Shell extremely involute, elliptical, compresses, oxycone. Whorl section triangular, with maximum thickness near the umbilicus. Venter acute, whereas the flanks are straight. Umbilicus occluded. Surface smooth, without ornamentation. Suture line is ceratitic, very complex, with trifid main lateral lobe. Other lobes are bifid.

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Dimensions:

Inv.br.	D	H	W	H/D	W/D
GBR 45/11	x	28.5	x	x	x
GBR 47/11	x	21.6	x	x	x
GBR 48/11	x	16.2	6.4	x	x
GBR 49/11	x	x	5.4	x	x
GBR 50/11	25.9	16	6.2	61.78	23.94
GBR 51/11	22.3	13	5.6	58.3	25.11
GBR 52/11	23.2	13.9	x	59.91	x
GBR 53/11	23.4	14.1	6.2	60.26	26.5
GBR 54/11	x	10.1	3.4	x	x
GBR 55/11	43.6	27.7	11	63.53	25.23
GBR 59/11	x	x	5.8	x	x
GBR 60/11	32.5	19.9	x	61.23	x
GBR 61/11	x	12.2	4.5	x	x
GBR 64/11	19.4	12.5	4.2	64.43	21.65
GBR 66/11	x	16.8	7.8	x	x
GBR 70/11	24.9	16.9	6.4	67.87	25.7
GBR 71/11	52.2	29.6	x	56.7	x
GBR 72/11	23.3	15.1	6.6	64.81	28.33
GBR 73/11	x	17.6	7.7	x	x
GBR 77/11	20.4	12.6	5.7	61.76	27.94
GBR 78/11	26.2	17.5	6.7	66.79	25.57
GBR 82/11	18.1	12.2	4.3	67.4	23.76
GBR 83/11	x	x	4.6	x	x
GBR 84/11	x	x	6.2	x	x
GBR 5/14	x	16.4	6.5	x	x
GBR 6/14	x	17.8	6.2	x	x
GBR LK 16/90	30.7	21.5	6.5	70.03	21.17
GBR LK 17/90	28.5	17.4	6.2	61.05	21.75
GBR LK 18/90	19.4	13	4.7	67.01	24.22
GBR LK 19/90	27	17.9	7.3	66.3	27.04
GBR LK 20/90	x	x	7.9	x	x
GBR LK 28/90	21.9	13.4	5.6	61.19	25.57

Remarks. According to the description of the species based on shell characteristics and suture line in Petković & Mihailović (1935), there is no doubt that part of their material must have belonged to *Pseudosageceras multilobatum*. Unfortunatelly, those specimens are no longer present in the collection of the Faculty of Mining and Geology of Belgrade any more. Paradoxally, the only specimen in their collection is not a *Pseudosageceras*, but it is here referred to the new species *Parahedenstroemia*? *tatjanae*.

Occurrence. *Pseudosageceras multilobatum* represents one of the most common and widest distributed ammonoid species of the Early Triassic (Smithian and Spathian).

