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# New and poorly known Valanginian ammonites from South-West Crimea

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## Abstract.

A revision of Valanginian ammonites from South-West Crimea has revealed a great variety of representatives of the family Neocomitidae. The following taxa are described: *Luppovella (Neoluppovella)* subgen. nov, *Luppovella (Neoluppovella) spinosa* subgen.et sp. nov., *Belbekiceras* BARABOSHKIN, 1997, *Belbekiceras belbekii* BARABOSHKIN, 1997, *Bodrakiceras* gen. nov., *Bodrakiceras constrictum* sp. nov., *Busnardoites* NIKOLOV, 1977, *Busnardoites* (?) *kojasdjilgensis* sp. nov., *Campylotoxia* gen. nov., *Campylotoxia campylotoxa* (UHLIG, 1902), *Campylotoxia campylotoxa densocostata* subsp. nov., *Campylotoxia evoluta* sp. nov., *Pseudacanthodiscus* BARABOSHKIN, 1997, *Pseudacanthodiscus crymicus* BARABOSHKIN, 1997.

**Key-words:** Crimea, Lower Cretaceous, Valanginian, ammonites, Neocomitidae.

## Résumé

La révision des ammonites du Valanginien du sud-ouest de la Crimée a révélé la grande variété des représentants de la famille des Neocomitidae. Les taxa suivants sont décrits: *Luppovella (Neoluppovella)* subgen. nov, *Luppovella (Neoluppovella) spinosa* subgen.et sp. nov., *Belbekiceras* BARABOSHKIN, 1997, *Belbekiceras belbekii* BARABOSHKIN, 1997, *Bodrakiceras* gen. nov., *Bodrakiceras constrictum* sp. nov., *Busnardoites* NIKOLOV, 1977, *Busnardoites* (?) *kojasdjilgensis* sp. nov., *Campylotoxia* gen. nov., *Campylotoxia campylotoxa* (UHLIG, 1902), *Campylotoxia campylotoxa densocostata* subsp. nov., *Campylotoxia evoluta* sp. nov., *Pseudacanthodiscus* BARABOSHKIN, 1997, *Pseudacanthodiscus crymicus* BARABOSHKIN, 1997.

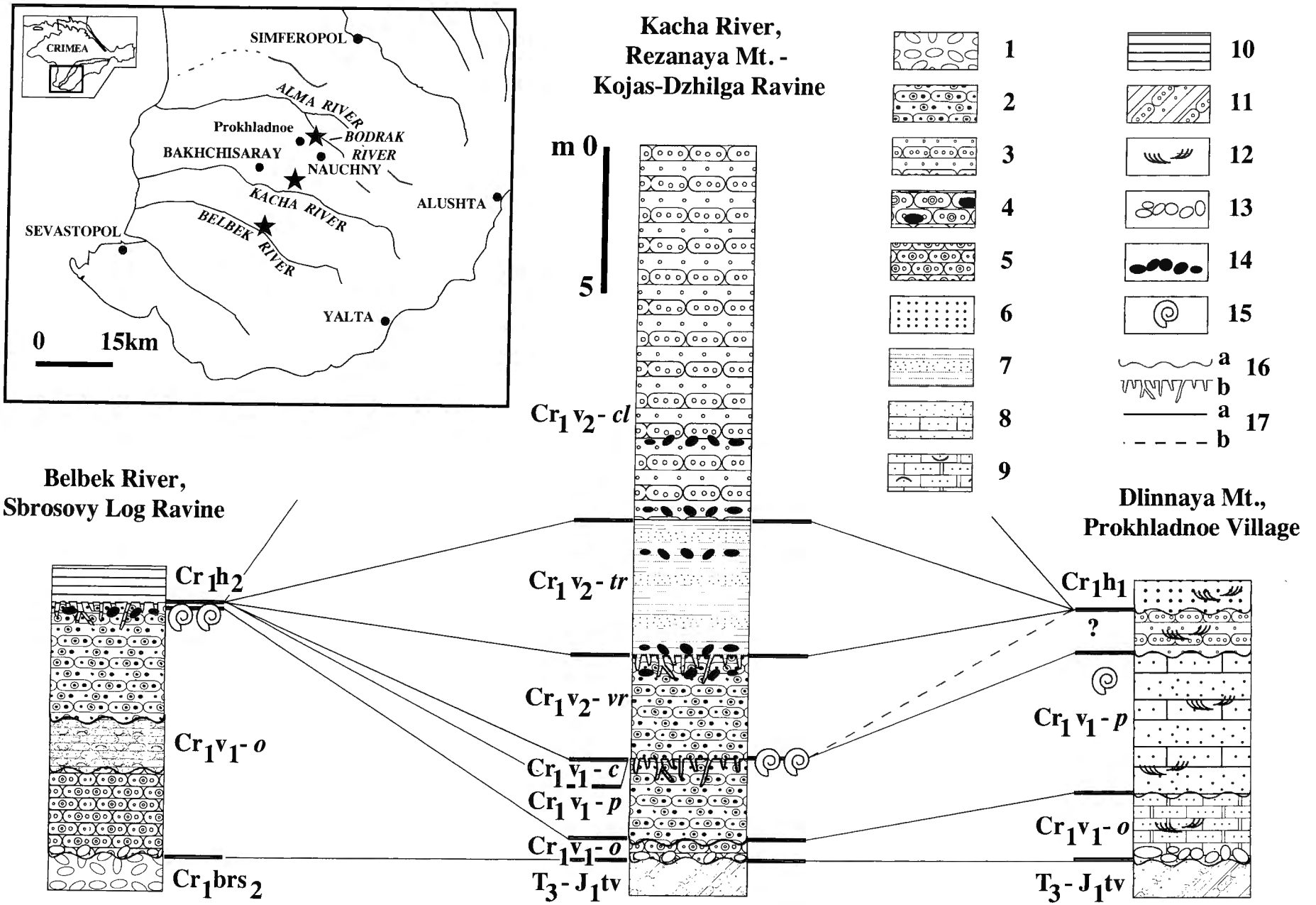
**Mots-clefs:** Crimée, Crétacé inférieur, Valanginien, ammonites, Neocomitidae.

## Introduction

The Valanginian deposits and ammonite faunas of South-West Crimea were described by KARAKASCH (1889, 1907, etc.). According to him (KARAKASCH, 1907), several levels of conglomerates and sandstones with "*Hoplites oxygonius, Ostrea rectangularis*" were determined as Valanginian (Table 1). A part of the grey sandstones above with "*Duvalia dilatata, Crioceras Duvali*" and other fossils was referred by him to the Hauterivian. Ammonites of the "*Hoplites Leopoldi*" group: *H. Leopoldi* (= *Bodrakiceras* sp. : pl. X, 21a-b; *Karakaschiceras biassalense*: pl. XIII, fig. 7a-b, pl. XXVI, fig. 10; *Bodrakiceras inostranzewi*: pl. X, fig. 8a-b, pl. XXVI, fig. 11), *H. biassalensis* (= *Karakaschiceras biassalense*: pl. X, fig. 9a-b, pl. XII, fig. 2, pl. XXVI, fig. 4; *Karakaschiceras* (?) sp. : pl. XI, fig. 3), *H. desmoceroides* (= *Leopoldia desmoceroides*: pl. XII, fig. 1; pl. XXVIII, fig. 10) and *H. Arnoldi* (= *Neohoploceras* pl. XIII, fig. 3a-b, p. 78) KARAKASCH referred mainly to the Hauterivian, but noted that they occurred with Valanginian forms (p. 416). In his final biostratigraphical schema (the adapted table between pp. 442 and 443) KARAKASCH excluded most of these ammonites because of uncertainties in their interpretation. The biostratigraphical scheme of KARAKASCH was accepted by DRUSHITS (1960) except for the Valanginian. DRUSHITS assumed the Valanginian fauna was redeposited in the basal sediments of the Hauterivian. Most of the geologists who worked in this region after DRUSHITS, used his scheme to define the stratigraphical position of rocks. The error arose from an incorrect determination of the ammonite genus "*Leopoldia*" that DRUSHITS supposed to be Early Hauterivian.

Recent investigations by BARABOSHKIN & MIKHAILOVA (1994), BARABOSHKIN, (1997a, b), BARABOSHKIN & YANIN (1997) in the Bakhchisaray region (Belbek, Kacha, Bodrak Rivers) have demonstrated that most of the "Hauterivian" succession must be referred to the Valanginian. The revision of the ammonite fauna collected by geologists and students of Moscow State University over a period of 40 years has demonstrated the high diversity of Neocomitidae in this region. This article revises the ammonites and deals with some new representatives of the Neocomitidae from the Lower Valanginian (mainly) of Belbek, Kacha and Bodrak Rivers (Figure 1). The bed numbering used in the article was taken from BARABOSHKIN & YANIN (1997).

For the ammonite shell morphology we have used the international terminology. For the suture line we used the terminology developed by the "Russian School" (see MIKHAILOVA, 1983 for details). Measurements (Figure 2), which seem to be important are given in mm (sizes) and in degrees (angles) after BARABOSHKIN & MIKHALOVA (1994).


CRIMEA
SIMFEROPOL
ALMA RIVER
Prokhladnoe
BODRAK RIVER
BAKHCHISARAY
NAUCHNY
KACHA RIVER
ALUSHTA
SEVASTOPOL
BELBEK RIVER
YALTA
0 15km
Kacha River,
Rezanaya Mt. -
Kojas-Dzhilga Ravine
m 0
5
Cr1v2- cl
Cr1v2- tr
Cr1v2- vr
Cr1v1- c
Cr1v1- p
Cr1v1- o
T3 - J1tv
Belbek River,
Sbrosovy Log Ravine
Cr1h2
Cr1v1- o
Cr1brs2
Dlinnaya Mt.,
Prokhladnoe Village
Cr1h1
?
Cr1v1- p
Cr1v1- o
T3 - J1tv
1
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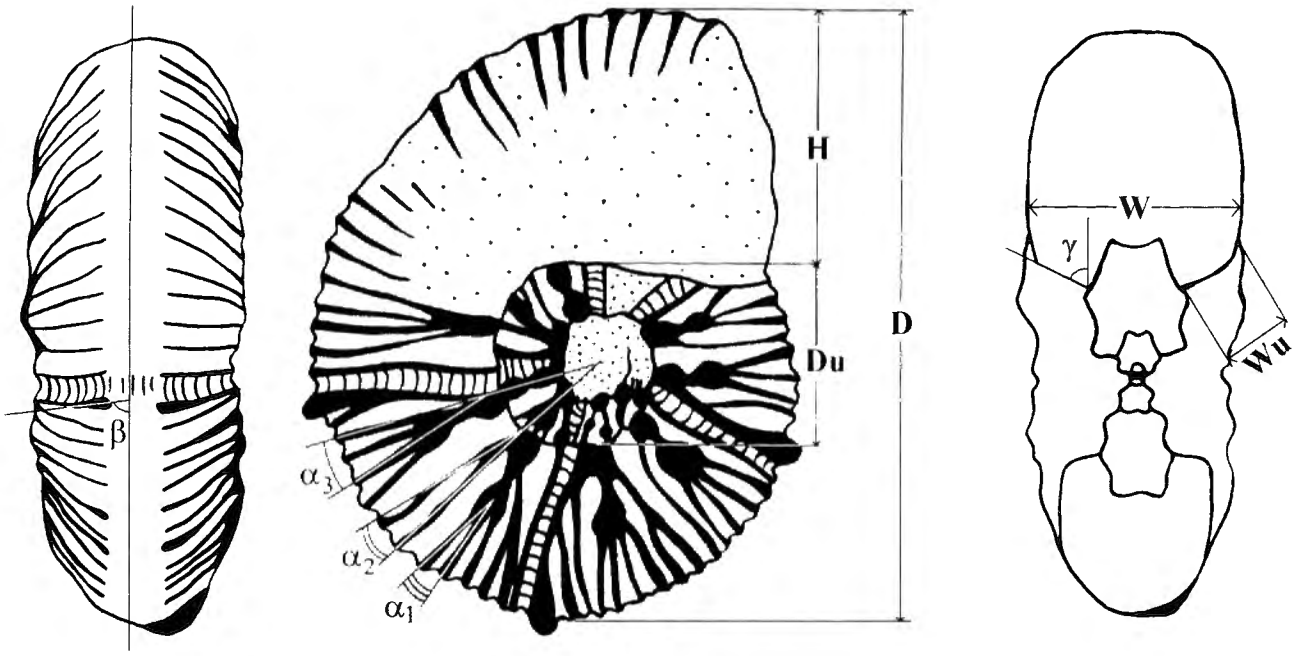



Fig. 2 — The sculpture of *Neohoploceras submartini* (MALLADA) and main measurements (adopted after BARABOSHKIN & MIKHAILOVA, 1994). Size (in mm): Diameter: **D** - of the shell, **Du** - of umbilicus; **H** - height of the whorl; Width: **W** - of the whorl, **Wu** - of the umbilical wall; angles (in degrees): $\alpha_1$ - between radius of the shell and the direction of the main rib, $\alpha_2$ - between radius of the shell and the direction of the secondary rib, $\alpha_3$ - between secondary ribs; $\beta$ - between plane of tubercles and plane of symmetry of the shell; $\gamma$ - between the umbilical wall and plane of symmetry of the shell.

## Depositories

The collection of ammonites is deposited in the Museum of the Earth in Moscow State University (**MSU**), under Nos. 93, 94, 95. The other depositories: Monograph museum of the Department of Historical geology of Sankt - Petersburg State University (**SPU**), Monograph Museum of the All Russian Geological Institution (**ARGI**), Bayerische Staatssammlung für Paläontologie und historische Geologie, Munich, BRD (**MM**).

