Upper Albian and Cenomanian ammonites from some sections of the Mangyshlak and Tuarkyr regions, Transcaspia, Soviet Union

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With 8 figures in the text

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Abstract: Presented is a revised and description of the poorly known genus *Saltericeras* ATABEKYAN 1960, which is a transitional link between the Upper Albian genus *Callihoplites* SPATH 1925, and the Cenomanian genus *Schloenbachia* NEUMAYR 1875. The latter is represented by abundant forms indicative of a wide range of intraspecific variability in *S. varians* (SOWERBY 1817) and *S. coupei* (BRONGNIART 1822). Moreover described are Upper Albian ammonites from the Begiarslan section, as well as examples of pathology in ammonite shells, and ammonite commensals.

Key words: Lytoceratida (Ancyloceratida: *Mariella, Scaphitees*), Desmoceratida (Hoplitaceae: *Arrhaphoceras;* Schloenbachiidae: *Saltericeras, Schloenbachia;* Acanthocerataceae: *Stoliczkaia*), Upper Albian, Cenomanian, biologic evolution, variation, pathology, commensalism; Ustyurt (Transcaspia), Mangyshlak.

Zusammenfassung: Zunächst erfolgt die Beschreibung der wenig bekannten Gattung *Saltericeras* ATABEKYAN 1960, die als Übergangsform zwischen der Alb-Gattung *Callihoplites* SPATH 1925 und der Cenoman-Gattung *Schloenbachia* NEUMAYR 1875 betrachtet wird. Innerhalb dieser Gattung wird auf die extreme intraspezifische Variabilität der Arten *S. varians* (SOWERBY 1817) und *S. coupei* (BRONGNIART 1822) hingewiesen. Schließlich werden eine Ammonitenfauna der Oberalb von Begiarslan, pathologische Ammonitengehäuse und Ammoniten-Kommensalismus beschrieben.

Introduction

The investigated ammonite-bearing sections are located in Transcaspia, mid-Asiatic part of the Soviet Union (see Figs. 1–2). Description of the collected ammonites supplements previous reports (MARCINOWSKI 1980) which have not covered all Upper Albian ammonites, in particular the family Schloenbachiidae PARONA & BONARELLI 1897. Mid-Cretaceous ammonites of Transcaspia display great similarities to the coeval faunas of England and north-western France, which were part of the same Boreal zoogeographic province during this time. Therefore the regional stratigraphic subdivisions of Transcaspia can be well correlated with those of north-western Europe (SAVELIEV 1973, 1976, 1981; LUPPOV 1975; MARCINOWSKI 1980).

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General remarks on lithology, ammonite preservation and distribution

The ammonite-bearing sections, although exposed throughout a large area, are lithologically rather uniform (cf. Figs. 1–2). Upper Albian and Cenomanian deposits are represented by clays, silts, sands and sandstones, sometimes calcareous, all of which occur in variable proportions. They contain varying amounts of glauconite, and of ferro-siliceous and phosphatic nodules. Some profiles show indistinct non-depositional surfaces of the omission type within the Cenomanian (Sullu-kapy, Akkup), whilst in others the Cenomanian/Turonian boundary is distinctly sculptured by subaqueous erosion, extending over a remarkably large area (Figs. 1–2). With the latter surfaces sometimes connected is a redeposition, into Lower Turonian deposits, of the phosphatized moulds of Cenomanian pelecypods, gastropods, schloenbachiids and acanthoceratids (see Kuznecov & Titova 1961: 221).

The investigated ammonites are either preserved as ferro-siliceous moulds with a phosphatic content (Sullu-kapy), phosphatic or phosphatic-sandy moulds (Zhanasha, Besakty, Akkup), or as glauconitic sandstone moulds (Begiarslan). In the

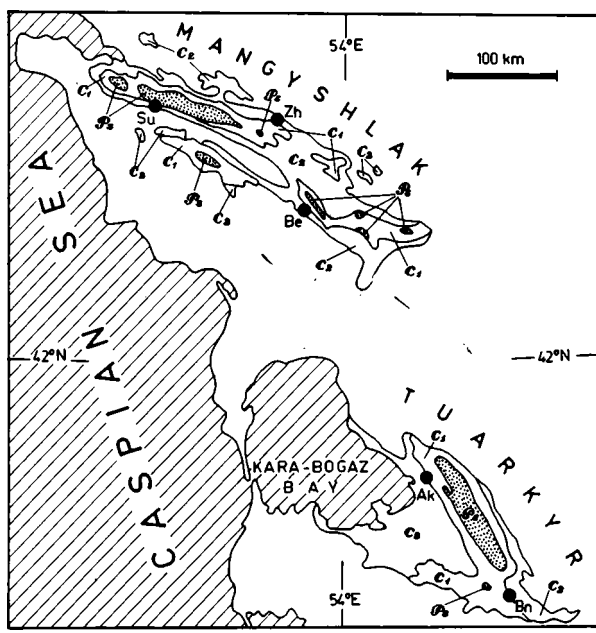


Fig. 1. Geological sketch map of the Mangyshlak and Tuarkyr regions in Transcaspia, Soviet Union (after Geological Map of the Soviet Union 1966, D. V. Nalivkin (Ed.) – slightly simplifed). Black dots indicate the sections presented in Fig. 2; Su – Sullu-kapy, Zh – Zhanasha, Be – Besakty, Ak – Akkup, Bn – Begiarslan. *Ps* – Pre-Cretaceous substrate, C_1 – Lower Cretaceous, C_2 – Upper Cretaceous.

Zhanasha and Besakty sections, a part of the ammonites have their shells preserved. Most of the specimens however are only phragmocones, while complete specimens are extremely rare.

The section Sullu-kapy was the only one in which ammonites were collected bed by bed, so that it was possible to distinguish two faunal horizons, and to subdivide the Cenomanian stage more precisely (see MARCINOWSKI 1980: Fig. 12). In the other sections, ammonites were met sporadically, and/or are represented by species of low stratigraphic value. In the profiles (Fig. 2), occurrences of ammonite faunas are indicated, including the general Catalogue Numbers of specimens under description.

To characterize the ammonite assemblages in particular sections, combined is the following list which comprises previously published species (MARCINOWSKI 1980) as well as those described in this paper.

A. Sullu-kapy, Cenomanian

I. faunal horizon, Lower Cenomanian: *Hamites (Stomohamites) duplicatus* PICTET & CAMPICHE, *Sciponoceras baculoide* (MANTELL), *Anisoceras* aff. *exoticum*

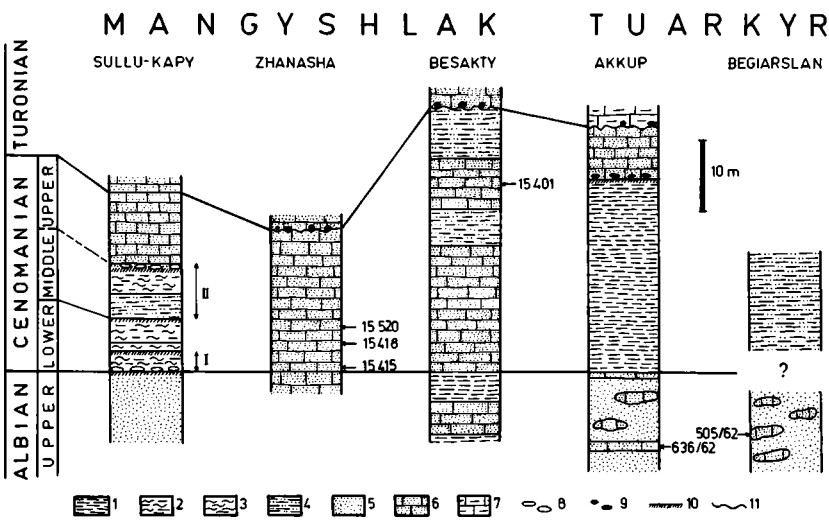


Fig. 2. Upper Albian and Cenomanian sections of the Mangyshlak and Tuarkyr regions (after D. P. NAIDIN, unpublished data). Arrow-tipped lines indicate the range of the ammonite faunal horizons recognized by MARCINOWSKI (1980); normal arrows indicate sampled localities (numbers = general Catalogue Number, as used in the text and Figs. 3–8). 1 – clays, 2 – silty clays, 3 – silts, 4 – sandy clays, 5 – sands or poorly cemented sandstones, 6 – sandstones, 7 – marly limestones, 8 – ferro-siliceous nodules with phosphatic content, 9 – phosphatic nodules, 10 – omission surfaces, 11 – subaqueous erosion surfaces.

SPATH, *Hyphoplites falcatus* (MANTELL) and varieties, *H. campichei* SPATH and varieties, *H. pseudofalcatus* (SEMENOV), *H. pylorus* WRIGHT & WRIGHT, *H. curvatus* (MANTELL), *H. crassofalcatus* (SEMENOV), *H. arausionensis* (HÉBERT & MUNIER-CHALMAS), *Karamaites grossouvrei* (SEMENOV), *Mantelliceras mantelli* (SOWERBY), *M. saxbii* (SHARPE), *M. tuberculatum* (MANTELL), "*M*". *aumalense* (COQUAND), "*M*". *suzannae* (PERVINQUIÈRE), and very common *Schloenbachia varians subplana* (MANTELL), *S. varians subvarians* SPATH, *S. varians subtuberculata* (SHARPE), *S. varians varians* (SOWERBY), *S. varians ventriosa* STIELER.