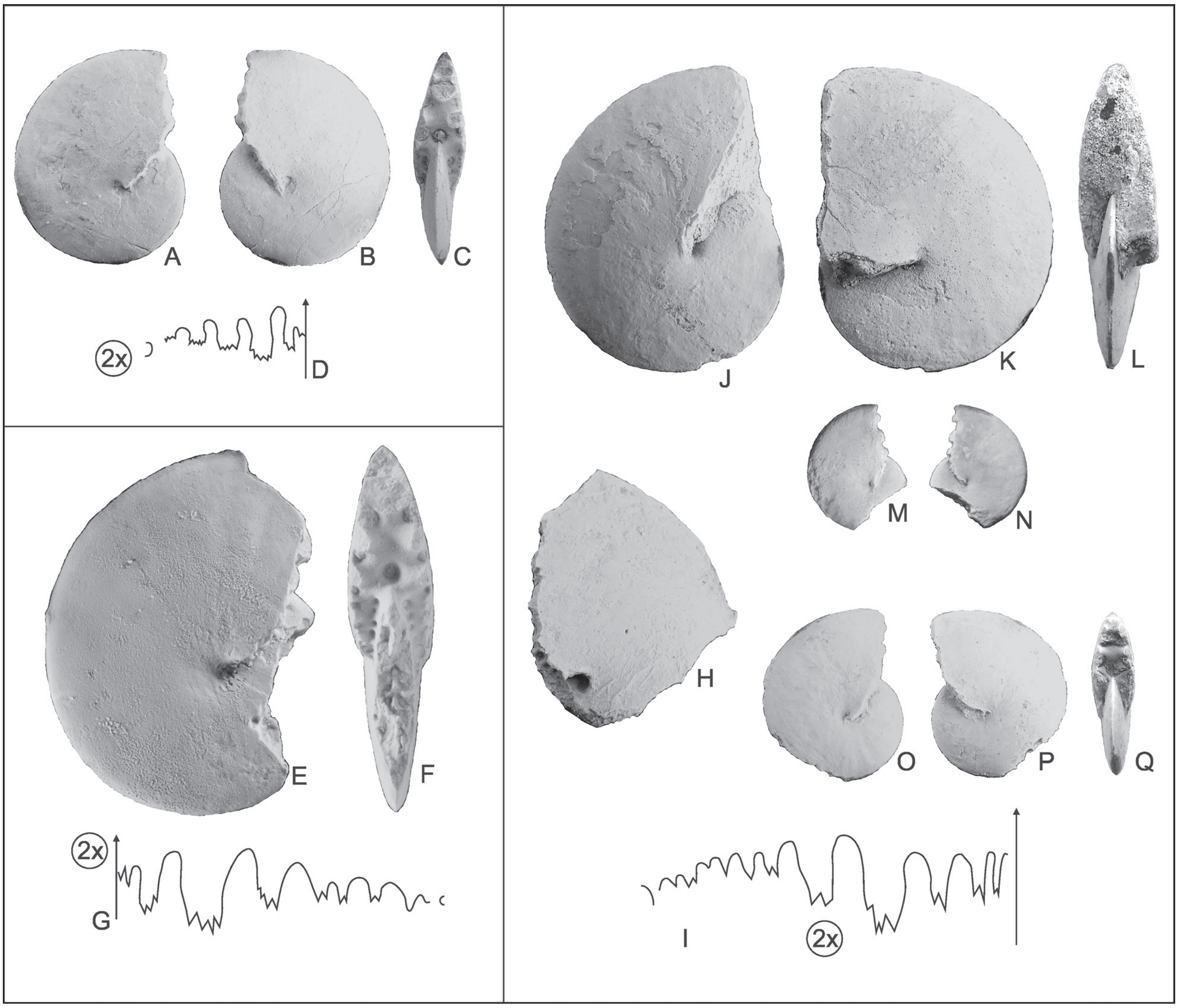

Fig. 11 - A-D) Holotype of *Parahedenstroemia petkovici* Đaković, GBR 19/14; E-G) *Parahedenstroemia*? *tatjanae* n. sp., RGF MZ 211; H-Q) *Pseudosageceras multilobatum* Noetling, H-I) GBR 45/11; J-L) GBR 55/11; M-N) GBR 61/11; O-Q) GBR 5/14. All pictures natural size, unless indicated differently.

Genus *Cordillerites* Hyatt & Smith, 1905

Type species: *Cordillerites angulatus* Hyatt & Smith, 1905

Cordillerites cf. ***antrum*** Brayard & Bucher, 2008

Fig. 12

1935 *Hedenstroemia hyatti* – Petković & Mihailović, p. 258, pl. 2: 3-6.
2008 *Cordillerites antrum* n. sp. Brayard & Bucher, p. 74, pl. 40: 1-9.

Material: 33 specimens.

Description. Shell extremely involute, elliptical, compresses, oxycone. Whorl section subrectangular, with maximum thickness in the middle of the section. Venter tabulate, with angular ventral shoulders. Flanks are slightly convex. Umbilicus occluded. Ornamentation consists of weak growth lines. Suture line is ceratitic, very complex with only one auxiliary lobe.