←

Fig. 1 – The position of investigated sections (stars on the map) and their correlation (after BARABOSHKIN & YANIN, 1997).
Legend: 1: conglomerates; 2: soft/hard sandstone alternation with gravel and oolites; 3: soft/hard sandstone alternation; 4: oolitic sandstones with phosphorites; 5: oolitic sandstones; 6: soft sandstones; 7: soft sandstone/clay alternation; 8: alternation of soft sandstones and sandy limestones; 9: sandy limestone/dolomitic limestone alternation; 10: clays; 11: terrigenous flysh; 12: cross-bedding; 13: conglomerates and pebbles; 14: phosphorites and phosphorite pebbles; 15: position of the ammonite finds; 16: unconformities: a - erosional type, b - hard ground type; 17: correlation lines: a - reliable; b - presumable
Letter indexes: $T_3$-$J_1$-tv Upper Triassic Lower Jurassic Tauric Formation; $Cr_1brs_2$ - Upper Berriasian; Lower Valanginian: $Cr_1v_1$-*o* - *Kilianella otopeta* Zone, $Cr_1v_1$-*p* - *Thurmanniceras pertransiens* Zone, $Cr_1v_1$-*c* - *Campylotoxia campylotoxa* Zone; Upper Valanginian: $Cr_1v_2$-*vr* - *Saynoceras verrucosum* Zone, $Cr_1v_2$-*tr* - *Himantoceras trinodosum* Zone, $Cr_1v_2$-*cl* - *Teschenites callidiscus* Zone; $Cr_1h_1$ - Lower Hauterivian; $Cr_1h_2$ - Upper Hauterivian.

## Stratigraphy

The Valanginian of the Bakhchisaray region (Figure 1) can be traced between the villages of Kuibyshevo (Belbek River) and Verkhorechie (Formerly Biasala, Kacha River) in the south of the area up to Trudolubovka Village in the north (Bodrak River, a tributary of the Alma). Valanginian sediments are transgressive over a Triassic Middle Jurassic folded structure being transgressively covered by Hauterivian deposits towards the north. Both substages of the Valanginian are recognised in this region (BARABOSHKIN & MIKHAILOVA (1994), BARABOSHKIN (1997a, b), BARABOSHKIN & YANIN (1997)).

**Lower Valanginian** is well presented in the base of Mt. Rezanaya (Kacha River: 4 m.) and Mts. Dlinnaya, Sheludivaya, Patil near Prokhladnoe Village (0-8m, north of Nauchny) (Fig. 1).

***Kilianella otopeta* Zone.** This Zone was determined in several sections. In the Mt. Rezanaya section (beds Kp20/1-5) it is represented by ''pudding'' oolitic conglomerates, gravel clayey silts and clays with pyrite concretions. There is a hard/soft ground or erosional surface

in the top of each bed. The thickness is 1.5 m. The ammonites assemblage includes *Kilianella otopeta* (THIEULOY) (Pl. 4, Fig. 3), *K.* cf. *pexiptycha* (UHLIG), *K. roubaudiana* (D'ORBIGNY) *Clavithurmannia* aff. *foraticostata* THIEULOY, *Thurmanniceras* sp., *Bodrakiceras* ex gr. *inostranzewi* (KARAKASCH), *Bodrakiceras* sp.

The section Sbrosovy Log Ravine (beds Kp29/2-53, Belbek River) is similar in composition to the Kacha section, but its lower member stratigraphically referred to the *otopeta* Zone (by correlation), does not contain ammonites. The thickness of the member is about 12 m and its top is burrowed by *Thalassinoides*.

The *otopeta* Zone of Mts. Dlinnaya (beds Kp22/2-12), Sheludivaya, Patil sections is represented by cross-bedded rhythmical carbonate sandstones and sandy limestones with numerous *Cyclolites neocomiensis* (MILNE-EDWARDS & HAIME). Each rhythm commences with a carbonate-rich bed and is terminated by less carbonate sediment content. The thickness of the Zone reaches 1.5 - 2.5m. Ammonites are very rare: *Kilianella otopeta* (THIEULOY.), *K* cf. *pexiptycha* (UHLIG), *K.* cf. *roubaudiana* (D'ORBIGNY), *Thurmanniceras gueymardi* (SAYN), *Thurmanniceras* spp., *Distoloceras* sp., *Neolissoceras grasianum* (D'ORBIGNY), *Luppovella* (*Planibulliceras*) *lambertiformis* BARABOSHKIN & MIKHAILOVA. One *Thurmanniceras* (probably a new species) was figured by DRUSHITS (1960, pl. XXVI, fig. 5) as an Hauterivian *Lyticoceras amblygonium (NEUMAYR & UHLIG) from Prokhladnoe Village region (in the explanation to the table the locality is wrongly specified as Kacha River).*

The absence of the genera *Tirnovella* and *Favrella* and the presence of the first representatives of *Thurmanniceras* indicates that only upper part of the *otopeta* Zone exists in the studied region as in France (BUSNARDO & THIEULOY, 1979), Spain (COMPANY, 1987) and Italy (FARAONI *et al.*, 1997).

***Thurmanniceras pertransiens* Zone**. This zone is represented in the Mt. Rezanaya section (beds Kp23/4-15) by the same type of sediments to these below and is near 3 m thick there. A ''mature'' hard ground (with condensed *campylotoxa* and *verrucosum* ammonite Zones) is developed in the top of that interval (bed Kp23/15). Ammonites are comparatively rare: *Thurmanniceras pertransiens* (SAYN), *T. salientinum* (SAYN), *T.* ex gr. *thurmanni* (PICTET & CAMPICHE), *T. valdrumense* (SAYN), *Bodrakiceras inostranzewi* (KARAKASCH), *B. moutonianum* (D'ORBIGNY).

The *pertransiens* Zone in the Sbrosovy Log Ravine section (Belbek River) is represented by a condensed horizon (bed Kp29/54: BARABOSHKIN, 1997, 2000; YANIN & BARABOSHKIN, 2000), which contains *Euphylloceras* sp., (?) *Protetragonites* sp., *Neolissoceras grasianum* (D'ORBIGNY), *Olcostephanus (Olcostephanus)* cf. *globosus* SPATH, *Thurmanniceras* cf. *pertransiens* (SAYN), *T.* cf. *valdrumense* (SAYN), *Kilianella roubaudiana* (D'ORBIGNY), *Pseudacanthodiscus crymicus* BARABOSHKIN, *Belbekiceras belbekii* BARABOSHKIN, (first generation of hardground) and *Protetragonites* cf. *tauricus* KULJINSKAIA.-VORONETZ., *Ptychophylloceras ptychoicum* (QUENSTEDT), *Paquiericeras (Paquiericeras)* sp., (second generation of hardground with more carbonate and better preservation). The thickness of this bed is 0.2 m, and it is covered by Lower Hauterivian clays with *Lamellaptychus angulicostatus* (PICTET & DE LORIOL) in the Mts. Dlinnaya (beds Kp22/13-32), Sheludivaya and Patil sections, the *pertransiens* Zone is represented by massive carbonate sandstones, cross-bedded and seldom oolitic. The total thickness varies from 0 to 6m. Ammonite assemblage includes: *Thurmanniceras* cf. *pertransiens* (SAYN) (Pl. 4, Fig. 5), *T. salientinum* (SAYN) (Pl. 4, Fig. 4), *T. gueymardi* (SAYN), *Thurmanniceras* sp., *Bodrakiceras inostranzewi* (KARAKASCH), *B. moutonianum* (D'ORBIGNY), *B.* cf. *trezanense* (LORY) and *Bodrakiceras* sp.

***Campylotoxia campylotoxa* Zone.** This Zone was only found in the condensed *campylotoxa - verrucosum* interval in Mt. Rezanaya (bed Kp23/15) and non-condensed in the Kojas - Dzhilga Ravine sections (small exposures, beds unnumbered). The ammonites from different biostratigraphical levels are difficult to distinguish due to peculiarities of their primary lithology: ammonites from *verrucosum* Zone differ by less carbonate composition and a significant content of limonite oolites. The following ammonite assemblage is distinguished for the *campylotoxa* Zone: *Euphylloceras* sp., *E.* cf. *serum* (OPPEL), *Eulytoceras phestum* (MATHERON.), *Thurmanniceras* sp., *Campylotoxia campylotoxa* (UHLIG), *Campylotoxia campylotoxa densocostata* subsp. nov., *Campylotoxia evoluta* sp. nov., *Bodrakiceras moutonianum* (D'ORBIGNY), *B. inostranzewi* (KARAKASCH), *Bodrakiceras constrictum* sp. nov., *Bodrakiceras* sp., *Busnardoites sp., Karakaschiceras biassalense* (KARAKASCH) (Pl. 4, Fig. 1), *Luppovella (Neoluppovella) spinosa* subgen.et sp. nov., *Varlheideites peregrinus* RAWSON &. KEMPER. It is possible that the last species could be condensed into the *verrucosum* Zone and it further investigation of that problem is needed.

The following ammonites indicate the ***Saynoceras verrucosum* Zone**: *Busnardoites desori* (PICTET & CAMPICHE), *Neohoploceras submartini* (MALLADA) (Pl. 4, Fig. 2), *N. karakaschi* (UHLIG), *N. recticostatum* BARABOSHKIN & MIKHAILOVA, *Luppovella* (*Planibulliceras*) *kachensis* BARABOSHKIN & MIKHAILOVA, *L.* (*Luppovella*) *baumbergeri* (SPATH), *Rodighieroites* (?) *sp., Neolissoceras subgrasianum* (DRUSHITS) and *Valanginites nucleus* (ROEMER).

The succession above (beds Kp23/16-29, 4.4-4.5m) is represented by oolitic sandstones with rare ammonites: *Rodighieroites* (?) sp., ''*Neocomites*'' sp., *Neolissoceras subgrasianum*, *Spiticeras* sp. By its position below the first occurrence of *Himantoceras,* we refer this interval to the *verrucosum* Zone. It is inclined northwards.

The condensation horizon becomes less condensed in northward direction, where *Busnardoites* (?) *kojasdjil-*

*gensis* sp. nov. was found in the upper part of Kojas-Dzhilga Ravine.

The ***Himantoceras trinodosum* Zone** (beds Kp23/30-45 of Mt. Rezanaya section) was determined on the basis of a single discovery of *Himantoceras* cf. *lessinianum* FARAONI *et al.*, 1997 (Pl. 4, Fig. 6; = *Himantoceras* cf. *trinodosum*: BARABOSHKIN & YANIN, 1997, BARABOSHKIN, 1997). The interval consists of rhythmic alternation of grey carbonate sandstones (0.2-0.3 m), silty clays and bioturbated clays (0.3-1.2 m), which are usually badly exposed. The sandstones contain pyrite concretions, phosphorites and plant debris. The ammonite assemblage includes: *Eulytoceras* cf. *borissiaki* KULJINSKAIA-VORONETZ, *E.* cf. *phestum* (MATHERON), *Lytoceras* sp., *Karakaschiceras* sp., *Teschenites* sp., *Neolissoceras grasianum* (D'ORBIGNY), *N. subgrasianum* (DRUSHITS), *Partschiceras* (?) aff. *stuckenbergi* (KARAKASCH) and *Phyllopachyceras* sp.

The ***Teschenites callidiscus* Zone** is represented within alternating grey sandstones (0.2-0.3 m.) and clayey sandstones (1-2 m.), which contain carbonate and pyrite concretions, phosphorites and large wood fragments. The best occurrence of this Zone is in the base of the Mt. Rezanaya section (beds Kp23/46-102), where its thickness reaches 16-22 m. The following ammonite assemblage was found there: *Bochianites* (?) sp., *Dicostella* cf. *tuberculata* (ROMAN), *Teschenites* aff. *pachydicranus* THIEULOY, *Teschenites* sp. *[= T. neocomienseformis* (HOHENEGGER *in* UHLIG) *sensu* THIEULOY, 1971] (Pl. 4, Fig. 7), *Oosterella* cf. *cultrata* (D'ORBIGNY), *Eulytoceras* sp., *Protetragonites* cf. *quadrisulcatum tauricus* KULJINSKAIA-VORONETZ., *Neolissoceras subgrasianum* (DRUSHITS), *Euphylloceras tethys* (D'ORBIGNY), *Partschiceras* (?) sp. and *Phyllopachyceras* sp.

The ***Eleniceras tauricum* Zone** was recognised in the Verkhorechie Village region (beds Kp23/103-116 of Mt. Rezanaya section and beds Kp28/1-9 of Mt. Belaya section) and in a small quarry at Nauchny. The succession is composed of grey clayey sandstones (0.5-2 m) and carbonate sandstones (0.1-0.3 m), which contain pyrite concretions. The thickness is about 17.5 m, in the Kacha River outcrops, cutting northward to Selbukhra Mt. (Nauchny region) in the base of *Lyticoceras nodosoplicatum* Zone of the Lower Hauterivian. A strong condensation occurs northward of Nauchny. Remains of *Eleniceras* were found in a thin horizon with Lower Hauterivian *Leopoldia desmoceroides* (KARAKASCH), *Crioceratites* (?) sp. and others forms there. The *Eleniceras tauricum* Zone assemblage includes *Eulytoceras konushobaense* KULJINSKAIA-VORONETZ, *Eleniceras tauricum* (EICHWALD), *E. stevrecense* BRESKOVSKI, *E. spinigerum* (VON KOENEN) (Pl. 4, Fig. 8), *E. transsylvanicum* (JEKELIUS), *E. koeneni* (KARAKASCH.), *Eleniceras* sp. and *Neolissoceras grasianum* (D'ORBIGNY).