II. faunal horizon, Middle Cenomanian: *Worthoceras rochatianum* (D'ORBIGNY), *W. vermiculum* (SHUMARD), *Hamites (Stomohamites) duplicatus* PICTET & CAMPICHE, *Sciponoceras baculoide* (MANTELL), *S. roto* CIESLINSKI, *Anisoceras plicatile* (SOWERBY), *Turrilites (T.) costatus* LAMARCK – very common, *T. scheuchzerianus* BOSC, *Scaphites (S.) basseae* COLLIGNON – common, *S. (S.) evolutus* PERVINQUIÈRE, *Karamaites grossouvrei* (SEMENOV), *K. mediasiaticum* (LUPPOV), very common *Schloenbachia varians subplana* (MANTELL), *S. varians subvarians* SPATH, *S. varians varians* (SOWERBY), *S. varians ventriosa* STIELER, and relatively rare *S. coupei trituberculata* SPATH, *S. coupei quadrata* SPATH, *S. coupei costata* (SHARPE).

B. Zhanasha, Cenomanian

I. faunal horizon (15415): *Schloenbachia varians subvarians* SPATH, *S. varians subtuberculata* (SHARPE), *S. varians ventriosa* STIELER.

II. faunal horizon (15418): *S. varians subvarians* SPATH, *S. varians subtuberculata* (SHARPE), *S. varians varians* (SOWERBY), *S. coupei quadrata* SPATH, *S. ?coupei* (BRONGNIART).

III. faunal horizon (15520): *S. varians subtuberculata* (SHARPE), *S. varians varians* (SOWERBY), *S. varians ventriosa* STIELER, *S. coupei quadrata* SPATH.

C. Besakty, Cenomanian (15401)

Schloenbachia varians subplana (MANTELL), *S. varians subvarians* SPATH, *S. varians varians* (SOWERBY).

D. Akkup, Upper Albian – *Stoliczkaia dispar* Zone (636/62)

Saltericeras salteri (SHARPE).

E. Begiarslan, Upper Albian – *Stoliczkaia dispar* Zone (505/62)

Mariella (M.) bergeri (BRONGNIART), *Scaphites (S.) simplex* JUKES-BROWNE, *Arrhaphoceras variabile* RENZ, *Stoliczkaia (S.) tenuis* RENZ.

Stratigraphic remarks

Upper Albian (*Stoliczkaia dispar* Zone)

This zone is documented in the Tuarkyr sections by *M. (M.) bergeri* (BRONGNIART), *S. (S.) simplex* JUKES-BROWNE, *A. variabile* RENZ, *S. (S.) tenuis* RENZ, and *S. salteri* (SHARPE). The latter species represents the form transitional between Upper Albian specimens of the genus *Callihoplites* SPATH and undoubtedly Cenomanian *Schloenbachia* NEUMAYR (see systematic description). In Transcaspia and Kopet-Dag, *S. salteri* (SHARPE) always appears beneath the first records of *Schloenbachia* and *Mantelliceras*. The stratigraphic position of deposits containing this species is evidenced also by *M. (M.) bergeri* (BRONGNIART), *A. studeri* (PICTET & CAMPICHE), *A. renauxianus* (D'ORBIGNY), *C. tetragonus* (SEELEY), *S.* cf. *rhamnonota* (SEELEY), *K. kolbajense* SOKOLOV, and frequent representatives of the genera *Lepthoplites* and *Discohoplites* (cf. ATABEKYAN 1960, 1961; MANIJA 1974; LUPPOV 1975; SAVELIEV 1981). All these ammonites are indicative of the *dispar*-Zone, and most likely of its uppemost part i. e. the *perinflatum*-Subzone in the standard ammonite subdivision of England (cf. KENNEDY & HANCOCK 1978). It should be noted that, in contrast to England, this subzone is not condensed in Transcaspia, and that its thickness ranges from over a dozen to a few dozens of meters.

Cenomanian

This stage is the best one documented in Sullu-kapy, which makes it possible to correlate this section with subdivisions commonly used in western Europe (see MARCINOWSKI 1980: 235–236). The Ist faunal horizon represents the Lower Cenomanian, featured by the frequent occurrence of the genera *Hyphoplites, Schloenbachia* and *Mantelliceras*. The Middle Cenomanian represented by the IInd faunal horizon is featured by the disappearance of *Hyphoplites* and *Mantelliceras*, and by the mass appearance of *T. (T.) costatus* LAMARCK and *S. (S.) basseae* COLLIGNON. In this horizon, the frequent occurrence of *S. varians* (SOWERBY) continues and the first representatives of *S. coupei* (BRONGNIART) appear rarely. The IInd faunal horizon most probably represents only a lower part of the Middle Cenomanian, i. e. the *T. costatus* Zone, which is bounded at its top by a stratigraphic gap. Tentatively, non-fossiliferous deposits which underlie the strata with the first finds of *I. labiatus* (SCHLOTHEIM) are assigned to the Upper Cenomanian (MARCINOWSKI 1980). In the Zhanasha and Besakty sections, the ammonites are represented only by the co-occurring species *S. varians* (SOWERBY) and *S. coupei* (BRONGNIART), so that a more precise subdivision of the Cenomanian strata (see Fig. 2) is impossible in these places.

Systematic description of the ammonites

The systematic arrangement of high-rank taxa (down to subfamilial level) accepted in the present chapter follows WRIGHT (1981).

For the investigated specimens the following measurements are given:
D – shell diameter, in mm
Wh – whorl height, as percent proportion of diameter
Wb – whorl breadth (or thickness), as percent proportion of diameter
U – umbilical breadth, as percent proportion of diameter
Tu – number of umbilical tubercles per whorl
Tl – number of marginal (ventro-lateral) tubercles per whorl
Rp – primary ribs number per whorl
R – total ribs number per whorl
(where only a whorl fragment is considered, this is pointed out in parentheses)

The described ammonite collection is housed at the Institute of Geology of the University of Warsaw.

Order Ammonoidea ZITTEL 1884
Suborder Ancyloceratina WIEDMANN 1966
Superfamily Turrilitaceae GILL 1871
Family Turrilitidae GILL 1871
Subfamily Turrilitinae GILL 1871
Genus *Mariella* NOWAK 1915
Subgenus *Mariella* NOWAK 1915
Type species: *Turrilites bergeri* BRONGNIART 1822

Mariella (Mariella) bergeri (BRONGNIART 1822)

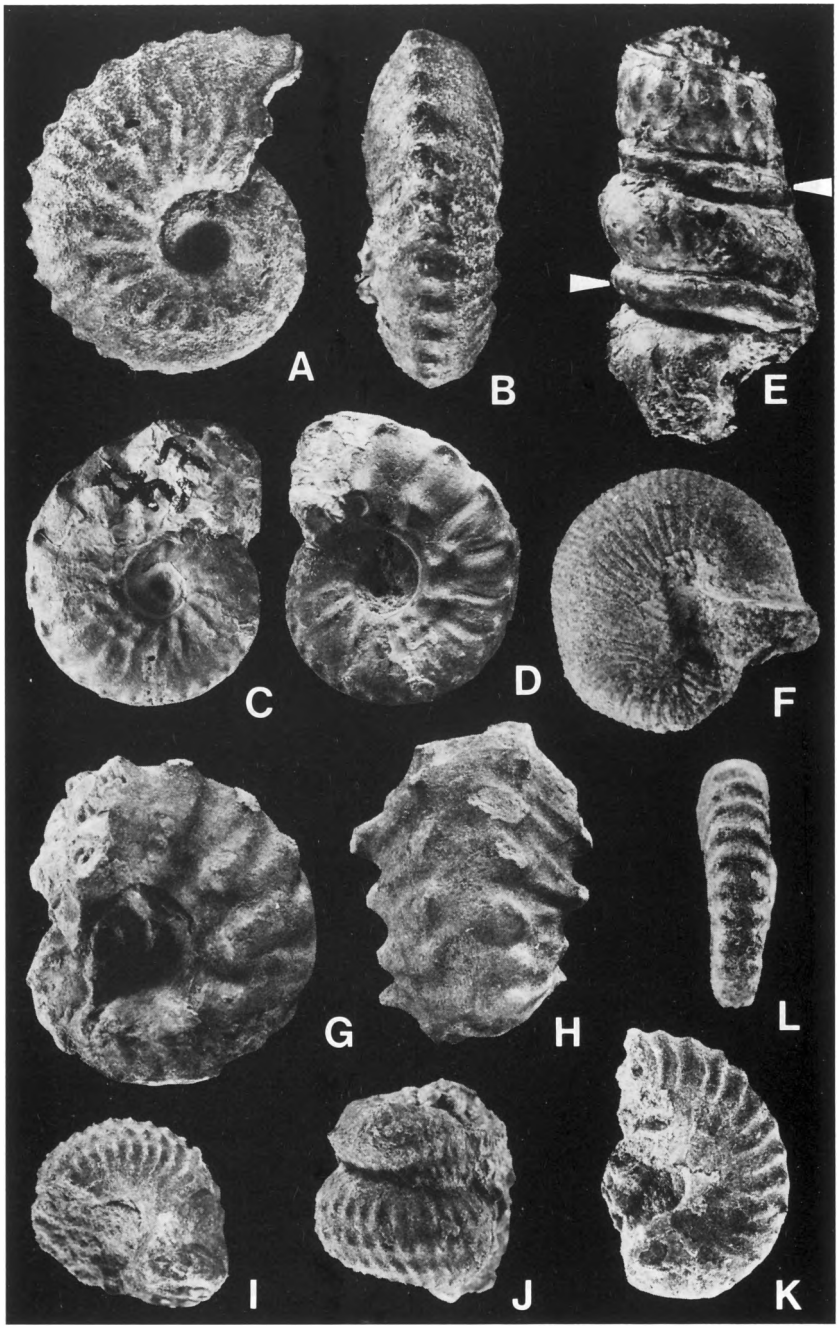
Fig. 3I–J

1822 *Turrilites Bergeri,* A. BR. – BRONGNIART, p. 395, pl. 7, fig. 3
1937 *Mariella bergeri* (BRONGNIART) – SPATH, p. 510–514, pl. 57, fig. 28, text-fig. 178 (with synonymy)
1968 *Mariella (Mariella) bergeri bergeri* (BRONGNIART) – RENZ, p. 85–86, pl. 17, figs. 37, 41, pl. 18, figs. 3–4, 8, text-figs. 31f, k (with synonymy)
1968 *Paraturrilites (Bergericeras) bergeri* (BRONGN.) – WIEDMANN & DIENI, p. 80–81, pl. 7, fig. 5, pl. 9, figs. 2, 5 (with synonymy)
1978 *Mariella (Mariella) bergeri* (BRONGNIART, 1822) – KLINGER & KENNEDY, p. 28, pl. 1, fig. H, text-fig. 6E (with synonymy)

Material: Nine fragments of various large whorls Nos. 505/62-4 to 12.