Remarks. Specimens of this species were first mentioned as *Cordillerites angulatus* by Đaković (2017) but morphologically they are closer to the older, more compressed species *Cordillerites antrum* described from the Early Smithian *Kashmirites kapila* beds of South China (Brayard & Bucher 2008). One specimen of Petković & Mihailović (1935) named as *Hedenstroemia hyatti* belongs to the present species. The same authors mention three specimens of *H. hyatti* in their collection that are similar to the de-

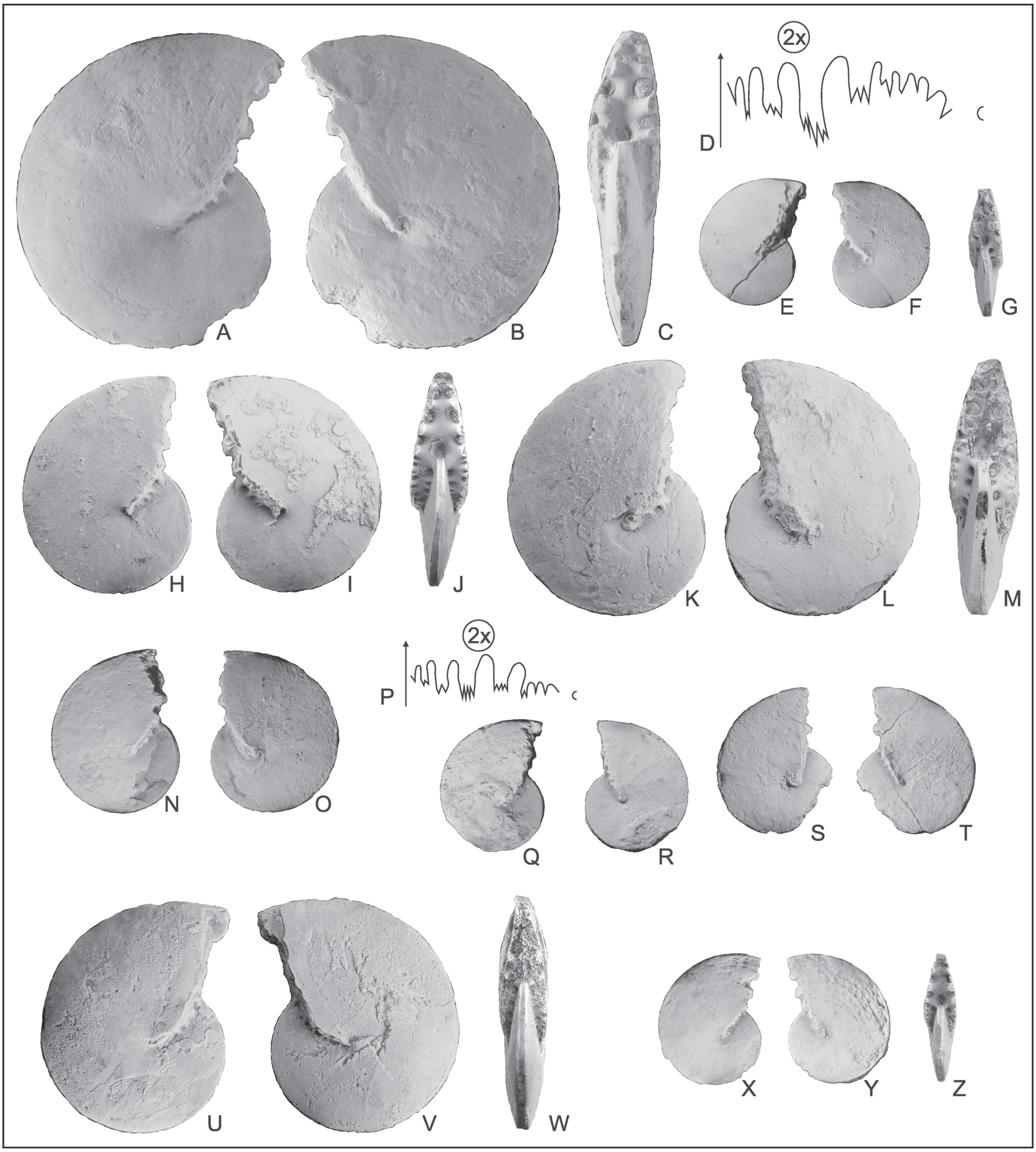

Fig. 12 - *Cordillerites* cf. *antrum* Brayard & Bucher, A-D) RGF MZ 209; E-G) GBR 29/11; H-J) GBR 33/11; K-M) GBR 34/11; N-P) GBR 35/11; Q-R) GBR 36/11; S-T) GBR 37/11; U-W) GBR 4/13; X-Z) GBR LK 6/90. All pictures natural size, unless indicated differently.

scription given by Smith (1932) and show a small, but distinctive umbilicus. The single presently preserved specimen (RGF MZ 209) in the collection of Faculty of Mining and Geology in Belgrade, however, has an occluded umbilicus and a suture line consistent with the genus *Cordillerites.* This, as well as our specimens differ from *Cordillerites antrum* by the missing of the second auxiliary lobe and leads us to a cf. identification.