The Lower Hauterivian transgressively covers Lower Valanginian rocks

## Palaeontology

Superfamily Perisphinctaceae STEINMANN, 1890
Family Neocomitidae SALFELD, 1921
Subfamily Neocomitinae SALFELD, 1921

Genus ***Luppovella*** NIKOLOV, 1966

1966 - *Luppovella*: NIKOLOV, p. 642
1994 - *Luppovella*: BARABOSHKIN & MIKHAILOVA, p. 47
1996 - *Kilianella:* WRIGHT *et al.*, p. 58

**Type:** *Thurmannia (Kilianella) superba* (SAYN, 1907, p. 51, pl. 4, fig. 18a-b), Valanginian, south-east France.

**Diagnosis:** Moderately evolute to evolute, small to moderate in size. Whorl-section hexagonal high to low. The umbilicus moderately shallow with subvertical umbilical wall.

Sculpture consists of single, bi- tripartite, intercalated and bidichotomic ribs with tubercles. Ribs are grouped in cycles, separated by constrictions. All ribs are slightly curved, terminated by small ventral tubercles. Umbilical and lateral tubercles are well developed in the branched ribs.

**Composition:** Three subgenera: *Luppovella (Luppovella)* NIKOLOV, 1966; *L. (Planibulliceras)* BARABOSHKIN & MIKHAILOVA, 1994 and *L. (Neoluppovella)* subgen. nov.

**Remarks:** *Luppovella (Planibulliceras)* is distinguished by the presence of well developed constrictions in the early whorls, the presence of 2-3 simple ribs between branched ribs, by rare ribbing in the adult and by unequal ventral tubercles in the simple and branching ribs in the early whorls. It is the earliest representative of the genus *Luppovella* (Figures 10-11).

*Luppovella (Neoluppovella)* has well developed bidichotomic ribs in the end of each cycle and equal ventral tubercles on all of the ribs. The suture line is almost the same as in *Luppovella (Planibulliceras)*, having a wide asymmetric umbilical lobe (U) of the same deepness as for

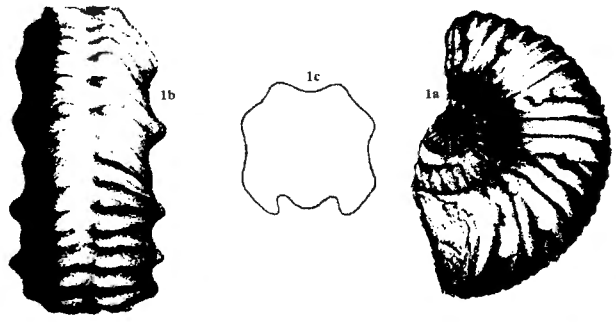



Fig. 3 — *Ammonites Hookeri*, reproduced from BLANFORD (1865: p. 83: pl. 17, fig. 1a-d), Valanginian (?) of the Himalayas.

the ventral lobe (V) (Figure 11). *Neoluppovella* is the descendant of *Planibulliceras* (Figures 10-11).

*Luppovella (Luppovella)* is characterised by the disappearance of bidichotomic ribs at the end of each cycle and early disappearance of constrictions. The suture line shows a very deep, relatively narrow, subsymmetric umbilical lobe (U), similar to *Kilianella* and *Balkites* (Figure 11). *Luppovella* was derived from *Neoluppovella* (Figures 10-11).

Tuberculated *Kilianella* are also similar to *Luppovella,* but they have well-developed high ventral tubercles in the last branch of terminal ribs in each cycle and simple or bipartite ribbing in the adult. This feature clearly distinguishes *Kilianella* from *Balkites* BOGDANOVA & KVANTALIANI, 1983, and from *Luppovella* NIKOLOV, 1966.

**Distribution:** Lower Upper Valanginian of South-West Crimea, (?) *Busnardoites campylotoxum-Saynoceras verrucosum* Zones of Italy, (?) *Saynoceras verrucosum* Zone of North Caucasus, *Saynoceras verrucosum* Zone of Bulgaria, Lower Valanginian of Pakistan, Himalaya, Valanginian of Morocco, *Lyticoceras pseudoregale* Zone of Argentina.

Subgenus ***Luppovella (Neoluppovella)***
subgen. nov.

**Subgeneric name:** from Greek *neos* - new, and genus *Luppovella* NIKOLOV, 1966.

**Type species:**. *Luppovella (Neoluppovella) spinosa* subgen. et sp. nov., Lower Valanginian, *Campylotoxia campylotoxa* Zone (?) of South-West Crimea.

**Diagnosis**: Shell small, evolute, with octagonal whorl-section and a convex and weakly keeled venter. The umbilicus is shallow and broad.

The whorl flanks show single, bifurcate and bipartite bidichotomic ribs grouped into cycles separated from each other by constrictions. Ribs are thickened or become tuberculate on the umbilical shoulder above mid-whorl height or on the ventrolateral shoulder. The terminal ribs of each cycle have flattened ventral tubercles, which are larger than on other ribs; their angle with the plane of symmetry of the shell becomes smaller with age. Bifurcate ribs branch above the middle of the lateral side, or on the umbilical shoulder. Cycles of ribbing terminate in bifurcate ribs or by bipartite bidichotomic ribs, having additional branching of adapetual ribs at mid-lateral sides. **Suture line:** See description of the type species.

**Composition:** *Luppovella (Neoluppovella) hookeri* (BLANFORD, 1865); *L. (Neoluppovella) spinosa* subgen. et sp. nov.

**Remarks:** *Ammonites Hookeri* was described by BLANFORD (1865: p. 83, pl. 17, fig. 1a-d, reproduced here: Figure 3) from the Valanginian (?) of the Himalayas. Later UHLIG (1910: p. 215, pl. XXV, fig. 2a-d) figured a species *hookeri* from the same region and referred it to *Acanthodiscus* UHLIG, 1905. NIKOLOV described *Acanthodiscus hookeri* from the Berriasian of Bulgaria (NIKOLOV, 1960: p. 187, pl. XXIV, fig. 3). However, because of the presence of the looped ribbing and other features this specimen was referred to *Neocosmoceras* by DIMITROVA (1967: p. 118, pl. LIV, fig. 3). Himalayan samples differ strongly from Bulgarian ones and cannot be referred to either *Acanthodiscus*, or *Neocosmoceras* BLANCHET, 1922. They differ from *Acanthodiscus* by the coarse ribbing of the inner whorls, absence of bi- tripartite high branching on each rib, the presence of constrictions and by ventral tubercles which are not parallel to the plane of symmetry of the shell. *Neocosmoceras* differs by the presence of looped and zigzag ribbing, absence of constrictions and by spiny ventral tubercles.

A fragment of *Acanthodiscus* ex aff. *A. hookeri* (BLANFORD, 1865) was figured by LEANZA & WIEDMANN (1980: p. 953, pl. 7, fig. 1) from the Lower Hauterivian *Lyticoceras pseudoregale* Zone of Neuquèn Basin (Argentina). However, this specimen is very similar to the type of *Luppovella: L. superba* (SAYN, 1907) and differs from *Luppovella (N.) hookeri* by the absence of bidichotomic ribs, by the presence of intercalated ribs and by the shape of the ventral tubercles. According to AGUIRRE-URRETA (1998) the *Lyticoceras pseudoregale* Zone is the equivalent of the uppermost Valanginian *Pseudofavrella angulatiformis* Zone. Taking into account the find of *Luppovella,* it could be even older.

*Neocosmoceras* sp. aff. *smithi* (UHLIG, 1910) figured by COLLIGNON (1962: p. 16, pl. 180, figs. 808, 809) from Madagascar is almost identical with the holotype of *Luppovella (Neoluppovella) hookeri* (BLANFORD, 1865). However, it was described from the *Berriasella boissieri* Zone, so we need some additional data to be sure of the identification, which could affect, therefore, the determination of the stratigraphic position of that specimen. The assemblage of the other ammonites, figured from the locality ''Coupe d'Andranomavo, Est Malakialina (Marovoay)'' indicates the possible presence of the Lower Valanginian there.

The sculpture of the internal whorls of *Luppovella (Neoluppovella)* reminds one of *Kilianella* UHLIG, 1905. The latter genus differs in possessing deeper constrictions, strong ventral tubercles and the absence of the lateral tubercles on external whorls. *Luppovella (Planibulliceras)* BARABOSHKIN & MIKHAILOVA, 1994 is also close to *Luppovella (Neoluppovella)* and is distinguished by rare bidichotomic ribs, the presence of bifurcate ribs with a high virgation point on the whorl flank and by the early disappearance of constrictions.

**Distribution:** Lower Valanginian, *Campylotoxia campylotoxa* Zone (?) of South-West Crimea, Lower Valanginian of the Prebalkan, Valanginian (?) of the Himalayas.

***Luppovella (Neoluppovella) spinosa*** subgen. et sp. nov.

Pl. 1, Figs.1a-b, Text-fig. 4, 11

**Species name:** from Latin *spinosus* - prickly.

**Holotype:** MSU 95/1. Almost complete specimen of good preservation, found in bed Kp23/15, condensed horizon around the Lower - Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?), Verkhorechie Village, base of Rezanaya Mt.

**Description:**. Small evolute shell with octagonal whorl-section. Venter convex, weakly keeled on early whorls. Umbilicus shallow, broad, having a narrow subvertical umbilical wall.

Cycles of ribbing are separated by constrictions and contain single, bifurcate and bipartite bidichotomic tuberculated ribs. The cycle begins with a simple weakly curved rib, thickening above the mid-whorl height. The rib is terminated by a small tubercle on the ventral bend. Bifurcate ribs are of two types. The cycles of the internal whorls (D<30mm) have rare ribs, branching above the mid-whorl height and having tubercles on the umbilical shoulder and in the virgation point. Ornament cycles of internal and external whorls terminate by bifurcate ribs, branching on the umbilical shoulder. A tubercle appears in the point of virgation and in the mid-whorl height (or somewhat above) on both branches. The tubercle of the ultimate branch is usually larger and sharper. The bipartite, bidichotomic ribs appear in the external whorls as the result of additional branching of the adapertural branch of the terminal ribs. Their ventral tubercles are flattened and form a small angle with the plane of symmetry of the shell.

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 95/1 | 40,5 | 14,4 | 14 | 17,2 | 2,5 | 7 | 25 | 30 | 25 | 50 |

**Suture line:** (Figure 4). The tripartite, remarkably asymmetric umbilical lobe (U) is larger than the ventral lobe (V). The first umbilical lobe ($U^1$) is tripartite with unequal sides. The external saddle (V/U) is bipartite unequal and the first lateral saddle ($U/U^1$) is tripartite. The umbilical seam portion of the suture line is sharply lowered.

**Remarks**: The new species differs from *Luppovella (Neoluppovella) hookeri* (BLANFORD, 1865) by the earlier appearance of the bidichotomic ribs, deep constrictions, and unequal ventral tubercles.

**Distribution:** As for the holotype.

Genus ***Belbekiceras*** BARABOSHKIN, 1997

1997a - *Belbekiceras*: BARABOSHKIN, p. 116.
2000 - *Belbekiceras*: BARABOSHKIN, p. 104.

**Type species**: *Belbekiceras belbekii* (BARABOSHKIN, 1997a, p. 117, pl. 37, fig. 1a-b), Lower Valanginian of South-West Crimea.

**Diagnosis:** Medium size, moderately involute, with high hexagonal to rounded-hexagonal whorl-section. Umbilicus broad, shallow, with narrow umbilical wall.

Cycles of ribbing are separated by shallow constrictions and consist of simple, bi- or tripartite ribs, branching

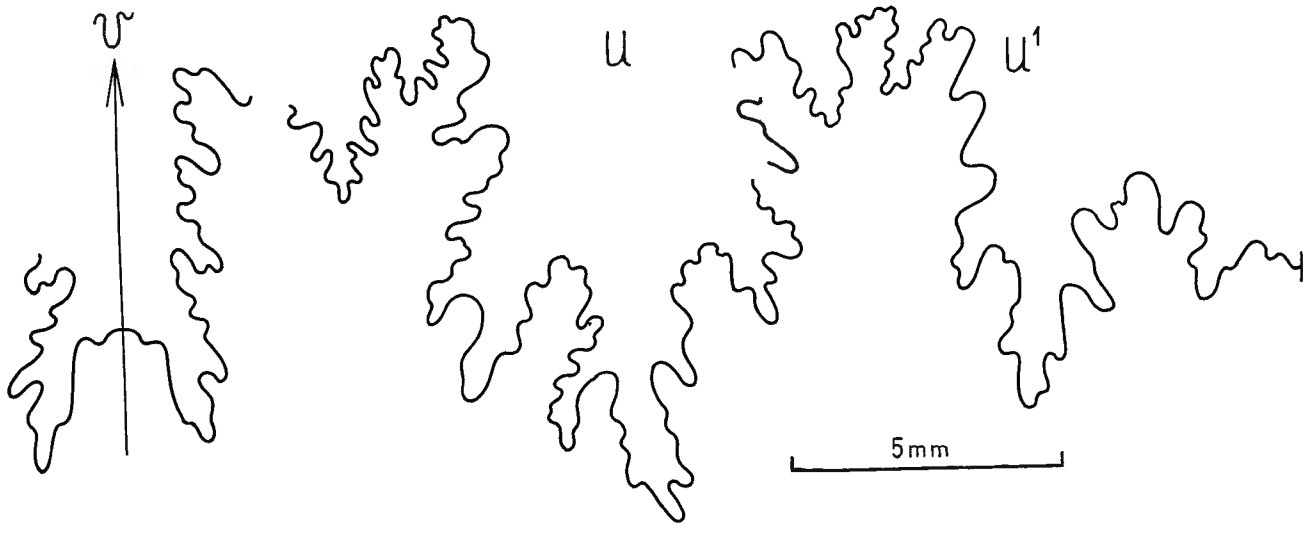



Fig 4 — The suture line of the holotype of *Luppovella (Neoluppovella) spinosa* subgen. et sp. nov.; MSU 95/1 at D=32.5 mm and H=11.4 mm; Lower Valanginian, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt., bed Kp23/15.

on the umbilical shoulder and in the upper third of the lateral sides. Small spicate tubercles appear in the virgation points on the ventral bend. Ribs do not cross the venter.