Remarks: Investigated specimens have 4 rows of tubercles, with those of the upper row being slightly elongated; and those of the two lower rows being more closely spaced. The number of tubercles in different rows, however, is the same (25–27 per whorl) and their size is not differentiated. At the same diameter and state of preservation, investigated specimens have the ornamentation variously pronounced, probably due to intraspecific variability.

Occurrence: Upper Albian (*dispar*-Zone), Begiarslan section, Tuarkyr. *M. (M.) bergeri* (BRONGNIART) has been recorded in the Upper Albian of Europe, Sardinia, North and South Africa, Madagascar, Mid-Asia (Kopet-Dag), India, North and South America.


A
B
E
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D
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Superfamily Scaphitaceae GILL 1871
Family Scaphitidae GILL 1871
Subfamily Scaphitinae GILL 1871
Genus *Scaphites* PARKINSON 1811
Subgenus *Scaphites* PARKINSON 1811
Type species: *Scaphites equalis* SOWERBY 1813

Scaphites (Scaphites) simplex JUKES-BROWNE 1875

Fig. 3F

1937 *Scaphites simplex,* JUKES-BROWNE – SPATH, p. 504–507, pl. 57, figs. 13–23, text-fig. 177 (with synonymy)
1965 *Sc. (Scaphites) simplex* JUKES-BROWNE – WIEDMANN, p. 412–415, pl. 54, figs. 1, 7, pl. 55, figs. 4–5, text-fig. 3e (with synonymy)
1976 *Scaphites (Scaphites) simplex* JUKES-BROWNE – MARCINOWSKI & NAIDIN, p. 99–100, pl. 1, fig. 7
1977 *Scaphites simplex* JUKES-BROWNE – SEYED-EMAMI, p. 131–132, pl. 13, figs. 7–10

Material: One completely preserved small specimen No. 505/62-1.

Description: Shell globular, sculptured by fine, densely spaced ribs. Primary ribs on the whorl sides become coarser and coarser towards the top and bifurcate on the ventro-lateral edge into two smaller ribs. These bifurcating ribs continue on the slightly convex and broad ventral side. The latter is sometimes covered with single ribs of the same features as the former ones. Ornamentation on the spiral portion is only slightly more delicate than on the body chamber (shaft and hook). The transition of the spiral portion into the shaft is accompanied by a rapid increase of the whorl thickness, the maximum of which straddles the shaft and hook junction, and here Wb:Wh = 1.59. Aperture with constricted mouth-border is situated near the spiral portion.

Fig. 3. Examples of pathologic and commensal-bearing specimens (Figs. 3A–E) and Upper Albian ammonites in the Begiarslan section (Figs. 3F–L).

A–B: *Schloenbachia* sp. with anormal crenulate and slightly asymmetrical keel, Middle Cenomanian, Sullu-kapy, No. II–1051 phragmocone, A: lateral-, B: ventral view, × 3.

C–D: *Schloenbachia* sp. with different ornamentation on both sides, Middle Cenomanian, Sullu-kapy, No. II-Sc. 27, C: lateral view to show normal ornamentation, D: lateral opposite view to show anormal ornamentation, × 2.

E: *Turrilites (T.) costatus* LAMARCK 1801, with a serpulid tube (arrowed) entangled along the whorls, Middle Cenomanian, Sullu-kapy, No. II–1052, × 3.

F: *Scaphites (S.) simplex* JUKES-BROWNE 1875, Upper Albian, Begiarslan, No. 505/62–1 microconch, lateral view, × 3.

G–H: *Arrhaphoceras variabile* RENZ 1968, Upper Albian, Begiarslan, No. 505/62–2, G: lateral-, H: ventral view, nat. size.

I–J: *Mariella (M.) bergeri* (BRONGNIART 1822), Upper Albian, Begiarslan, No. 505/62–4, I: lower part of the whorl, J: outer whorl face, × 2.

K–L: *Stoliczkaia (S.) tenuis* RENZ 1968, Upper Albian, Begiarslan, No. 505/62–3, K: lateral-, L: ventral view, × 2.

Remarks: The investigated specimen coincides with the diagnosis of *S. simplex* JUKES-BROWNE, although it is of very small size (D = 11.3 mm), only about a third of the large forms of this species (cf. dimensions and illustrations given by SPATH 1937, pl. 57, fig. 19; WIEDMANN 1965, pl. 54, fig. 7; MARCINOWSKI & NAIDIN 1976, pl. 1, fig. 7; SEYED-EMAMI 1977, pl. 13, figs. 9–10). Comparable variability of shell size in *S. simplex* JUKES-BROWNE from the Cambrigde Greensand (Upper Albian) has been observed by the author in the collection of the British Museum (Natural History), where completely preserved specimen No. 39661 measures about one half of the specimen No. C. 4794. Since shell size in Cretaceous scaphitids is of much diagnostic value, its variability may reflect sex dimorphism, and thus allow to distinguish the micro- and macroconchs (see MARCINOWSKI 1980: 264–269). Consequently, the investigated specimen (Fig. 3F) is considered a microconch.

Occurrence: Upper Albian (*dispar*-Zone), Begiarslan section, Tuarkyr. *S. (S.) simplex* JUKES-BROWNE has been recorded in the Upper Albian of England, France, Switzerland, Rumania, Soviet Union (Crimea), Iran and supposedly Northern Spain and Tunis.

Suborder Ammonitina HYATT 1889
Superfamily Hoplitaceae DOUVILLÉ 1890
Family Hoplitidae DOUVILLÉ 1890
Subfamily Hoplitinae DOUVILLÉ 1910
Genus *Arrhaphoceras* WHITEHOUSE 1927
Type species: *Ammonites woodwardi* SEELEY 1865

Arrhaphoceras variabile RENZ 1968

Fig. 3G–H

1968 *Arrhaphoceras? variabile* n. sp. – RENZ, p. 34, pl. 3, figs. 8–9, text-figs. 11f, 12b

Material: One specimen No. 505/62-2.

D (mm)	Wh (%)	Wb (%)	U (%)	$\frac{Wb}{Wh}$	Tu	Tm
42.5	45	54	31	1.19	$\left(\frac{1}{2}\right)$ 6	$\left(\frac{1}{2}\right)$ 9

Remarks: Inflated whorls, very prominent umbilical tubercles yielding two ribs weakly connected with much smaller, but distinct ventro-lateral ones, and sometimes single ribs with only ventro-lateral tubercles are the specific features of the investigated specimen. Marginal tubercles on both sides of the venter are slightly displaced (alternate), resulting in a weakly pronounced zigzag-line. All these features are typical for the body chamber of *A. variabile* RENZ. This species represents forms in which ornamentation develops during ontogenesis from the *Arrhaphoceras*-type on the phragmocone to the *Callihoplites*-type on the body chamber, what makes its generic assignment uncertain (RENZ 1968: 34). It seems to

me that such features as inflated whorls and prominent umbilical tubercles favor the attribution of the species *variabile* to the genus *Arrhaphoceras* WHITEHOUSE 1927 (cf. WRIGHT 1957: L398). This is supported by the similarity of the investigated specimen to some malformed specimens of *Arrhaphoceras studeri* (PICTET & CAMPICHE) (see SPATH 1928: 251, text-figs. 83a–c).

Occurrence: Upper Albian (*dispar*-Zone), Begiarslan section, Tuarkyr. *A. variabile* RENZ has been recorded in the Upper Albian (*dispar*-Zone) of Switzerland.

Family Schloenbachiidae PARONA & BONARELLI 1897
Genus *Saltericeras* ATABEKYAN 1960
Type species: *Ammonites salteri* SHARPE 1856

Diagnosis: Shell involute to about $^1/_3$, whorl section square, nearly trapezoidal, with maximum thickness at the umbilical margin. Distinct umbilical tubercles and clavate marginal tubercles are present, the number of the latter being up to twice larger than the former. The marginal clavate tubercles (i. e. the clavates) on the both sides of the venter are alternating. Between tubercles there appear 2 or 3 looped ribs, slightly connected with the marginal clavates. Venter flat, with a very small keel.