Occurrence. The species is known from the considerably older, Early Smithian, *Kashmirites kapila* beds of South China (Brayard and Bucher 2008).

Dimensions:

Inv.br.	D	H	W	H/D	W/D
RGF MZ 209	50.1	32.3	11.5	64.47	22.95
GBR 29/11	22.9	14.5	6	63.32	26.2
GBR 30/11	x	x	10.1	x	x
GBR 31/11	x	12.9	5	x	x
GBR 32/11	20.9	13.4	5.3	64.11	25.36
GBR 33/11	37	23.9	9.9	64.59	26.76
GBR 34/11	43.8	29.7	11.7	67.81	26.71
GBR 35/11	27	17.6	7.2	65.19	26.67
GBR 36/11	23.7	14.8	6.7	62.45	28.27
GBR 37/11	x	17.1	6.1	x	x
GBR 38/11	x	x	11.8	x	x
GBR 39/11	35.6	22.6	8	63.48	22.47
GBR 40/11	x	21.3	7.6	x	x
GBR 41/11	34.4	22.9	8.4	66.6	24.42
GBR 42/11	32.4	20.8	8.5	64.2	26.23
GBR 43/11	27.1	18	6.4	66.42	23.62
GBR 44/11	x	40.4	15.6	x	x
GBR 56/11	17.1	11.4	4	66.67	23.39
GBR 2/13	44	26.4	10.3	60	23.41
GBR 3/13	x	28.8	11	x	x
GBR 4/13	39.8	24.2	8.5	60.8	28.52
GBR 5/13	30.8	19.8	7.1	64.29	23.05
GBR 6/13	x	13.9	5.9	x	x
GBR 1/14	x	27.3	9.2	x	x
GBR LK 1/90	x	x	7.9	x	x
GBR LK 2/90	28.6	18.5	7.3	64.69	25.52
GBR LK 3/90	x	18.7	x	x	x
GBR LK 4/90	x	x	5.9	x	x
GBR LK 5/90	25.2	15.8	6	62.7	23.81
GBR LK 6/90	23.4	14.1	5.8	60.26	24.79
GBR LK 7/90	x	x	8.5	x	x
GBR LK 8/90	x	x	8.6	x	x
GBR LK 9/90	x	24.8	9.2	x	x

Family Aspenitidae Spath, 1934
Genus *Aspenites* Hyatt & Smith, 1905

Type species: *Aspenites acutus* Hyatt & Smith, 1905

Aspenites acutus Hyatt & Smith, 1905

Fig. 13A-P

1905 *Aspenites acutus* sp. nov. Hyatt & Smith, p. 96, pl 2: 9-13, pl. 3: 1-5.
1922 *Aspenites acutus* - Welter, p. 98, fig. 7.
1922 *Aspenites laevis* nov. sp. Welter, p. 99, pl. 1: 4-5.
1932 *Aspenites acutus* - Smith, p. 86, pl. 2: 9-13, pl. 3: 1-5, pl. 30: 1-26, pl. 60: 4-6.
1932 *Aspenites laevis* - Smith, p. 86, pl. 28: 28-33.
1932 *Aspenites obtusus* - Smith, p. 86, pl. 31: 8-10.
1959 *Aspenites acutus* - Chao, p. 269, pl. 35: 12-18, 23.
1959 *Aspenites laevis* - Chao, p. 270, pl. 35: 9-11.
1962 *Aspenites acutus* - Kummel & Steele, p. 692, pl. 99: 16-17.
1962 *Hemiaspenites obtusus* - Kummel & Steele, p. 666, pl. 99: 18.
1979 *Aspenites acutus* - Nichols & Silberling, pl. 1: 12-14.
2008 *Aspenites acutus* - Brayard & Bucher, p. 77, pl. 42: 1-9.
2012a *Aspenites acutus* - Brühwiler & Bucher, p. 48, pl. 26: 1-2.
2012c *Aspenites acutus* - Brühwiler et al., p. 166, fig. 41 A-M.
2013 *Aspenites acutus* - Brayard et al.,p. 212, fig. 81 a-j.
2020 *Aspenites acutus* - Jattiot et. al., p. 62, pl. 32: AE-AH.