**Suture line:** with deep, comparatively symmetrical, umbilical lobe (U) and shorter narrow first umbilical lobe ($U^1$). The edge part of the suture line comes down steeply to the umbilicus.

**Composition:** *Belbekiceras belbekii* BARABOSHKIN, 1997a.

**Remarks**: The early whorls of this genus are similar to the Berriasian *Euthymiceras* GRIGORIEVA, 1938 and *Transcaspiites* LUPPOV, 1985, but differ from both in the construction of its cycles of ribbing and sculpture of the last preserved whorl, which has some proximity to *Campylotoxia* gen. nov. (see below). *Belbekiceras* is distinguished by the sculpture of its middle whorls. The new genus is close to *Eristavites* NIKOLOV, 1966, but differs in possessing bifurcating ribs, branching in the upper part of lateral sides with formation of a lateral tubercle.

**Distribution:** Lower Valanginian of South-West Crimea.

***Belbekiceras belbekii*** BARABOSHKIN, 1997

Pl. 1, Figs. 2a-b, Text-fig. 5, 11

1997a - *Belbekiceras belbekii*: BARABOSHKIN, p. 117, pl. 37, fig. 1a-b.

2000 - *Belbekiceras belbekii*: BARABOSHKIN, p. 105, pl. 5, fig. 1a-b.

**Holotype:** MSU 94/1 by monotypy. An incomplete phragmocone from bed Kp29/54, Lower Valanginian, *Thurmanniceras pertransiens* Zone of Sbrosovy Log Ravine, Belbek River, South-West Crimea.

**Description:** Moderately involute, with high hexagonal whorl-section, rounded in the later whorls and flattened in the venter. Umbilicus broad, shallow; umbilical wall narrow, somewhat separated from the lateral sides. Cycles of ribbing are separated by weak constrictions and contain simple, bi- and tripartite ribs. Simple ribs are sinuous, thickened in the upper third of the whorl height, slightly curved in the direction of the aperture; they dominate in the middle whorls, located at the beginning of each cycle. Bifurcating ribs are present closer to the end of cycles. The virgation point is in the upper third of the whorl height, forming a small, sharp tubercle. The branching of the terminal ribs occurs on the umbilical shoulder, which is marked by a weak bulla. This type of ribbing prevails on the outer whorls, where tripartite bidichotomic ribs also exist. Ribs terminate on the ventro-lateral shoulder by equal flattened tubercles, which form an angle of 45 - 55$^0$ to the plane of symmetry of the shell. There are 3 cycles of ribbing per half whorl, which contain 4 simple and 2-3 bifurcate ribs.

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 94/1 | 51 | 21,5 | 17 | 19,5 | 5 | 25 | -20 | 25 | 45-55 | 70 |

* - minus means backward direction of the ribs after branching

**Suture line:** (Figure 5). Bisected ventral lobe has a high secondary saddle and a large oblique lateral teeth lower to

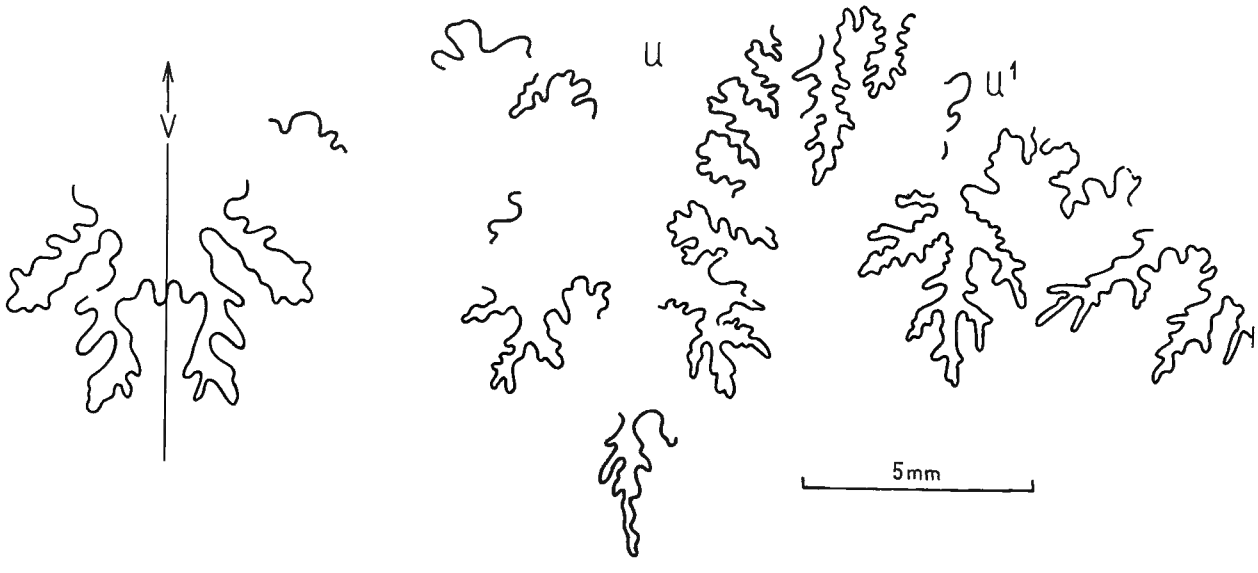



Fig 5 — The suture line of the holotype of *Belbekiceras belbekii* BARABOSHKIN; MSU 94/1 at D=52.5mm and H=11.8 mm; Lower Valanginian, *Thurmanniceras pertransiens* Zone of Belbek River; bed Kp29/54,

the side. The most deep umbilical (U), and first umbilical ($U^1$) lobes are narrow, nearly symmetrical. The suture line gets shallower to the umbilicus. The two following oblique lobes are shallow.

**Distribution:** As for the holotype.

Genus ***Bodrakiceras*** gen. nov.

**Generic name:** from the Bodrak River in the Bakhchisaray region of South-West Crimea.

**Type:** *Hoplites Inostranzewi* (KARAKASCH, 1889, p. 434, pl. I, figs. 1-3), Lower Valanginian of South-West Crimea.

**Diagnosis:** Medium to large, discoidal, sub-involute shells with moderate narrow umbilicus and abrupt umbilical wall. Whorl section varies from hexagonal to high trapezoidal. Cycles of ribbing are separated usually by narrow constrictions and consist of ribs having 3 rows of tubercles in the inner whorls. Each cycle contains one single rib, one bifurcate rib and one trifurcate rib in the young whorls (D<20mm); a single rib and complex rib in the middle whorls (D=20-40mm); single, complex and bi- or trifurcate ribs in the late whorls (D>40mm). Ribs stem from the umbilical edge at an umbilical tubercle (on mould, or spines in the shell), directed into the umbilicus and terminate by a ventral tubercle. The row of strong tubercles present at mid-whorl height marks the point of virgation. Ribbing becomes weaker to completely smooth in the adult. Some of the species (the type species at least) have a narrow ventral groove on the inner whorls.

**Suture line:** (Figure 6). The ventral lobe (V) has a diversely divergent teeth; the umbilical lobe (U) is very large tripartite and asymmetric; the first umbilical lobe ($U^1$) is narrower and shorter than the umbilical lobe. Saddles are bipartite, equal, or the external saddle (V/U) is shorter than the first lateral saddle ($U/U^1$). The umbilical seam portion of the suture line descends steeply into the umbilicus with age.

**Composition:** (see Pl. 2, Figs. 1-6).**?** *Bodrakiceras gibbosum* (VON KOENEN, 1902); *B. constrictum* sp. nov., *B. discoideum* (COLLIGNON, 1962);? *B. heteroptychum* (PAVLOW, 1892); *B. inostranzewi* (KARAKASCH, 1889); *B. quadristrangulatum* (SAYN, 1907)*;? B. subgibbosum* (WIEDMANN *in* KUTEK *et al.*, 1989); *B. moutonianum* (D'ORBIGNY, 1849-1850); ?*B. neumayri* (BEHRENDSEN, 1892).

**Remarks:** *Hoplites Inostranzewi* (KARAKASCH, 1889: p. 434, pl. I, figs. 1-3), the type of *Bodrakiceras* (SPU No.218/1) was refigured as *Hoplites Leopoldi* in later work of KARAKASCH, 1907: p. 76, pl. XXVI, fig. 11), because of the similarity with *Leopoldia* in the rapid reduction of the sculpture. The type of *Bodrakiceras* is significantly different from the type of *Karakaschiceras* (SPU No.218/2, *Hoplites biassalensis*, KARAKASCH 1889: p. 435, pl. I, fig. 4, 5 and refigured in KARAKASCH, 1907: p. 76, pl. XXVI, fig. 4) and it differs from *Karakaschiceras* in fine ornamentation, absence of well developed lateral and ventral tubercles, absence of deep constrictions and in having a very compressed involute shell. In the Crimean succession *Bodrakiceras* appears at the base of the Valanginian succession, while *Karakaschiceras* was recognised only from the uppermost Lower Valanginian (Kojas-Dzhilga region) and from the condensed horizon on the Lower / Upper Valanginian boundary in Kacha River sections. The holotype of *Bodrakiceras inostranzewi* is from Mangush Village (= Prokhladnoe Vil-

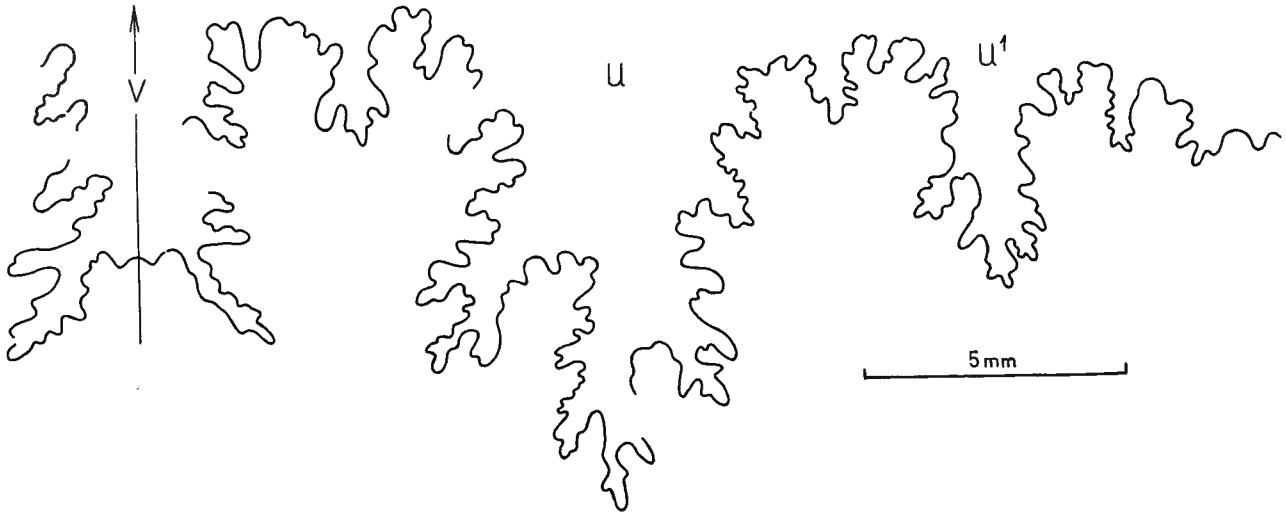



Fig. 6 — The suture line of *Bodrakiceras inostranzewi* (KARAKASCH, 1889*)*; MSU 95/3 under D=44 mm, H=15.0 mm; Lower Valanginian, *Thurmanniceras pertransiens* Zone (?) of Dlinnaya Mt., Prokhladnoe Village.

lage today) and therefore, could appear either from the *Kilianella otopeta* Zone, or from the *Thurmanniceras pertransiens* Zone according to recent data (see BARABOSHKIN, 1997c and BARABOSHKIN & YANIN, 1997). The first finds of *Bodrakiceras* in the Kacha River succession come also from the base of that section. Therefore, the range of *Bodrakiceras* (Figure 10) is extended upward to the top of the Lower Valanginian and very probably up to the base of the Upper Valanginian (if one takes into account finds of *Bodrakiceras* from the condensed Lower / Upper Valanginian horizon in Rezanaya Mt.). Both *Bodrakiceras* and *Karakaschiceras* have smooth ornamentation in the adult, which makes them very similar. It is the reason why previous investigators did not make any attempt to separate these two groups of ammonites. The exception was the work of WIEDMANN (in KUTEK *et al.*, 1989) who proposed to recognise two groups in the genus *Karakaschiceras*. The group of *Karakaschiceras quadristrangulatum* (*K. quadristrangulatum, K. heteroptychum, K. subgibbosum*) differs from the group of *K. biassalense (K. biassalense, K. pronecostatum K. pruszkowskii*) by having smaller size, ''persistent sculpture up to the adult (?), and more primary ribs than umbilical bullae''. AGUIRRE-URRETA (1998) following COMPANY (1987) considered *Leopoldia quadristrangulata* of SAYN (1907: p. 56, pl. III, fig. 21; pl. V, fig. 20) to be a junior synonym of *Hoplites inostranzewi* KARAKASCH and therefore did not agree with such a separation. AGUIRRE-URRETA (1998) figured an extensive collection of ammonites determined as macro- and microconchs of *Karakaschiceras attenuatum* (BEHRENDSEN, 1892), and ''new combination'' of *K. lycoris* (LEANZA & GIOVINE, 1949) and *K. neumayri* (BEHRENDSEN, 1892). The former species in our opinion is a true *Karakaschiceras*, with the exception of the examples figured in figs. 7.4,?7.8, 8.2, 8.3-4, 8.6-7 and 8.8, which could probably be referred to *Bodrakiceras* in having a similar ribbing style of the inner whorls. The species *neumayri* is very close to *Bodrakiceras*, because of the similarity of the cycles of ribbing of the inner whorls and traces of lateral tubercles (figs. 10.8-9, 10.10). However, the presence of 4-6 partite ribs of the middle to adult stage with strong umbilical tubercle is not very typical of *Bodrakiceras* (*B. constrictum* is the exception) and is similar to *Busnardoites* s. s. It is difficult to say something about *Karakaschiceras lycoris* (LEANZA & GIOVINE, 1949) because its inner whorls are unknown.