Remarks: ATABEKYAN (1960: 187; 1961: 35) established this genus in an extremely concise way, indicating only the type species and discussing its range. Since that time the genus has been commonly reported from the uppermost Albian of Transcaspia and Kopet-Dag (cf. MANIJA 1974, MIKHAILOVA 1974, LUPPOV 1975), but it has never been described or illustrated. This explains why a description of *Saltericeras salteri* (SHARPE) is here presented, regardless of the scarcity and poor preservation of the material at hand.

Discussion: KENNEDY, CHAHIDA & DJAFARIAN (1979: 30) regarded the genus *Saltericeras* ATABEKYAN 1960 to be synonym with *Schloenbachia* NEUMAYR 1875. In my opinion this genus really exists and is characterized by features transitional between the Upper Albian genus *Callihoplites* and the Cenomanian *Schloenbachia*. With the former genus it shares the looped ribs, distinct alternation of marginal clavates, with the latter shell proportions and primarily the presence of a low keel. MIKHAILOVA (1974: 123) suggested a phylogenetic lineage ?*Callihoplites* → *Saltericeras* → *Schloenbachia*, and stated that suture lines do not differ in the families Hoplitidae and Schloenbachiidae; as apparent from her paper, the early ontogenetic stages of the genus *Saltericeras* are rather nearer to *Callihoplites* than to *Schloenbachia*. The author attributes the genus to the family Schloenbachiidae because of the presence of the keel, a feature unknown in typical hoplitids. Moreover, the stratigraphic range of this genus is intermediate, as its representatives appear in the uppermost Albian, with *Mariella bergeri* (BRONGNIART) and *Stoliczkaia* cf. *rhamnonota* (SEELEY), and below undoubtedly Cenomanian with the genera *Mantelliceras* and *Schloenbachia* (see ATABEKYAN 1960, 1961; MANIJA 1974;

LUPPOV 1975). It is noteworthy that contrary to England the genus *Saltericeras* occurs in Transcaspia and Kopet-Dag in non-condensed sections, in which uppermost Albian deposits (*perinflatum*-Subzone) reach over a dozen to a few dozens of metres in thickness. The genus *Saltericeras* has hitherto been interpreted as comprising only the poorly known type species. In the author's opinion the following forms, either described and/or illustrated also belong to this genus: *Schloenbachia obtusocarinata* of SOKOLOV (1963: 149; 1966: 57), *Saltericeras* sp. of MIKHAILOVA (1974: 119, figs. 1i–n, v) and *Callihoplites* aff. *vraconensis* of KENNEDY, CHAHIDA & DJAFARIAN (1979: 49, pl. 3, fig. 1).

Occurrence: The genus *Saltericeras* ATABEKYAN occurs in the uppermost Albian of England, Transcaspia and Kopet-Dag.

Saltericeras salteri (SHARPE 1856)

Fig. 4A–D

1856 *Ammonites Salteri*, SHARPE – SHARPE, p. 50–51, pl. 23, figs. 3, 5
1960 *Saltericeras* (gen. nov.) *salteri* SHARPE – ATABEKYAN, p. 187
1961 *Saltericeras salteri* SHARPE – ATABEKYAN, p. 35

Material: Five poorly preserved phragmocones at various ontogenetic stages (Nos. 636/62-1 to 5).

Specimen	D (mm)	Wh (%)	Wb (%)	U (%)	$\frac{Wb}{Wh}$	Tu	Tm
Fig. 4A–B	30.5	44	38	30	0.86	12	20
Fig. 4C–D	57.8	44	35	27	0.78	12	~ 18

Description: Shell involute. The whorls are higher than wide, with almost trapezoidal cross section and maximum breadth on the umbilical shoulder (Fig. 4C), or slightly rounded on the inner parts of the phragmocone (Fig. 4B). Umbilical wall vertical, with its edge rounded. Umbilical tubercles distinct, during the ontogeny becoming more and more longitudinally flattened and gradually more and more distant from the umbilicus. Two or three looped ribs are stretching out of these tubercles and are slightly connected with the terminal, marginal tubercles. The ribs between the tubercles are jointed (Fig. 4A, D), "forming an irregular zigzag pattern on the side of the whorl" (SHARPE 1856: 51). Marginal tubercles are distinctly clavate, displaced on the both sides of the venter (= alternate); they are distinctly greater than the umbilical tubercles. The number of marginal clavates is up to two times greater than that of the umbilical ones. Venter flat, with a slightly pronounced keel which does not stretch above the marginal clavates (in the illustrated specimen, Fig. 4B–C, it is slightly concave due to diagenetic compression!).

Occurrence: Upper Albian (*dispar*-Zone), Akkup section, Tuarkyr. *S. salteri* (SHARPE) has been recorded in the uppermost Albian of England and occurs frequently in Transcaspia and Kopet-Dag in a comparable stratigraphic position.

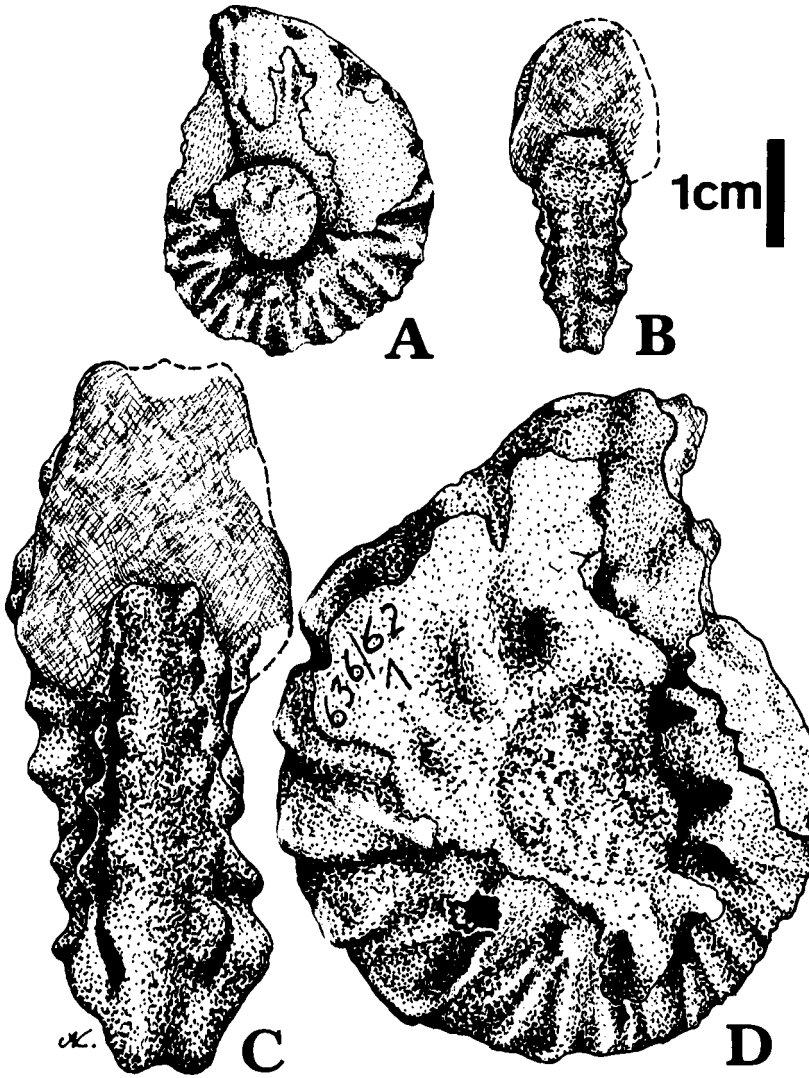


Fig. 4. *Saltericeras salteri* (SHARPE 1856) from the Upper Albian of the Akkup section. – A–B: No. 636/62–2, A: lateral-, B: frontal view. C–D: No. 636/62–1, C: frontal-, D: lateral view.

Genus *Schloenbachia* NEUMAYR 1875
Type species: *Ammonites varians* SOWERBY 1817

Diagnosis and discussion: See JUIGNET & KENNEDY (1976: 76–77), KEN-

NEDY, CHAHIDA & DJAFARIAN (1979: 28–30), KENNEDY, HANCOCK & CHRISTENSEN (1981: 236).

Remarks: This is the most abundant genus in the investigated sections. Paleontological revision of the genus *Schloenbachia* is under way by Dr. J. M. HANCOCK (King's College, London). HANCOCK (in: JUIGNET & KENNEDY 1976 and KENNEDY, CHAHIDA & DJAFARIAN 1979) believes that the Cenomanian representatives of *Schloenbachia* have been oversplit by former students who disregarded intraspecific variability, and claims that there are only three species, namely: *S. varians* (SOWERBY) in the Lower Cenomanian, *S. coupei* (BRONGNIART) in the Middle Cenomanian, and *S. lymense* SPATH in the Upper Cenomanian (cf. also KENNEDY & JUIGNET 1975, KENNEDY & HANCOCK 1977). In HANCOCK's classification *S. varians* includes varieties ranging from the hypernodose *ventriosa* to almost smooth-shelled *subplana; S. coupei* includes the hypernodose forms *trituberculata* and *quadrata* as well as the finely ornamented *costata;* only *S. lymense* is more or less monotypic. If so, one has to accept that *S. varians* ranges into the Middle Cenomanian and *S. coupei* appears already in the upper Lower Cenomanian (MARCINOWSKI 1980: 282). In the investigated sections the two species co-occur, and this does not result from condensation (see list of ammonites in Sullukapy, Zhanasha and Besakty sections in the present paper). We consequently think that the stratigraphic value of these discussed species is doubtful. On the other hand, we accept HANCOCK's idea that *S. varians* (SOWERBY) and *S. coupei* (BRONGNIART) comprise a number of morphotypes which, since the revision by SPATH (1926a, b; 1938), have commonly been regarded as separate species. This view is supported by numerous schloenbachiids in our collection that display features transitional between formerly established species. In the following characterisation of the species *S. varians* and *S. coupei,* the particular morphotypes will be treated as "subspecies", using the names commonly used in former descriptions of the genus *Schloenbachia.* In the author's opinion, this is the best way to indicate the conventional nature of such designations which have nothing in common with the real meaning of the subspecies; the discussed morphotypes are not separated either by stratigraphic range or geographic distribution.