Material: 25 specimens.

Description. Shell extremely involute, elliptical, compresses, oxycone with an acute keel. Whorl section lenticular, with maximum thickness in the middle of the section. Venture acute, keeled, while the flanks are convex. Umbilicus occluded. Ornamentation consists of falcoid growth lines, as well as of convex radial folds. Folds are best developed in the middle of the flanks, whereas they disappear near the umbilicus and venter. Suture line is ceratitic, very complex, with long auxiliary series.

Dimensions:

Inv.br.	D	H	W	H/D	W/D
GBR 57/11	x	x	5.7	x	x
GBR 58/11	19.6	12.9	5	65.81	25.51
GBR 63/11	36.4	22.9	x	62.91	x
GBR 65/11	25.9	16.9	7.2	65.25	27.8
GBR 67/11	32	20.6	6.7	64.37	20.34
GBR 68/11	24.5	16.9	7.2	68.98	29.39
GBR 69/11	20	12.6	5.3	63	26.5
GBR 74/11	x	13.8	6.1	x	x
GBR 76/11	25.6	16.7	x	65.23	x
GBR 85/11	28.2	17.8	6.4	63.12	22.69
GBR 86/11	25.3	16.9	7.5	66.8	29.64
GBR 87/11	25	14.4	4.7	57.6	18.8
GBR 88/11	x	15.2	6.1	x	x
GBR 8/13	x	x	7.5	x	x
GBR 9/14	35.1	22.6	7.7	64.39	21.94
GBR 13/14	18.9	11.2	5	59.26	26.45
GBR LK 29/90	x	x	9	x	x
GBR LK 30/90	x	16.1	7.3	x	x
GBR LK 31/90	x	x	7.2	x	x
GBR LK 32/90	22.1	14.9	5.3	67.42	23.98
GBR LK 33/90	29.9	18.7	7.2	62.54	24.08
GBR LK 34/90	x	14.4	5.6	x	x
GBR LK 35/90	x	20	7.6	x	x
GBR LK 36/90	28.2	17.4	6.5	61.7	23.05
GBR LK 37/90	x	16.2	6.4	x	x