Among the ammonites figured by AGUIRRE-URRETA (1998) the closest to *Bodrakiceras* are samples of *Neohoploceras arnoldi* (PICTET & CAMPICHE, 1860) on figs. 12.5, 12.6, 12.22-23, 12.24-25 because of the presence of *Bodrakiceras* cycles of ribbing, constrictions and 3 rows of tubercles. In our previous work (BARABOSHKIN & MIKHAILOVA, 1994, p. 44) we have already given our opinion that *Neohoploceras arnoldi* (PICTET & CAMPICHE,1860) cannot be included in *Neohoploceras* because the lectotype of the species (PICTET & CAMPICHE, 1860: p. 252, pl. 35, fig. 1a-b) designated by SAYN (1907), does not possess deep constrictions and enlarged ventral tubercles in the terminal rib of the ribbing cycle (i.e. typical features for *Neohoploceras*). According to this criterion, it seems to us that the only example of true *Neohoploceras* figured by AGUIRRE-URRETA (1998) is the example figured in her fig. 12.13-14. The remaining specimens show ornamentation intermediate between ''*Karakaschiceras*'' (=? *Bodrakiceras) neumayri* (BEHRENDSEN, 1892) and *Neohoploceras*, which confirms the idea of the relation of the *Bodrakiceras* and *Neohoploceras* (Figure 10).

*Hoplites heteroptychum* of PAVLOW (1892: p. 109, pl. 6 (18), fig. 22; text-fig. 1) was referred to *Karakaschiceras* by KEMPER *et al.* (1981, p. 284), KVANTALIANI & SAKHAROV (1986: p. 65, pl. II, fig. 11a-b; text-fig. 10), WIEDMANN (*in* KUTEK *et al.* 1989). According to AGUIRRE-URRETA (1998, p. 51) this species should be included in the synonymy of *Neohoploceras arnoldi* (PICTET & CAMPICHE, 1860) because of the specifics of morphology. Unfortunately, the lectotype of the species was decomposed (KEMPER *et al.* 1981, p. 284), but PAVLOW's figure and the badly preserved sample from the type locality (1981: p. 284, pl. 41, fig. 16-17), demonstrates that it does not possess complex bidichotomic ribs with high ventral tubercles - the very typical feature of *Neohoploceras.* On the contrary, it has cycles of ribbing and equal ventral tuberculation characteristic of *Bodrakiceras*. However, its more evolute shell and very late smoothing of ribbing differentiate this species from typical *Bodrakiceras*.

Outer whorls of *Hoplitides brandesi* from the *Saynoceras verrucosum* Zone of Germany (VON KOENEN, 1902: p. 226, pl. VII, fig. 1, 2a-c, 3a-b), have some similarity with *Bodrakiceras*, however its fine-ribbed inner whorls (pl. VII, fig. 3a, pl. XXX, fig. 4a-b) are much closer to *Karakaschiceras*; because they do not have any tubercles and significant constrictions.

*Hoplites (Hoplitides) gibbosum,* described by VON KOENEN (1902: p. 226, pl. VII, fig. 1, 2a-c, 3a-b), from the *Saynoceras verrucosum* Zone of Germany and *Karakaschiceras gibbosum*, figured by KEMPER *et al.* (1981: p. 284, pl. 40, fig. 5-6) is even closer to *Bodrakiceras* in having coarse-ribbed middle whorls, becoming smooth in the adult. However, absence of knowledge of the inner whorls makes its definition as *Bodrakiceras* questionable.

*Karakaschiceras subgibbosum* WIEDMANN (*in* KUTEK *et al.*, 1989: p. 733, pl. 1, fig. 3A-B; pl. 2, fig. 2, text-fig. 4C, 5D) probably could also be referred to *Bodrakiceras*. Several features differentiate it from *Bodrakiceras*: inflated whorlsection, coarse ribbing with umbilical and lateral tubercles, absence of constrictions and the presence of equal ventral tubercles. The latter feature does not allow the inclusion of this species in *Neohoploceras* as advocated by AGUIRRE-URRETA (1998, p. 41, 51). The inflated whorl-section is characteristic of the coarse-

ribbed *Bodrakiceras moutonianum* (D'ORBIGNY, 1850: p. 64, pl. IX, fig. 42), which was refigured by COTTREAU (1934: p. 46, pl. LXIX, fig. 6, 7). The species demonstrates the specific features in the construction of cycles of ribbing: they contain two bidichotomic ribs in the moderate whorls.

*Neocomites trezanensis* (LORY *in* SAYN, 1907), *Karakaschiceras pronecostatum* (FELIX, 1891), *Neocomites copei* (FATMI, 1977) are close to *Bodrakiceras*. The first two differ in possessing evolute shells and by having a different construction of cycles of ribbing. The last of this species is distinguished by dense ribbing without lateral tubercles on internal whorls. *Sarasinella chichalensis* (SPATH, 1939: p. 101, pl. 21, fig. 4a-c (only)) has some similarity with *Bodrakiceras,* but the holotype of this species (fig. 3) differs by the presence of several bidichotomic ribs in a cycle and late smoothing of the ribbing.

*Leopoldia biassalensis* (TZANKOV, 1937: p. 60, pl. II, fig. 1, 3 and TZANKOV, 1946: pl. XI, fig. 10, refigured by DIMITROVA, 1967, as *Leopoldia biassalensis* (p. 125, pl. LXII, fig. 1) and *L. pronecostata* (p. 126, pl. LVIII, fig. 2-2a; pl. LXII, fig. 2) because of the presence of umbilical, lateral and ventral tubercles and the general style of ribbing also belong to *Bodrakiceras*.

*Karakaschiceras biassalense* (COMPANY, 1985: p. 124, pl. 2, fig. 11 (only)) from the *Saynoceras verrucosum* Zone of southern Spain also appears to belong to *Bodrakiceras* on account of coarse ventral ribbing and strong umbilical bullae of the outer whorls. This specimen is very close to *Karakaschiceras* gr. *biassalense / inostranzewi* (ETTACHFINI *et al.,* 1998. fig. 2H) from the *campylotoxa* Zone of Morocco for the same reasons. The example of *Neohoploceras arnoldi* (PICTET & CAMPICHE, 1860) of the same age and locality figured by ETTACHFINI *et al.*, 1998: fig. 2C is a typical *Bodrakiceras*, very close to *B. inostranzewi*. It differs from *Neohoploceras* by the absence of enlarged ventral tubercles in the terminal complex rib of the cycle, and less developed umbilical and ventral tubercles.

*Sarasinella discoidea* (COLLIGNON, 1962: p. 50, fig. 884) from the Upper Valanginian *Olcostephanus schenki* Zone of Madagascar is a true *Bodrakiceras*, which has remarkable constrictions, more fully developed than in *B. inostranzewi*. It is very probable that *Sarasinella quadristrangulata* (ibid., 1962, p. 49, fig. 879 (only)) should be included also in this species. *Bodrakiceras discoideum* (COLLIGNON, 1962) from the *Thurmanniceras pertransiens* Zone of the Crimea sections (Pl. 2, Fig 1a-b) is almost identical with the holotype of the COLLIGNON (1962) species, being less ornamented in the outer whorls.

*Sarasinella quadristrangulata* (COLLIGNON, 1962: p. 49, 886 (only)) is similar to *Bodrakiceras inostranzewi*, while *S. quadristrangulata* (COLLIGNON, 1962: p. 49, 880 (only)) is a true *Karakaschiceras* without lateral and umbilical tubercles.

*Leopoldia biassalensis* (COLLIGNON, 1962: p. 52, fig. 888 (only)) and *L. pronecostata* (ibid, 1962: p. 52, fig. 889, 890) possibly should be referred to the same species of *Bodrakiceras*, which has some similarity with *B. inostranzewi* with the exception of more frequent and later smoothening of the ribbing.

*Karakaschiceras* sp. (COPE, 1991: pl. 7, fig. 3) has a great resemblance with *Bodrakiceras inostranzewi*.

*Karakaschiceras* cf. *inostranzewi* (KEMPER *et al.*, 1981: p. 283, pl. 40, fig. 2, 4), *Karakaschiceras* sp. a (KEMPER *et al.*, 1981: p. 286, pl. 41, fig. 18-19), *Karakaschiceras* sp. b (KEMPER *et al.*, 1981: p. 286, pl. 41, figs. 1-3, 8-9) from the Upper Valanginian *Dichotomites hollwedensis* Zone of Germany also belong to *Bodrakiceras. Karakaschiceras* sp. b seems to us to be very close to *Bodrakiceras inostranzewi* in the inner whorls, but differs by possessing a more evolute shell and coarse ribbing of the outer whorls, as in *B. heteroptychum*.

*Karakaschiceras* cf. sp. b from the *Saynoceras verrucosum* Zone of France (KEMPER *et al.*, 1981: p. 286, pl. 41, fig. 1-3, 8-9) also has three rows of tubercles in the innermost part of the shell and should be referred to *Bodrakiceras*.

**Distribution:** Lower Valanginian: *Kilianella otopeta-Campylotoxia campylotoxa* Zone South-West Crimea, Bulgaria, Romania; *Thurmanniceras pertransiens* Zone of Poland, *Campylotoxia campylotoxa* Zone of (?) Pakistan and Morocco. Upper Valanginian: *Dichotomites* spp. beds of Great Britain, *Dichotomites hollwedensis* Zone of Germany, (?) *Saynoceras verrucosum* Zone of North Caucasus, *Saynoceras verrucosum* Zone of France, Spain, *Olcostephanus schenki* Zone of Madagascar, *Karakaschiceras attenuatum* Subzone of *the Olcostephanus atherstoni* Zone of Argentina.

### ***Bodrakiceras constrictum* sp. nov.**

Pl. 2, Fig. 4

1889 - *Hoplites* cfr. *Desori:* KARAKASCH, p. 437, pl. II, fig. 4a-b (pars)

**Species name:** from Latin *constrictus* - having constrictions.

**Holotype:** MSU 95/4 from bed Kp23/15, condensed horizon on the Lower and Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

**Material**: Two complete specimens from Verkhorechie Village, base of Rezanaya Mt., collected by students of the Geological Faculty, Moscow State University.

**Description:** Moderately discoidal shells with trapezoidal whorl-section. Venter slightly convex, clearly separated from the lateral sides. Umbilicus narrow, deep, with sparingly broad umbilical wall, vertical to projecting. The cyclic sculpture consists of 6 - 7 cycles per whorl, separated by constrictions. Cycle of the external whorls consists of a simple rib and a 3-6 partite bunch. Bunch begins at the umbilical wall and divides on the umbilical shoulder into 2 - 3 branches, at a strong , sharp tubercle, stemming from inside the umbilicus. Ribs are weakly sigmoidal and have a second branching (or intercalation) in the middle of lateral side. The frontal branch is thickened in the upper part, reminding one of *Neohoploceras* or *Kilianella*, but a large ventral tubercle is not formed in *B. constrictum*. Simple ribs are without umbilical tubercles, separated from the preceding cycle by a narrow deep constriction, which crosses the venter. The simple rib joints the base of a bunch and "seizes" the constriction inside the bunch (D=45mm). Ribs do not cross the venter and are terminated on the ventro-lateral shoulders by small tubercles. Sculpture quickly smoothes with age (D>60mm).

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 95/4 | 70,5 | 35 | 23,7 | 16 | 6 | 10-15 | 30 | 15 | 75 | -5* |
| 95/23 | 40,5 | 19 | 16 | 11 | 4 | 20 | 35 | 15 | 90 | -3 |

**Remarks:** Deep constrictions and 3-6 partite bunches of terminal ribs, stemming from strong umbilical tubercles distinguish the new species from *Bodrakiceras discoideum* (COLLIGNON). The specific character of the bunches makes this species similar to *Karakaschiceras neumayri* (BEHRENDSEN), but the new species differs by the presence of lateral tubercles, deep constrictions and trapezoidal whorl-section.

**Distribution:** As for the holotype.

Genus ***Busnardoites*** NIKOLOV, 1977

1977 - *Busnardoites*: NIKOLOV, p. 642.
1987 - *Busnardoites*: COMPANY, p. 144.
1996 - *Neocomites* (*Neocomites*): WRIGHT *et al.*, p. 60 (pars).

**Type:** *Ammonites Desori* (PICTET & CAMPICHE, 1860: p. 246, pl. 33, fig. 4a-b), Lower Valanginian, Sainte-Croix, Vaud, Switzerland.