Occurrence: The genus *Schloenbachia* NEUMAYR occurs in the Cenomanian of Europe and Mid-Asia, being commonly regarded as a typically Boreal form because of its geographic distribution, which it shares with Boreal Albian hoplitids (OWEN 1971: 131; KENNEDY & COBBAN 1976: 75).

Schloenbachia varians (SOWERBY 1817)

Figs. 5–7

1976 *Schloenbachia varians* (J. SOWERBY) – JUIGNET & KENNEDY, p. 78, pl. 7, figs. 4–6, 8–9, pl. 8, figs. 1–3, 5–6 (with synonymy)

1979 *Schloenbachia varians* (J. SOWERBY) – KENNEDY, CHAHIDA & DJAFARIAN, p. 31, pl. 3, figs. 2–7, pl. 4, figs. 1–5 (with synonymy)

Material: About half a thousand specimens, mainly inner parts of phragmocones.

Specimen	D (mm)	Wh (%)	Wb (%)	U (%)	$\frac{Wb}{Wh}$	Rp	R
Fig. 5C–E	21.4	47	34	23	0.72	16	37
Fig. 5G–I	39.4	44	30	24	0.69	18	32
Fig. 6A–C	57.5	43	31	27	0.72	15	28
Fig. 6D–E	92.0	42	–	29	–	15	26
Fig. 7A–B	23.5	37	48	31	1.29	0	0
Fig. 7C–E	23.4	36	69	38	1.70	0	0
Fig. 7F–G	28.0	44	55	31	1.27	0	0

Remarks on intraspecific variability: The investigated material of *S. varians* (SOWERBY) comprises three groups of morphotypes, all of which co-occur in the same strata. The boundary between the first and the second group of morphotypes does not seem to be sharply marked.

Ist Group (*subplana – subvarians – subtuberculata*)

Morphotypes with rather narrow whorls and flat sides, in which ribbing is stronger than tubercling. These morphotypes possess only distinct marginal (= ventro-lateral) tubercles. Observable are transitions (see figs. 5 and 6A–C) from completely smooth *S. varians subplana* (MANTELL) and slightly ornamented *S. varians subvarians* SPATH to those of a pronounced ornamentation and coarse whorls, as *S. varians subtuberculata* (SHARPE). More pronounced ornamentation is associated with the appearance of more and more distinct lower-lateral tubercles as well as initial umbilical ones at the beginning of the primary ribs. In adult specimens of *S. varians subtuberculata* (SHARPE) ornamentation of the body chamber gradually fades out, and the aperture is featured by a narrow, forwardly elongated ventral lappet.

IInd Group (*varians subtuberculata – varians varians*)

Morphotypes with rather broad and inflated whorls, with lower-lateral and marginal tubercles distinctly greater than in comparable ontogenetic stages of the first group. The same concerns the primary and secondary ribs, both of which are shorter and more massive, and less connected with the tubercles, particularly with the marginal ones. The body chamber is sculptured by massive ribs. These are the main ribs, which near the lower-lateral tubercle bear secondary ribs, faintly connected with that tubercle as well as with the marginal tubercle. The body chamber (cf. Fig. 6E) lacks a weakening in ornamentation as it happens in *S. varians subtuberculata* (SHARPE). These morphotypes range from specimens of rather narrow whorls and weakly ornamented i. e. *S. varians subtuberculata* (SHARPE) to typical *S. varians varians* (SOWERBY).

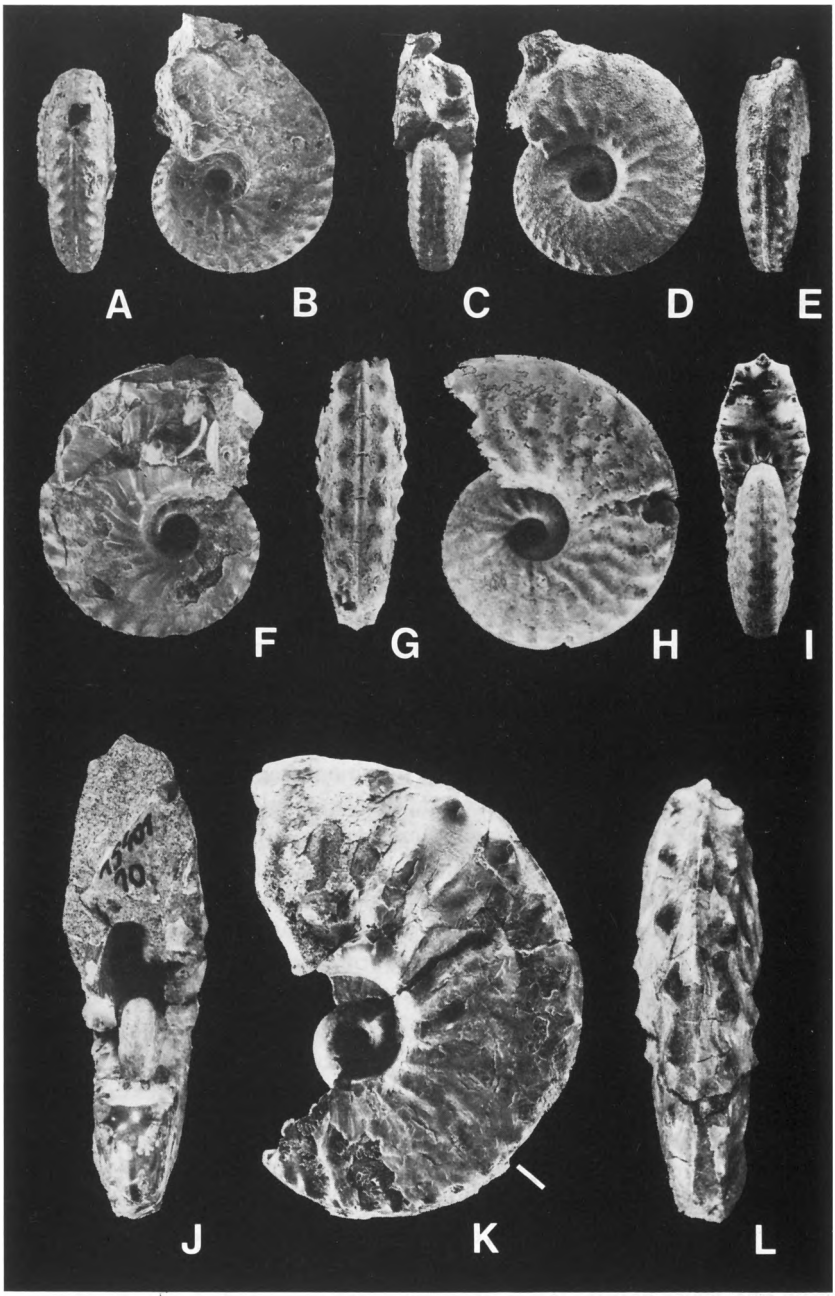


Fig. 5. *Schloenbachia varians* (Sowerby 1817) and its compressed, almost smooth, and slightly ribbed morphotypes.

A–E: *S. varians subplana* (Mantell 1822), Middle Cenomanian, Sullu-kapy; A–B: No. II-Sc. 1a phragmocone, A: ventral-, B: lateral view, × 1.5; C–E: No. II-Sc. 3a phragmocone, C: frontal-, D: lateral-, E: ventral view, × 1.5.

F: Transitional form between *S. varians subplana* (Mantell) and *S. varians subvarians* Spath, Cenomanian, Besakty, No. 15401–10b, lateral view, × 1.5.

G–I: *S. varians subvarians* Spath 1926, Cenomanian,Zhanasha, No. 15418–11 phragmocone, G: ventral-, H: lateral-, I: frontal view, nat. size.

J–L: *S. varians subvarians* Spath 1926, Cenomanian, Besakty, No. 15401–10a, J: frontal-, K: lateral-, L: ventral view, leader indicates the end of the phragmocone, × 1.5.