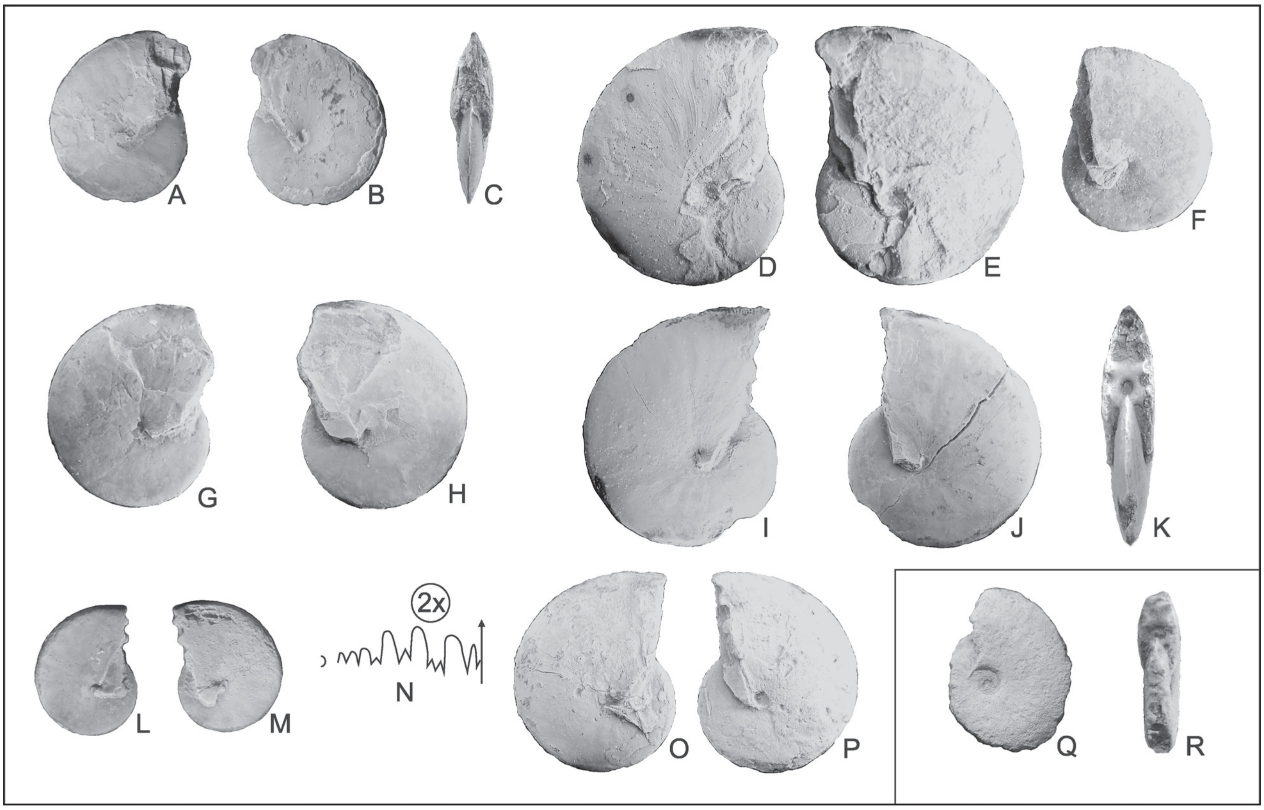

Fig. 13 - A-O) *Aspenites acutus* Hyatt & Smith, A-C: GBR 57/11; D-E: GBR 63/11; F: GBR 65/11; G-H: GBR 8/13; I-K: GBR 9/14; L-N: GBR 13/14; O-P: GBR LK 36/90; Q-R: *Pseudaspenites* cf. *layeriformis* (Welter), GBR 3/11. All pictures natural size.

Remarks. *Aspenites acutus* represents a very common species in sediments of Smithian age. Specimens from Gornji Brčeli show great similarity with the ones described by Brayard & Bucher (2008) from Southern China, especially in the shape of the shell and trace of the suture line.

Occurrence. *Aspenites acutus* is a very common Smithian species. It is know from Early Smithian *Flemingites rursiradiatus* beds and Middle Smithian *Owenites koeneni* beds in China (Brayard & Bucher 2008), Middle Smithian *Brayardites compressus* beds of India (Brühwiler et al. 2012c), *Nammalites pilatoides*, *Owenites koeneni* beds of Oman (Brühwiler et al. 2012a), *Owenites* fauna of Timor (Jattiot et al. 2020) and *Owenites* beds of Utah (Brayard et al. 2013).

Genus *Pseudaspenites* Spath, 1934

Type species: *Aspenites layeriformis* Welter, 1922

Pseudaspenites cf. ***layeriformis*** (Welter, 1922)
Fig. 13Q-R

1922 *Aspenites layeriformis* nov. sp. Welter, p. 97, pl. 1: 6-7.
1959 *Inyonites striatus* sp. nov. Chao, p. 197, pl. 2: 22-26.
1959 *Inyonites oblicatus* sp. nov. Chao, p. 198, pl. 2: 7,17-21,27.
2008 *Pseudaspenites layeriformis* - Brayard & Bucher, p. 79, pl. 43: 1-6.
2012a *Pseudaspenites layeriformis* - Brühwiler & Bucher, p. 48, pl. 26: 3.
2020 *Pseudaspenites layeriformis* - Jattiot et. al., p. 62, pl. 32: A-AD.

Material: One poorly preserved specimen.

Description. Shell involute, elliptical, compressed oxycone with acute keel. Whorl section lenticular. Venter acute, keeled, while the flanks are convex. Umbilicus medium-sized, elliptical in shape, shallow with rounded shoulders. Ornamentation and suture line are not preserved.

Dimensions:

Inv. number	D	H	W	U
GBR 3/11	x	x	x	3

Remarks. The described specimen has most similarities with the species *Pseudaspenites layeriformis*. However, because the specimen is damaged, it was not possible to determine surely if it belongs to this species.

Occurrence. *Pseudaspenites layeriformis* is known from Early Smithian *Flemingites rursiradiatus* beds of China (Brayard & Bucher 2008), and *Rohillites omanensis* beds of Oman (Brühwiler et al. 2012a) and from the Middle Smithian *Owenites* fauna of Timor (Welter 1922; Jattiot et al. 2020).

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