**Diagnosis:** Medium to large, moderately involute, discoidal shells, with a high trapezoidal (to rounded trapezoidal) whorl-section and convex venter. Umbilicus narrow, deep; the umbilical wall is comparatively narrow, vertical, or with a weak negative sloping. The cycled neocomitid sculpture is formed by simple ribs, one or two 3-5 partite bidichotomic bunches. Bidichotomic ribs

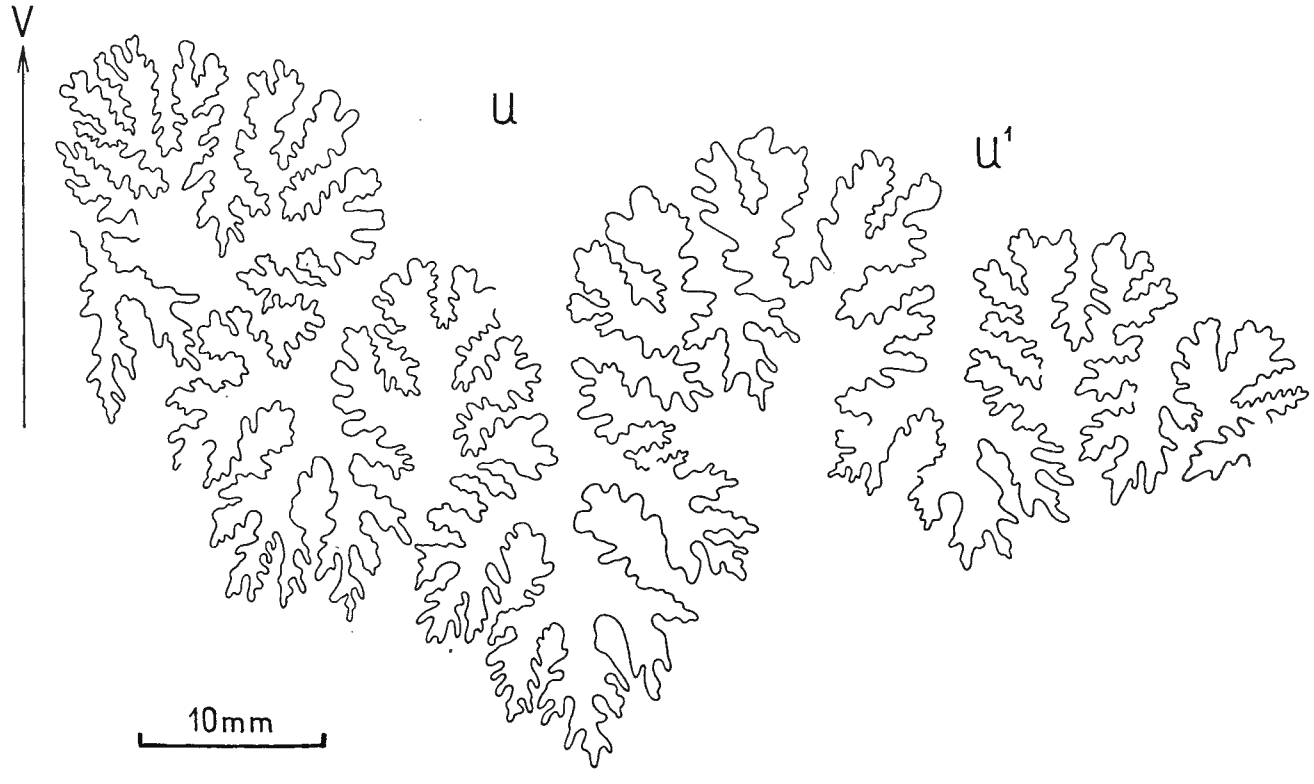



Fig. 7 — The suture line of the holotype of *Busnardoites* (?) *kojasdjilgensis* sp. nov.; MSU 95/8 at D=140 mm and H=81 mm; Lower Valanginian, *Campylotoxia campylotoxa* Zone of Kojas - Dzhilga Ravine, near Nauchny Town.

begin on the umbilical wall in the pronounced umbilical tubercle, directed inside the umbilicus. Simple ribs do not have tubercles. The point of branching of bidichotomic bunches is marked by a tubercle on the early whorls (D<20mm), which disappears with age. Cycles of ribbing (10 per whorl) include a simple rib and a bunch separated from each other by narrow constrictions. The cycled sculpture disappears in the adult, but retains bidichotomic ornament. Ribs divide at mid-whorl height. Ribs are terminated on the ventro-lateral shoulder by tubercles having an angle of 60-80$^0$ in the plane of symmetry of the shell.

**Suture line:** with asymmetric tripartite second umbilical lobe (U) and shallower tripartite, comparatively symmetrical, first umbilical lobe ($U^1$).

**Composition**: *Busnardoites desori* (PICTET & CAMPICHE, 1860); *B.* (?) *kojasdjilgensis* sp. nov. (see below); *B. makariopolskii* NIKOLOV, 1977; *B. subcampylotoxus* NIKOLOV, 1977.

**Remarks:** The morphology of the genus reminds one of different representatives of the Neocomitidae: *Bodrakiceras* gen. nov. (see above), *Campylotoxia* gen. nov. (see below), *Dicostella* BUSNARDO, 1966 (*in* BUSNARDO *et al.*, 1966) and *Teschenites* THIEULOY, 1971.

*Busnardoites* is distinguished from *Bodrakiceras* by the absence of bifurcate and intercalated ribs, as well as by the development of lateral tubercles in cycles on the early whorls. The genus *Dicostella* is characterised by absolutely different ornament cycling and by weakly developed umbilical tubercles on internal whorls; the shell is becoming more evolute in the adult. *Teschenites* is more evolute and has fine ribbing in the inner whorls.

NIKOLOV (1977) related the *desori* type to "*Sarasinella* (?) *schardti* (BMBG.)", which belongs to *Neohoploceras* (see BARABOSHKIN & MIKHAILOVA, 1994). The absence of large ventral tubercles in this sample, the characteristic feature of *Neohoploceras*, excludes this attribution.

NIKOLOV, the author of *Busnardoites*, identified its representatives as: *B. desori, B. campylotoxus, B. subcampylotoxus* and *B. makariopolskii. B. campylotoxus* however, does not have the specific features of *Busnardoites*:- strong umbilical tubercles are missing and the ribs of the internal whorls are not grouped in bunches, having more similarity with *Thurmanniceras*. This species we select as the type of new genus *Campylotoxia,* which is described below.

*Busnardoites concordis* (KVANTALIANI & SAKHAROV, 1986) has yet another style of ribbing with thickened and flattened frontal branch in bunches, which is more characteristic of *Eristavites.*

*(?) Busnardoites* sp. and *Busnardoites* sp. (FARAONI *et al.* 1997: pl. 6, fig. 6 and pl. 5, fig. 11) do not belong in *Busnardoites* being evolute and fine ribbed without umbilical tubercles.

**Distribution:** Lower Upper Valanginian, *Campylotoxia campylotoxa Saynoceras verrucosum* Zones of Switzerland, Bulgaria, France, Crimea: *Haploceras (Neolissoceras) salinarium* Zone of SE Spain, *Campylotoxia campylotoxa* Zone of Morocco.

***Busnardoites (?) kojasdjilgensis* sp.** nov.

Pl. 1, Figs. 3a-b, Text-fig. 7, 11

(?) 1907 - *Hoplites pronecostatus*: KARAKASCH, p. 87, pl. XI, fig. 1a-b (only).

**Species name:** from the Kojas - Dzhilga Ravine, South-West Crimea.

**Holotype:** MSU 95/8. Well-preserved large phragmocone from the Lower Valanginian, *Campylotoxia campylotoxa* Zone of Kojas - Dzhilga Ravine, near Nauchny, South-West Crimea, collected by students of the Geological Faculty of Moscow State University.

**Description:** Large, discoidal, strongly compressed, involute shell with high rhomboidal whorl-section. Umbilicus narrow, not deep, with vertical narrow umbilical wall.

The sculpture occurs only on the outer large whorls. Sinuous ribs (20 per whorl) are bi - tripartite or intercalated. They begin on the umbilical shoulder by small spicate tubercle and divide into broad flattened branches, which is marked by a broad swell. An additional branch intercalates when bifurcation occurs. Ribs terminate in broad flattened ventral tubercles, angled around 60 - 80° to the plane of symmetry of the shell. The narrowing of the venter results in the ventro-lateral merging of opposite ventral tubercles into a single siphonal line.

The increasing and sharpening of umbilical tubercles, typical for *Busnardoites*, can be observed in the umbilical area. Cycles of ribbing of the inner whorls consist of a simple rib and a bunch of rib, separated by constrictions. The innermost cycles, as could be seen, consist of two bunches.

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 95/8 | 166 | 88,5 | 42 | 30 | 7 | 0 | 7 | 10 | 60-80 | -5 |

**Suture line** (Figure 7): under D=140mm is strongly fissioned. Shortened bifurcate ventral lobe (V) is near to double the depth of the very large asymmetric umbilical lobe (U). The first umbilical lobe ($U^1$) is tripartite, sufficiently large, subsymmetrical. An external saddle is bipartite and projects remarkably over the tripartite lateral saddle.

**Remarks:** *Busnardoites kojasdlilgensis* clearly differs from the type of *Busnardoites* by the character of cyclicity of internal whorls (it has two bunches and a single rib) and the sculpture of external whorls, as well as by strongly involute discoidal shell.

*Hoplites pronecostatus* (FELIX, 1891), figured by KARAKASCH [SPU 103/495; 1907, p. 87, pl. 11, fig. 1a-b (only)] is very close to our species, but has more dense ribbing in the internal whorls. The specimen SPU 103/494 figured on pl. 10, fig. 10a-b in KARAKASCH (1907) differs from *Busnardoites* in having umbilical and lateral tubercles in the inner whorls. Probably it belongs to *Bodrakiceras.*

Regrettably, only the umbilical parts of the internal whorls of our new species were available for study. By morphology they are very close to the type of *Busnardoites*, but are distinguished by less coarse ribbing and less projecting tubercles. Therefore, we consider that the species can be referred to *Busnardoites*.

**Distribution**: Lower Valanginian, *Campylotoxia campylotoxa* Zone of South-West Crimea.

Genus ***Campylotoxia*** gen. nov.

**Generic name:** derived from the type species.

**Type:** *Hoplites campylotoxus* UHLIG (1902, p. 49, pl. 4, fig. 2), Lower Valanginian of Dolni Listna, Carpathians, Slovakia.

**Diagnosis:** Moderately evolute, medium size shells, having high trapezoidal and sparingly high rounded-trapezoidal whorl-section and slightly keeled venter. Umbilicus broad, shallow; umbilical wall is steep to vertical, narrow.

Ribs are grouped in cycles, which are separated by a weak constrictions in the earliest whorls (D<10mm) and represented by sinuous single, bifurcate, 3-4 - branch ribs and bidichotomic bunches. Ribs are flattened near the venter and terminate on the ventro-lateral shoulder by small tubercles. Cycles commence with a single rib followed by two bifurcate ribs, branching on the umbilical border or, rarely, - in the mid-lateral flanks. Under D>20mm this border is marked by a spiny umbilical tubercle. The cycle terminates by a 3-4 - branched rib or a tripartite bidichotomic rib, one of the branches of which has additional bifurcation in the mid - to upper third of the whorl height. The ventral flattened tubercles are orthogonal to the plane of symmetry of the shell in the early whorls, but they become subparallel to it in adult. There are about 10 cycles of ribbing per whorl.

**Suture line:** is characterised by trifid umbilical lobe (U), deeper than the ventral lobe and noticeably inclined to the wedge of the seam; the first umbilical lobe ($U^1$) trifid, half as deep as the umbilical lobe.

External saddle (V/U) is broad and asymmetric; the first lateral saddle ($U/U^1$) is also asymmetrical. It is higher, but narrower than the external saddle.

**Composition:** *Campylotoxia brasseuri* (COLLIGNON, 1962); *C. evoluta* sp. nov.; *C. campylotoxa* (UHLIG, 1902) with two subspecies: *C. campylotoxa campylotoxa* (UHLIG, 1902) and *C. campylotoxa densocostata* subsp. nov.

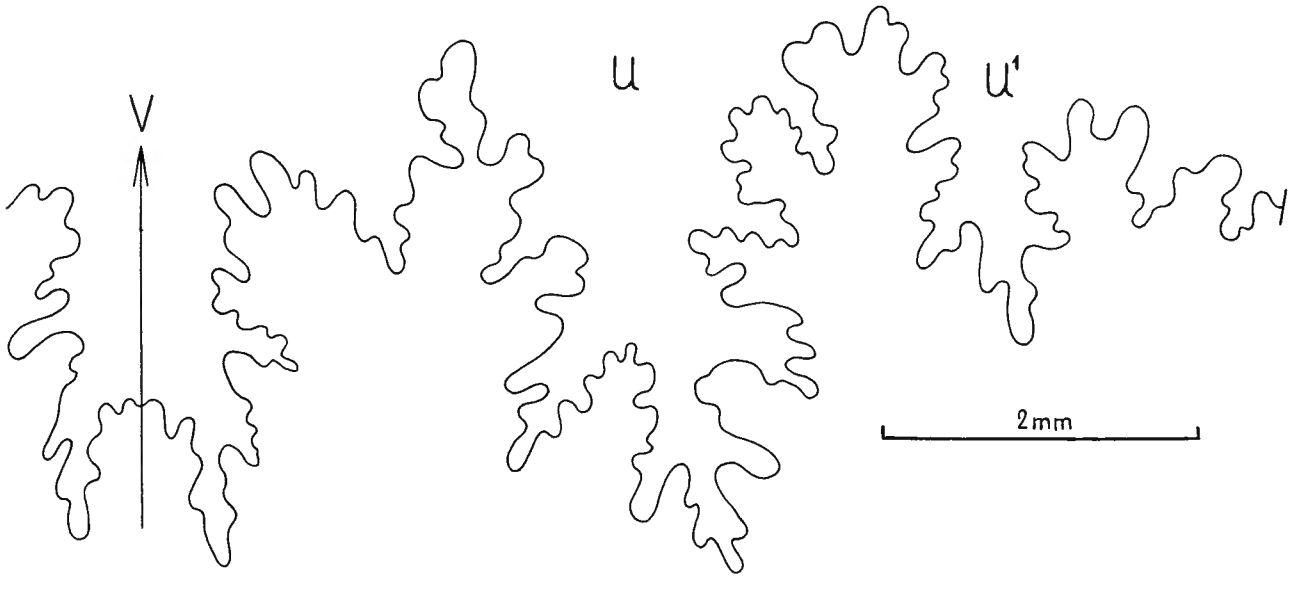



Fig. 8 — The suture line of *Campylotoxia campylotoxa campylotoxa* (UHLIG, 1902); MSU 95/15 at H=10 mm; Lower Valanginian, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt., bed Kp23/15.