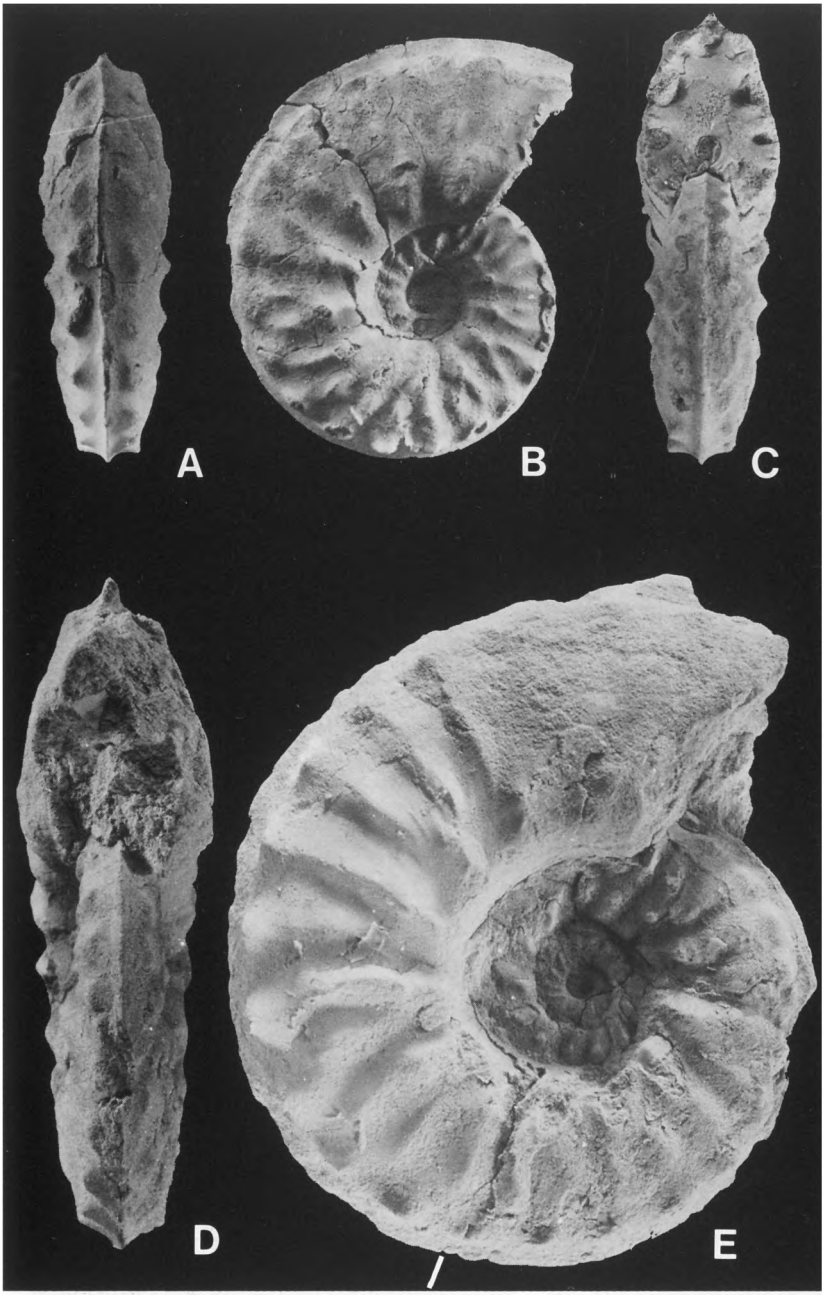


Fig. 6. *Schloenbachia varians* (Sowerby 1817) and its moderately (Figs. 6A–C) and normal (Figs. 6D–E) ribbed morphotypes, all figures in nat. size.

A–C: *S. varians subtuberculata* (Sharpe 1853), Cenomanian, Zhanasha, No. 15520–5a phragmocone, A: ventral-, B: lateral-, C: frontal view.

D–E: *S. varians varians* (Sowerby 1817) forma typica, Cenomanian, Zhanasha, No. 15418–9, the specimen almost completely preserved (leader indicates the end of the phragmocone), but slightly compressed by diagenetic processes, D: frontal-, E: lateral view.

IIIrd Group *(ventriosa)*

Morphotypes with low and inflated whorls and ornamentations consisting of exclusively very prominent lower-lateral tubercles and prominent marginal ones (cf. Fig. 7). During ontogeny, the height of the whorls increases (cf. Fig. 7I), but always Wb:Wh ≥ 1. Prominent tuberculation is maintained until the late growth stages (cf. Fig. 7H–I), during which swells appear between lower-lateral and marginal tubercles representing rudimentary ribbing. In our collection are large phragmocones with that type of ornamentation, even in specimens exceeding 100 mm in diameter. All these features are typical of *S. varians ventriosa* STIELER. The discussed morphotypes bear weak connections to the forms of the two previous groups with which they co-occur in some strata. Unfortunately completely preserved specimens are lacking in our collection. If further investigations prove a loose connection of *S. varians ventriosa* with the other morphotypes, and a lack of change in ornamentation of the body chamber then, in the author's opinion, it should be regarded as a separate species.

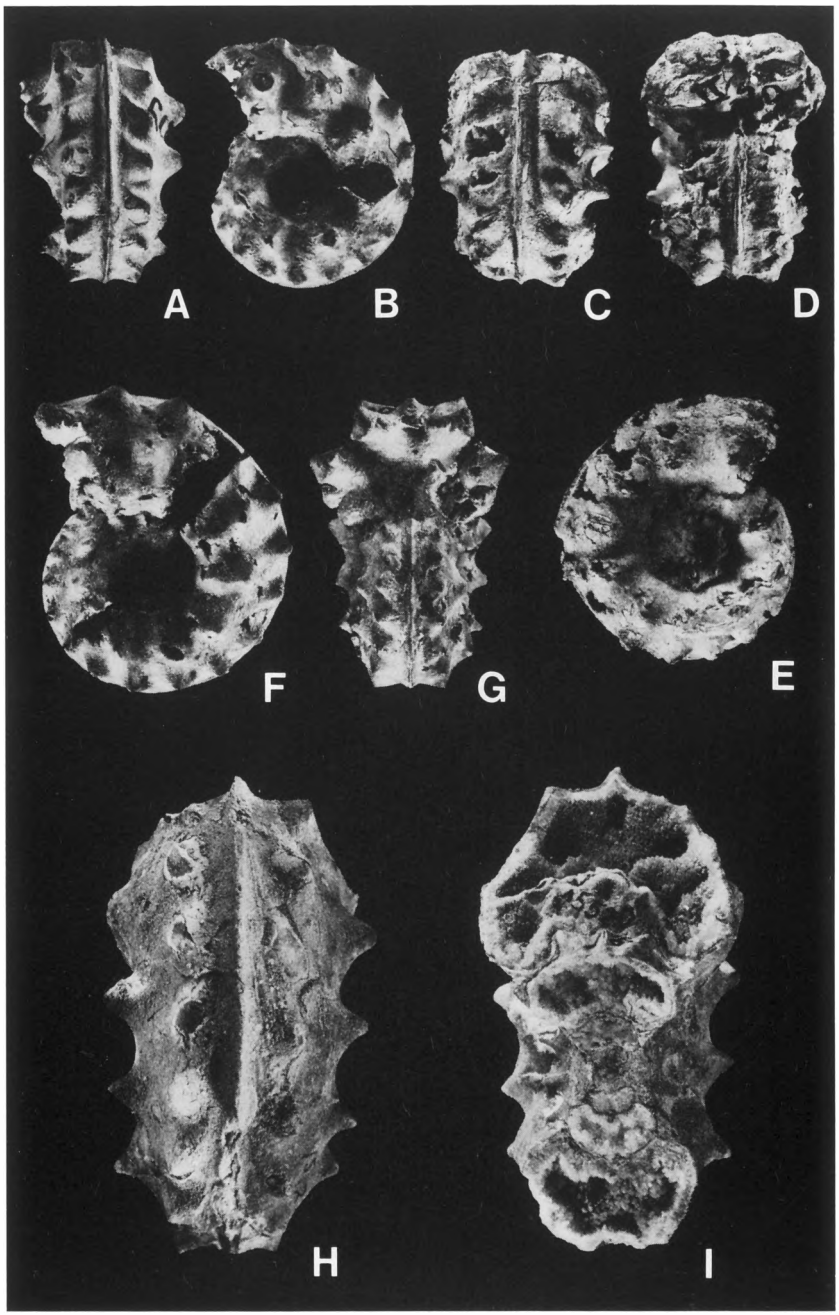
Discussion: A similar morphological differentiation can be seen in the schloenbachiids described by MANIJA (1974) from the Russian part of Kopet-Dag. This author distinguished 28 species of *Schloenbachia,* 12 of which were new, but he neglected both intraspecific variability and ontogenetic differentiation. All the forms described and illustrated by MANIJA (1974: 110–146, pls. 2–9) belong most likely to one of the three species of the genus *Schloenbachia.* This opinion is supported by a similarly wide range of intraspecific variability in *S. varians* (SOWERBY) from the Persian part of Kopet-Dag (cf. SEYED-EMAMI & ARYAI 1981). A wide range of intraspecific variability within this species is also reported by the authors listed in the synonymy, as well as by WIEDMANN & SCHNEIDER (1979), KENNEDY, HANCOCK & CHRISTENSEN (1981), and MARCINOWSKI & RADWANSKI (1983).

Occurrence: Lower and Middle Cenomanian of the Sullukapy section (I and II faunal horizon), and Cenomanian of the Zhanasha and Besakty sections. Outside the investigated area, *S. varians* (SOWERBY) is commonly known from the Lower, and sometimes also from the Middle Cenomanian of Europe and Mid-Asia.

Fig. 7. *Schloenbachia varians* (SOWERBY 1817), the phragmocones of hypernodose and non-ribbed morphotypes; all figures × 1.5, except Fig. 7H–I in nat. size.

A–G: *S. varians ventriosa* STIELER 1922, Middle Cenomanian, Sullu-kapy; A–B: No. II-Sc. 19b, A: ventral-, B: lateral view; C–E: No. II-Sc. 20a, C: ventral-, D: frontal-, E: lateral view; F–G: No. II-Sc. 19a, F: lateral-, G: frontal view.

H–I: *S. varians ventriosa* STIELER 1922, Cenomanian, Zhanasha, No. 15520–6, the phragmocone of a large specimen, H: ventral-, I: frontal view.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Schloenbachia coupei (BRONGNIART 1822)

Fig. 8A–J

1822 *Ammonites Coupei*, A. BR. – BRONGNIART, p. 391, pl. 6, fig. 3
1976 *Schloenbachia coupei* (BRONGNIART) – JUIGNET & KENNEDY, p. 78–79, pl. 8, figs. 4, 8–13, pl. 9, figs. 1–9 (with synonymy)

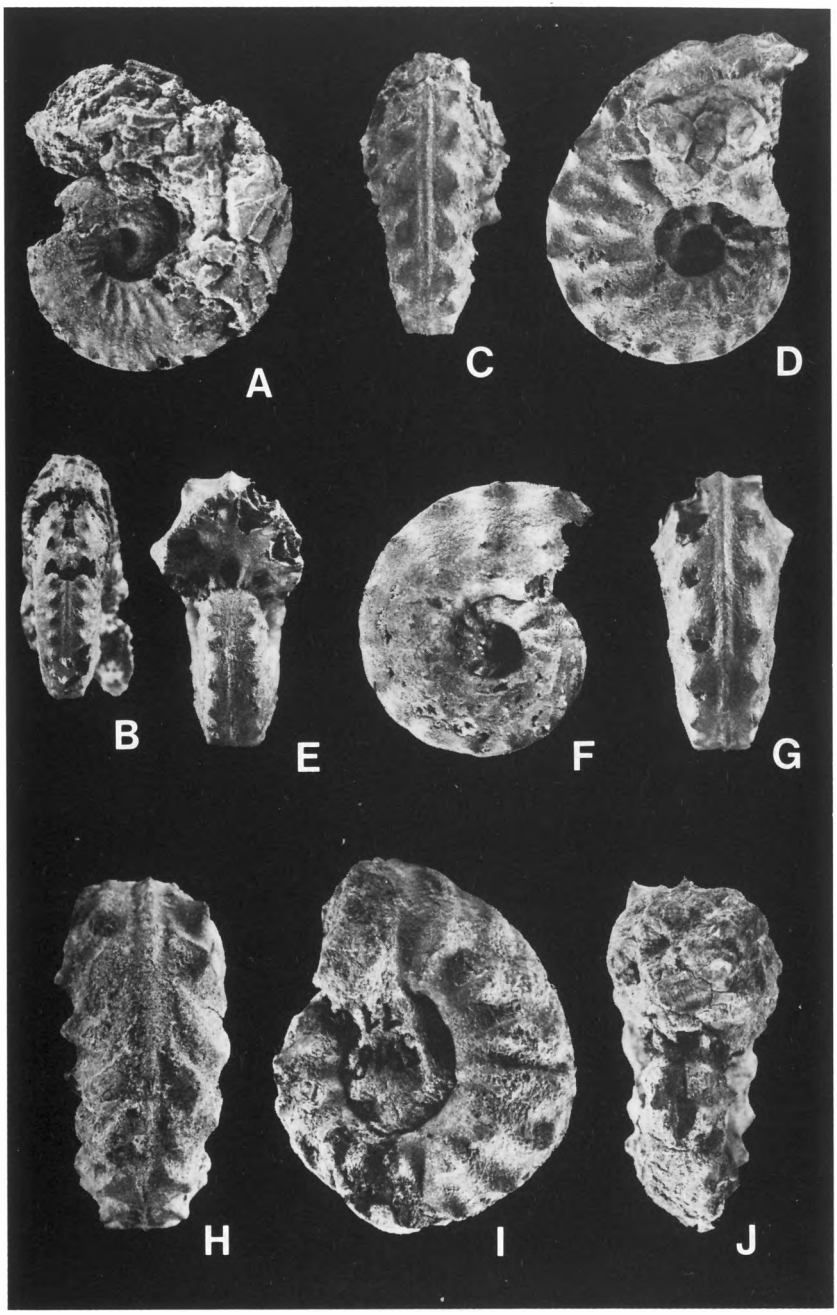
Material: Over twenty parts of phragmocones.

Specimen	D (mm)	Wh (%)	Wb (%)	U (%)	$\frac{Wb}{Wh}$	Tl	Tm
Fig. 8C–D	24.0	46	42	27	0.91	11	17
Fig. 8E–G	25.0	42	45	28	1.06	11	18
Fig. 8H–J	33.0	37	39	34	1.06	13	17

Remarks on intraspecific variability: In the investigated collection, this species is poorly represented, and recognition of its variability is less advanced than in *S. varians* (SOWERBY). According to suppositions presented by HANCOCK (op. cit.), the following morphotypes are present:
S. coupei costata (SHARPE) – forms of narrow whorls and delicate ribbing (rare)
S. coupei quadrata SPATH – forms of thick whorls, pronounced tuberculation and weakly ribbed (common)
S. coupei trituberculata (SHARPE) – forms of thick and inflated whorls, devoid of ribs, displaying pronounced marginal tubercles and less so the lower-lateral tubercles, and almost vanishing umbilical ones (very rare).

Occurrence: Relatively rare in the Middle Cenomanian of the Sullu-kapy section, and Cenomanian of the Zhanasha section, Mangyshlak. Outside the investigated area, *S. coupei* (BRONGNIART) is commonly known from the Middle Cenomanian of Europe and Mid-Asia, although in some regions it appears already in the Lower Cenomanian.

Fig. 8. *Schloenbachia coupei* (BRONGNIART 1822), the phragmocones of compressed, almost smooth to inflated and nodated morphotypes; all figures × 1.5.
A–B: *S. coupei costata* (SHARPE 1853), Middle Cenomanian, Sullu-kapy, No. II-Sc. 2a, A: lateral-, B: ventral view.
C–D: *S. coupei quadrata* SPATH 1926, Middle Cenomanian, Sullu-kapy, No. II-Sc. 15a, C: ventral-, D: lateral view.
E–G: *S. coupei trituberculata* SPATH 1926, Middle Cenomanian, Sullu-kapy, No. II-Sc. 26, E: frontal-, F: lateral-, G: ventral view.
H–J: *S. coupei quadrata* SPATH 1926, Cenomanian, Zhanasha, No. 15418–12, H: ventral-, I: lateral-, J: frontal view.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Superfamily Acanthocerataceae GROSSOUVRE 1894
Family Lyelliceratidae SPATH 1921
Subfamily Stoliczkaiinae BREISTROFFER 1953
Genus *Stoliczkaia* NEUMAYR 1875
Subgenus *Stoliczkaia* NEUMAYR 1875
Type species: *Ammonites dispar* D'ORBIGNY 1841

Stoliczkaia (Stoliczkaia) tenuis RENZ 1968

Fig. 3K–L

1968 *Stoliczkaia (Stoliczkaia) tenuis* n. sp. – RENZ, p. 48, pl. 6, figs. 6, 12, text-figs. 16b, f
1979 *Stoliczkaia (Stoliczkaia) tenuis* RENZ, 1968 – COOPER & KENNEDY, p. 249–264, figs. 46–53, 54A–F, 55, 68E

Material: One specimen represented by a half whorl of the phragmocone (No. 505/62-3).

D (mm)	Wh (%)	Wb (%)	U (%)	$\frac{Wb}{Wh}$	Rp	R
18.5	44	30	19	0.67	$\left(\frac{1}{2}\right)$ 9	$\left(\frac{1}{2}\right)$ 16

Description: Shell compressed and involute. Whorl section high, almost rectangular, with maximum width a little below the mid-flank. Ventral side flat, bounded by distinct margins. Ornamented by prorsiradiate, slightly flexed ribs, generally alternating long and short ones. The ribs above the mid-flank become more pronounced and continue on the ventral side, where they attain maximum relief and arch slightly forwards. The ribs bear ventro-lateral tubercles.

Remarks: The investigated specimen matches exactly the specific diagnosis and the type of ornamentation indicates inner parts of the phragmocone, i. e. a stage up to 20 mm in diameter (cf. COOPER & KENNEDY 1979: 249).

Occurrence: Upper Albian (*dispar*-Zone), Begiarslan section, Tuarkyr. *S. (S.) tenuis* RENZ is known from the uppermost Albian of Switzerland, and is reported from Angola in the same stratigraphic position (*perinflatum*-Subzone).

Examples of pathology and commensal activity

Pathology

Two phragmocones of *Schloenbachia* sp. have a disturbed ornamentation:

Specimen No. II-1051 bears normal ornamentation only to a diameter of about 8 mm. Above that diameter, a displacement of the marginal tubercles onto the ventral side takes place, associated with their fusion into one, well pronounced tubercle. The result is a crenulated keel, situated slightly asymmetrically on the venter (Fig. 3A-B).

Specimen No. II-Sc. 27 displays different ornamentation of opposite sides. While ornamentation is normal on one side (Fig. 3C), peculiar grooves replace the ribs on the other and the umbilical tubercles, especially the lower-lateral ones, are larger (Fig. 3D). Between the grooves the whorl interspace is slightly swollen.

Both cases indicate disturbance during ontogeny, and resulted certainly from a damage of the shell and ammonite body.