Table 1 — Schema of the biostratigraphic zonation of the Valanginian of the south east Crimea.

| SUBSTAGE | R.Busnardo, J.-P.Thieuloy, 1979 HYPOSTRATOTYPE ZONE | SUBSTAGE | N.I.Karakasch, 1907 BIASALA | SUBSTAGE | V.V.Drushits, 1960; B.T.Yanin, L.E.Vishnevsky, 1989 KACHA RIVER ZONE | SUBSTAGE | E.J.Baraboshkin, 1997b BODRAK RIVER - KACHA RIVER ZONE |
|---|---|---|---|---|---|---|---|
| UPPER VALANGINIAN | Teschenites callidiscus | HAUTERIVIAN | Sandstones with *Duvalia crimica* and *Holectypus* | UPPER HAUTERIVIAN | Crioceratites duvali | UPPER VALANGINIAN | Eleniceras tauricum |
| | | | | | | | Teschenites callidiscus |
| | Himantoceras trinodosum | | | LOWER HAUTERIVIAN | Leopoldia leopoldina and Trigonia carinata | | Himantoceras trinodosum |
| | Saynoceras verrucosum | VALANGINIAN | Conglomerates with *Hoplites* and *Ostrea rectangularis* | | | | Saynoceras verrucosum |
| LOWER VALANGINIAN | Thurmanniceras campylotoxum | | | | | LOWER VALANGINIAN | Campylotoxia campylotoxa |
| | Thurmanniceras pertransiens | | | | | | Thurmanniceras pertransiens |
| | Thurmanniceras otopeta | | | | | | Kilianella otopeta |

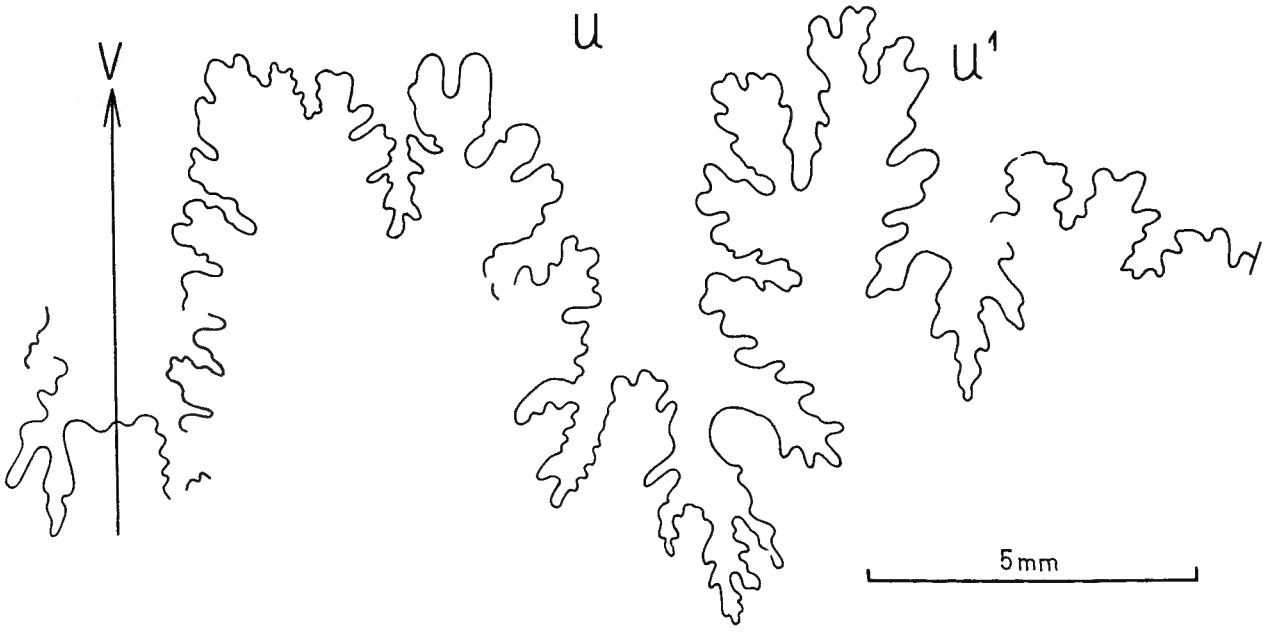



Fig. 9 — The suture line of the holotype of *Campylotoxia campylotoxa densocostata subsp. nov.*; MSU 95/12 at H=13 mm; Lower Valanginian, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt., bed Kp23/15.

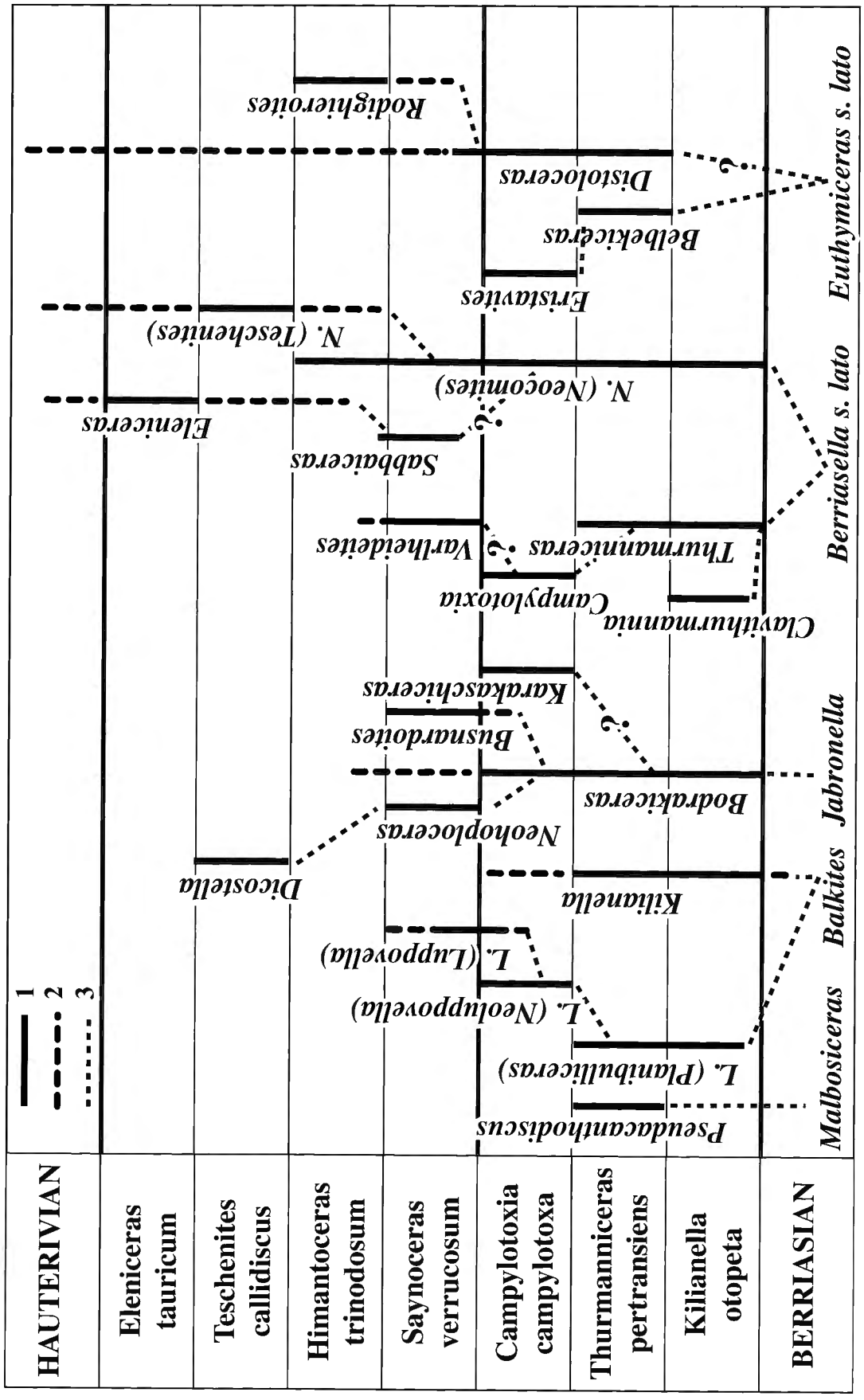



Fig. 10 — Proposed phylogenetic schema of Neocomitinae SALFELD, 1921 compiled from ATROPS & REBOULET, 1993, 1995; AUTRAN, 1989; BULOT & THIEULOY, 1993, 1994; BULOT*et al.*, 1992; BUSNARDO & THIEULOY, 1979; COMPANY, 1987; FARAONI *et al.* 1997; REBOULET *et al.*, 1992; VASICEK, 1994; VASICEK & FAUPL, 1996 and our own data.

**Remarks.** *Campylotoxia* is close to *Thurmanniceras* COSSMANN, 1901, *Busnardoites* NIKOLOV, 1966, *Sarasinella* UHLIG, 1905, *Kilianella* UHLIG, 1905, *Neocomites* UHLIG, 1905 and *Varlheideites* RAWSON & KEMPER, 1978. It differs from the genus *Thurmanniceras* by a different construction of cycles of ribbing, low rib branching and ventral tubercles, which are subparallel to the plane of symmetry already in the middle whorls. *Campylotoxia* is distinguished from *Busnardoites* s.s. by a different style of ribbing in its inner whorls, by the absence of strong umbilical tubercles in the early whorls, by the flattening of ribs, by the smaller number of branches in bunches and by ventro-lateral tubercles subparallel to the plane of symmetry. *Sarasinella* has well-marked lateral tubercles completely missing in the early whorls of *Campylotoxia*. *Kilianella* has deep constrictions, high-branched ribs and large rounded ventro-lateral tubercles in the end of cycles of ribbing. The genus *Neocomites* has a different construction of cycles of ribbing in the early whorls. The morphology of the middle whorls of *Varlheideites* RAWSON & KEMPER, 1978 is close to *Campylotoxia* but the presence of frequent fine ribs in the inner whorls and the appearance of lateral and ventro-lateral tubercles, clearly distinguishes the new genus.

*Sarasinella* sp. aff. *ambigua* (COLLIGNON, 1962; p. 26, fig. 829) possibly belongs to *Campylotoxia*, because of the close style of ribbing, but it is distinguished by the presence of weak constrictions, which appear in the adult whorls.

NIKOLOV (1977) was the first, to indicate the morphological specificity of the "*Hoplites*" *campylotoxus* group. He included it in *Busnardoites* NIKOLOV, 1966. Close examination of the internal whorls of *Busnardoites*, available in our collection, has revealed their essential differences. The revision of the *campylotoxus* group has shown that these ammonites have a sufficiently specific morphology of ribbing, to allow the separation of *Campylotoxia* as a new genus. This genus occupies a well-defined position at the end of the Lower Valanginian. We assume after NIKOLOV (1977) that *Campylotoxia* is a direct descendant of *Thurmanniceras* and has great morphological resemblance with it.

**Distribution**. Lower Valanginian, *Haploceras (Neolissoceras) salinarium* Zone of Spain, *Campylotoxia campylotoxa* Zone of France, Bulgaria, Carpathians, Crimea, Morocco, Pakistan and *Hibolites joleaudi* & *Neocomites teschenensis* Zone of Madagascar, *Saynoceras verrucosum* Zone of Italy.