Commensal activity

This phenomen is expressed by the relation between the serpulid and *Turrilites costatus* (Fig. 3E). The serpulid tube runs along the suture between the whorls and is depressed into them like a wire into a growing tree. In places, the serpulid tube displays an indistinct replica of the ammonite ornamentation. I therefore think that the growth of the serpulid tube was coeval with the growth of the ammonite, which is similar to normal coiling ammonites from German Lias (cf. SCHINDEWOLF 1934, SEILACHER 1982). This serpulid was certainly gaining from the water motion induced by the ammonite which did not suffer from the presence of such an epizoan, whose realtion to the host bears features typical of the commensalism.

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The other text-figueres were done by Mrs. J. SMOLENSKA, and photos of specimens taken by Mr. S. ULATOWSKI.

Literature

ATABEKYAN, A. A. (1960): Stratigrafija verkhnemelovykh otlozhenij Zapadnogo Kopet Daga. – Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI), new series, **42:** 182–210; Leningrad.

— (1961): In: ATABEKYAN, A. A. & LIKHATCHEVA, A. A.: Verkhnemelovye otlozhenija Zapadnogo Kopet. Daga. – Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI), new series, **62:** 1–242; Leningrad.

BRONGNIART, M. A. (1822): In: CUVIER, M. G. & BRONGNIART, M. A.: Description géologique des environs de Paris. Nouv. ed., 1–428; Paris.

COOPER, M. R. & KENNEDY, W. J. (1979): Uppermost Albian (*Stoliczkaia dispar* Zone) ammonites from the Angolan littoral. – Ann. S. Afr. Mus., **77** (10): 175–308; Cape Town.

JUIGNET, P. & KENNEDY, W. J. (1976): Faunes d'Ammonites et biostratigraphie comparée du Cénomanien du Nord-Ouest de la France (Normandie) et du Sud de l'Angleterre. – Bull. Soc. Géol. Normandie et Amis Mus. Havre, **63** (2): 5–193; Le Havre.

KENNEDY, W. J. & JUIGNET, P. (1975): Répartition des genres et espèces d'ammonites caractéristiques du Cénomanien du Sud de l'Angleterre et de la Normandie. – C.-R. Acad. Sc. Paris, Sér. D. **280**: 1221–1224; Paris.

KENNEDY, W. J. & COBBAN, W. A. (1976): Aspects of ammonite biology, biogeography, and biostratigraphy. – Spec. Pap. Palaeontology, **17**: 1–94; London.

KENNEDY, W. J. & HANCOCK, J. M. (1977): Towards a correlation of the Cenomanian sequences of Japan with those of north-west Europe. In: Mid. Cretaceous Events – Hokkaido Symposium, 1976. – Palaeont. Soc. Japan Spec. Pap., **21**: 127–141; Fukuoka.

— (1978): The mid-Cretaceous of the United Kingdom. Mid-Cretaceous Events, Uppsala 1975 – Nice 1976. – Ann. Mus. Hist. Natur. Nice, **4** (5): 1–72; Nice.

KENNEDY, W. J.; CHAHIDA, M. R. & DJAFARIAN, M. A. (1979): Cenomanian cephalopods from the glauconitic limestone southeast of Esfahan, Iran. – Acta Palaeont. Polon., **24** (1): 3–50; Warszawa.

KENNEDY, W. J.; HANCOCK, J. M. & CHRISTENSEN, W. K. (1981): Albian and Cenomanian ammonites from the island of Bornholm (Denmark). – Bull. geol. Soc. Denmark, **29**: 203–244; Copenhagen.

KLINGER, H. C. & KENNEDY, W. J. (1978): Turrilitidae (Cretaceous Ammonoidea) from South Africa, with discussion of the evolution and limits of the family. – J. Moll. Stud., **44**: 1–48.

KUZNECOV, V. I. & TITOVA, M. V. (1961): Skhema stratigrafii verkhnemelovykh otlozhenij Tuarkyra. – Trudy Vses. N-Issl. Geol. Inst. (VSEGEI), new series, **46**: 219–228; Leningrad.

LUPPOV, M. P. (1975): Paleontologichne obgruntovania stratigrafii verkhnoy chastini albskikh vidkladiv Zakaspiu ta ikh eistavlennia iz zakhidnoevropeiskimi rozrizami. Vikopy fauna i flora Ukraini. – Izd. »Naukova Dumka«, vyp. **3**: 3–19; Kiev.

MANIJA, A. A. (1974): Stratigrafija i amonity senomanskikh otlozhenij juzhnoy Turkmenii. Sbornik "Stratigrafija i fauna molluskov verkhnemelovykh i paleoceonovykh otlozhenij juzknoy i vostochnoy Turkmenii", 84–162; Ashkhabad.

MARCINOWSKI, R. (1980): Cenomanian ammonites from German Democratic Republic, Poland, and the Soviet Union. – Acta Geol. Polon., **30** (3): 215–325; Warszawa.

MARCINOWSKI, R. & NAIDIN, D. P. (1976): An Upper Albian ammonite fauna from Crimea. – Acta Geol. Polon., **26** (1): 83–119; Warszawa.

MARCINOWSKI, R. & RADWANSKI, A. (1983): Mid-Cretaceous transgression onto the Central Polish Uplands (marginal part of the Central European Basin). – Zitteliana, **10**; München.

MIKHAILOVA, I. A. (1974): The relationship between early Cretaceous and late Cretaceous Hoplitaceae. – Rev. Bulgar. Geol. Soc., **35** (2): 117–132; Sofia.

OWEN, H. G. (1971): Middle Albian stratigraphy in the Anglo-Paris Basin. – Bull. Br. Mus. Nat. Hist. (Geol.), Suppl., **8**: 3–164; London.

RENZ, O. (1968): Die Ammonoidea im Stratotyp des Vraconien bei Sainte-Croix (Kanton Waadt). – Schweiz. Paläont. Abh., **87**: 1–99; Basel.

SAVELIEV, A. A. (1973): Stratigrafija i ammonity nizhnego alba Mangyshlaka. – Trudy Vses. Neft. N.-Issl. Geologorazved. Inst. (VNIGRI), **323**: 3–339; Leningrad.

— (1976): Novaya zonalnaya skhema stratigrafii srednego alba Mangyshlaka. – Trudy Vses. Neft. N.-Issl. Geologorazved. Inst. (VNIGRI), **388**: 119–129; Leningrad.

— (1981): On the zonal ammonite division of the Albian stage in Mangyshlak. Organic evolution and biostratigraphy in the middle of the Cretaceous period, 41–46; Vladivostok.

SCHINDEWOLF, O. H. (1934): Über Epöken auf Cephalopoden-Gehäusen. – Palaeont. Z., **16** (1–2): 15–31; Berlin.

SEILACHER, A. (1982): Ammonite shells as habitus in the Posidonia Shales of Holzmaden – floats or benthic islands? – N. Jb. Geol. Paläont. Mh., **1982** (2): 98–114; Stuttgart.

SEYED EMAMI, K. (1977): Scaphiten aus dem Oberen Alb und Cenoman der Umgebung von Esfahan (Zentral-Iran). – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **17**: 125–136; München.

SEYED-EMAMI, K. & ARYAI, A. A. (1981): Ammoniten aus dem unteren Cenoman von Nordostiran (Koppeh-Dagh). – Mitt. Bayer. Staatsslg. Paläont. hist. Geol., **21**: 23–39; München.

SHARPE, D. (1856): Description of the fossil remains of Mollusca found in the Chalk of England. Part III, Cephalopoda. – Palaeontogr. Soc. (Monogr.), **9** (36): 37–68; London.

SOKOLOV, M. I. (1963): Ob obiemie albskogo yarusa i zonalnom sopostavlenii albskikh otlozhenij Turkmenii i Mangyshlaka s razrezami stratotipov Anglii i Francji. – Biul. Mosk. Obshch. Isp. Prirody, Otd. Geol., **38** (2): 148–149; Moskva.

— (1966): Zonalnoe raschlenenije i facji albskilch i verkhnemelovykh otlozhenij Zakaspia. – Biul. Mosk. Obshch. Isp. Prirody, Otd. Geol., **41** (4): 56–72; Moskva.

SPATH, L. F. (1923–1943): A monograph of the Ammonoidea of the Gault. – Palaeontogr. Soc. (Monogr.), parts **6** (1928): 207–266; **12** (1937): 497–540; London.

— (1926a): On new ammonites from the English Chalk. – Geol. Mag., **63** (2): 77–83; London.

— (1926b): On the zones of the Cenomanian and the uppermost Albian. – Proc. Geol. Assoc., **37** (4): 420–432; London.

— (1938): Problems of ammonites nomenclature. On *Ammonites varians* J. SOWERBY, – Geol. Mag., **75** (12): 543–547; London.

WIEDMANN, J. (1965): Origin, limits, and systematic position of *Scaphites*. – Palaeontology, **8** (3): 397–453; London.

WIEDMANN, J. & DIENI, I. (1968): Die Kreide Sardiniens und ihre Cephalopoden. – Palaeontogr. Italica, **64** (n. ser., **34**): 1–171; Pisa.

WIEDMANN, J. & SCHNEIDER, H. L. (1979): Cephalopoden und Alter der Cenoman-Transgression von Mülheim-Broich, SW-Westfalen. Aspekte der Kreide Europas. – IUGS Ser. A, **6**: 645–680; Stuttgart.

WRIGHT, C. W. (1957): In: MOORE, R. C. (Ed.): Treatise on Invertebrate Paleontology, part L (Mollusca 4), 80–437; Lawrence.

— (1981): In: HOUSE, M. R. & SENIOR, J. R. (Eds.): Cretaceous Ammonoidea. "The Ammonoidea". – Syst. Assoc., Spec. Vol., **18:** 157–174; London – New York.

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