### *Campylotoxia campylotoxa campylotoxa* (UHLIG, 1902)

Pl. 3, Figs. 2a-b, 3, 4a-b, 6, Text-fig. 8

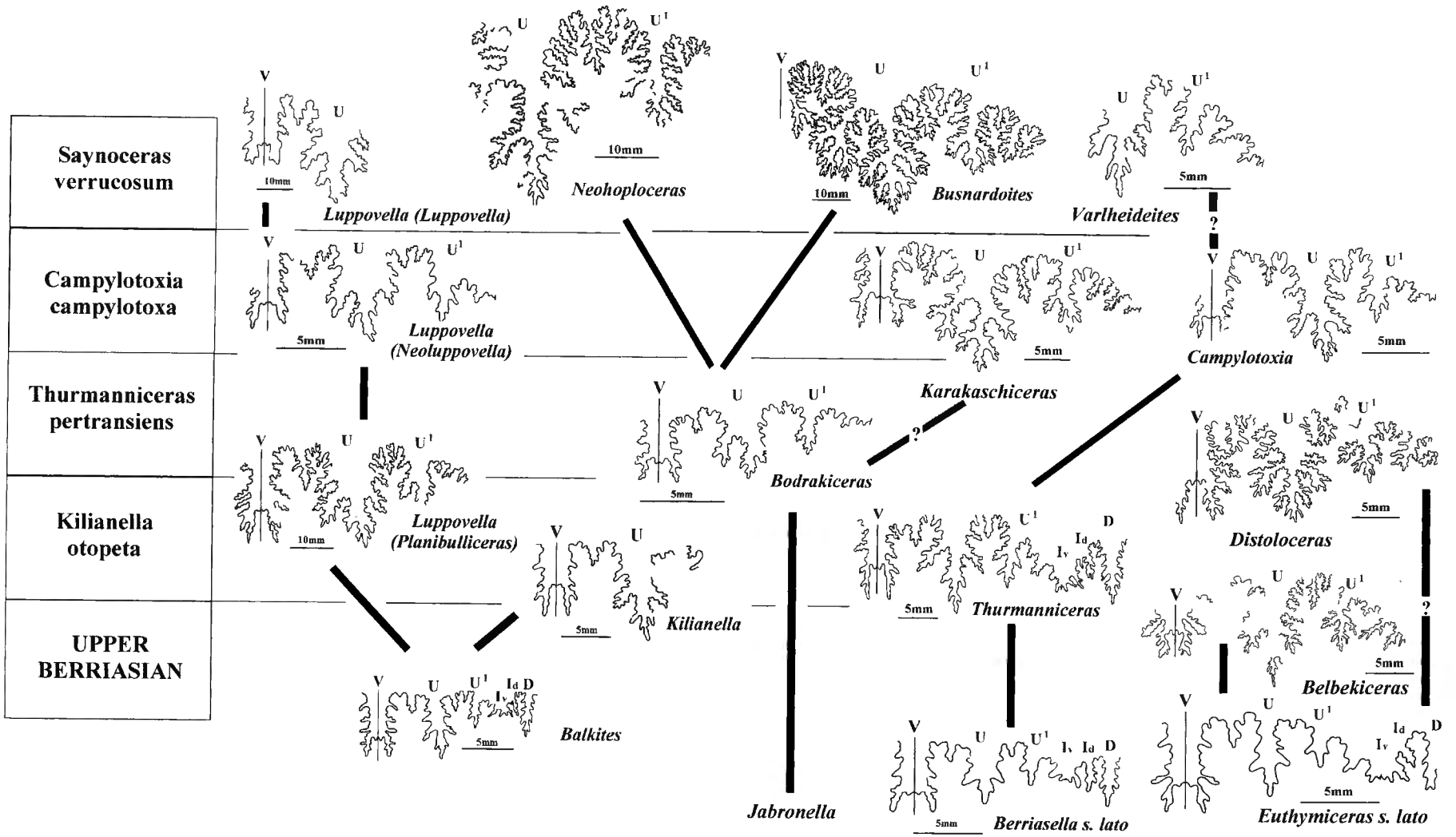
1902 - *Hoplites campylotoxus*: UHLIG, p. 49, pl. 4, fig. 1a-b, 2 (only).
1907 - *Thurmannia campylotoxa*: SAYN, p. 42, pl. 5, fig. 12.
1907 - *Hoplites* (*Neocomites*) aff. *campylotoxus*: TOULA, p. 87, pl. X, fig. 5.
1934 - *Hoplites amblygonium*: STEFANOV, p. 218, pl. VII, fig. 2 (only).
1939 - *Sarasinella* aff. *campylotoxa*: SPATH, p. 103, pl. XXII, fig. 9.
(?) 1946 - *Hoplites ambligonium*: TZANKOV, pl. XI, fig. 10
1960 - *Lyticoceras oxygonius*: DRUSHITS, p. 284, pl. XXVI, fig. 6.
1960 - *Thurmanniceras campylotoxum*: NIKOLOV, p. 178, pl. XIX, figs 1, 2 (only).
1967 - *Thurmanniceras campylotoxum*: DIMITROVA, p. 110, pl. XLVII, fig. 6.
1975 - *Thurmanniceras campylotoxum*: VASICEK, p. 90, pl. VI, figs. 1, 3; text-fig. 5.
1977 - *Busnardoites campylotoxus*: NIKOLOV, p. 112, text.-fig. 3 (only).
1979 - *Thurmanniceras campylotoxum*: THIEULOY, p. 46, pl. 2, figs. 4-6.
1981 - *Busnardoites campylotoxus*: ARNAUD *et al.*, pl. 2, fig. 1.
1986 - *Busnardoites campylotoxus*: VASICEK & MICHALIK, p. 466, pl. VI, fig. 2.
(?) 1997 - *Busnardoites campylotoxus*: FARAONI *et al.*, pl. 6, fig. 3 (only).
(?) 1998 - *Neocomites teschenensis*: ETTACHFINI *et al.*, fig. 2G

**Holotype:** MM No.ASIII158; Dolni Listna , Carpathians, Slovakia, Lower Valanginian.

**Material:** The material we have includes three complete specimens of good preservation (Nos. 95/9, 95/10, 95/15) and several fragments from the Verkhorechie Village, base of Rezanaya Mt., bed Kp23/15, condensed horizon on the Lower / Upper Valanginian boundary layer, *Campylotoxia campylotoxa* Zone (?), authors' collection and collected by students of the Geological Faculty, Moscow State University.

**Description**. Moderately evolute shells with high rounded hexagonal to trapezoidal whorl-section. Venter slightly keeled; umbilical wall is steep, subvertical and narrow. Umbilicus moderately broad, shallow.

The sculpture consists of 2-4 - partite ribs and bidichotomic ribs, which are grouped in cycles, separated by constrictions. Cycles of the internal whorls (D<10mm) consist of two - three single ribs, bifurcate rib, which branch in mid-whorl height and a tripartite rib. Ribs have flattened umbilical tubercle, directed obliquely backwards. The frontal rib of each cycle branches at the mid-whorl height without a tubercle. Cycles of the intermediate whorls (D<40mm) are represented by single and 2-4 bifurcate ribs branching on the umbilical border. Cycles of late whorls (D>40mm) are formed by single rib (can be absent), one or two bifurcate ribs branching on the umbilical border or above it, and tripartite ribs (one of its branches has an additional branching in the mid - upper third of the whorl height). Constrictions are not observed. Ribs broad, flattened, terminated by equal ven-


Saynoceras verrucosum
Campylotoxia campylotoxa
Thurmanniceras pertransiens
Kilianella otopeta
UPPER BERRIASIAN
Luppovella (Luppovella)
Neohoploceras
Busnardoites
Varlheideites
Luppovella (Neoluppovella)
Karakaschiceras
Campylotoxia
Bodrakiceras
Luppovella (Planibulliceras)
Distoloceras
Kilianella
Thurmanniceras
Belbekiceras
Balkites
Jabronella
Berriasella s. lato
Euthymiceras s. lato
10mm
5mm

tro-lateral tubercles, which are perpendicular (D<40mm) and subparallel (D>40mm) to the plane of symmetry of the shell. The cyclicity disappears under D>90mm, and the tripartite ribs with strong umbilical tubercles dominate.

Rare zigzag and looped ribs appear due to interruption of shell growth. Some of our samples differ from the holotype by rare adapertural quadripartite bunches (2 per the whorl).

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 95/15 | 32 | 14,5 | 9,5 | 9 | 2 | 20-25 | -20 | 10 | 50 | 85-90 |
| 95/11 | | 23,5 | - | 12,4 | 3 | 35 | -30 | - | - | 90 |
| 95/10 | 57,5 | 23,5 | 19,5 | 19 | 4 | 30 | -30 | 20-25 | 10-15 | 80 |
| 95/9* | 110 | 44,5 | 34 | 36 | 8 | 10 | -10 | 15 | 5 | 90 |

* - measurements were made on a preserved part of the phragmocone

←

Fig. 11 — Trends of change in the suture line in some Valanginian neocomitids based on the suture lines of *Luppovella (Neoluppovella) spinosa* subgen. et sp. nov. - Text-Fig. 4, *Belbekiceras belbekii* BARABOSHKIN, 1997 - Text-Fig. 5, *Busnardoites* (?) *kojasdjilgensis* sp. nov. - Text-Fig. 7, *Campylotoxia campylotoxa densocostata subsp. nov.* - Text-Fig. 9, *Kilianella otopeta* (THIEULOY, 1979), MSU 95/17 (see Pl. 4, Fig. 3), *Bodrakiceras* aff. *discoideum* (COLLIGNON, 1962), MSU 95/7 (see Pl. 2, Fig. 3), *Karakaschiceras biassalense* (KARAKASCH,1890), MSU 95/24, (see Pl. 4, Fig. 1), *Thurmanniceras* sp., MSU 95/26, *Neohoploceras* sp., MSU 95/25, *Distoloceras* sp., MSU 95/28, *Varlheideites* sp., MSU 95/27, *Luppovella (Planibulliceras) kachensis* BARABOSHKIN & MIKHAILOVA, 1994, MSU 5/93 (from BARABOSHKIN & MIKHAILOVA, 1994, text-fig. 5), *Luppovella (Luppovella) baumbergeri* (SPATH, 1939), MSU 3/93 (from BARABOSHKIN & MIKHAILOVA, 1994, text-fig. 4).

For the suture lines of Berriasian ammonites we have used *Balkites nerodenkoi* BOGDANOVA & KVANTALIANI, 1983 (Bogdanova collection); *Euthymiceras* s.l. is based on *Transcaspiites transcaspius* (LUPPOV, 1949) ARGI 25/11104 (from BOGDANOVA *et al.*, 1985, text-fig. 3); *Berriasella s.l. is based on Dalmasiceras dalmasi* (PICTET, 1867), ARGI 371/10 (Bogdanova collection).

**Suture line** (Figure 8): Ventral lobe (V) is shorter than the trifid umbilical lobe (U), noticeably deviating towards the umbilicus. The first umbilical lobe ($U^1$) is only half as deep as the umbilical lobe (U).

The external and first lateral saddles are bifurcate and unequal. The external saddle is broader and shallower than the first lateral saddle.

**Remarks:** The type of the species was chosen by UHLIG (1902: *Hoplites campylotoxus*, p. 49, pl. 4, fig. 2). VASICEK (1975: p. 90, pl. VI, fig. 1) refigured this specimen and formally named it the lectotype. *Hoplites campylotoxus* (UHLIG, 1902: p. 49, pl. 4, fig. 3) and refigured by VASICEK (1975, p. 90: pl. VI, fig. 2) as *Thurmanniceras* cf. *campylotoxum,* should be considered probably as a new species, because it has very rare ribs and tubercles in the point of branching.

There are very many references to this species in the literature.

*Thurmannia* (*Kilianella*) *campylotoxa* (COHEN, 1933: p. 163, pl. 2, fig. 11), *Thurmanniceras campylotoxus* (SAPUNOV, 1957: p. 158, pl. 3, fig. 7) and *Thurmannia* (*Kilianella*) *campylotoxa* (STEFANOV, 1934: p. 214, pl. 6, fig. 10, 11), *Thurmannites* cf. *campylotoxus* (ERISTAVI, 1955: p. 91, pl. III, fig. 5), *Thurmanniceras campylotoxum* (NIKOLOV, 1960: p. 178, pl. XX, fig. 3), *Busnardoites campylotoxus* (MICHALIK & VASICEK, 1989: p. 513, pl. 1, fig. 1) belong mainly to *Teschenites* because of the presence of fine ribbed inner whorls with weak umbilical tubercles.

*Hoplites campilotoxus* (*sic*) (LEMOINE, 1906: p. 180), *Thurmannia* (*Kilianella*) *campylotoxa* (ACKERMANN, 1932: p. 42) and *Thurmanniceras campylotoxum* (ERISTAVI, 1961: p. 95) were described without figuring, so exact identification is impossible.

*Sarasinella* aff. *campylotoxa* (SPATH, 1939: p. 103, pl. XXII, fig. 5a-b) according to the description, has three tubercles on ribs of the internal whorls and cannot therefore be referred to *Campylotoxia*.

*Sarasinella* sp. aff. *campylotoxa* (COLLIGNON, 1962: p. 26, figs. 830, 831) belongs to different genera. The sample figured on fig. 830, has fine, not flattened, weakly curved ribs and reminds one of *Thurmanniceras*. The weakly keeled sample (fig. 831) has intercalated single and bifurcating slightly curved ribs and possibly belongs to *Eristavites*.

*Neocomites (Neocomites) campylotoxus* (FATMI, 1977: p. 279, pl. 8, figs. 3, 4): the specimen in fig. 4 is almost identical with *Campylotoxia brasseuri*, and the specimen in fig. 3 has prevailing bipartite ribs and should referred to another species.

*Busnardoites campylotoxus* (MICHALIK & VASICEK, 1989:

p. 531, pl. 1, fig. 1, reproduced in VASICEK, 1994: p. 180, pl. 1, fig. 1), is distinguished from *Campylotoxia campylotoxa* by more frequent ribbing, weakened in the middle of whorls and is similar to *Teschenites neocomienseformis* HOHENEGGER *in* UHLIG, 1902.

*Busnardoites campylotoxus* (COMPANY, 1987: p. 145, pl. 11, fig. 12, 13; pl. 19, fig. 13) is referred by us to the new subspecies *Campylotoxia densocostata,* described below.

*Neocomites* sp. (KEMPER, 1976: pl. 30, fig. 10), redefined later as *Thurmanniceras* cf. *campylotoxum* (KEMPER *et al,* 1981: p. 279), has bidichotomic ribs with high branching as in *Teschenites.*

*Hoplites ambligonium* (TZANKOV, 1946: pl. XI, fig. 10) is close to *Campylotoxia campylotoxa* by the type of cyclicity of its ribs, but its poor preservation does not allow a complete identification.

It seems that only one sample of *Busnardoites campylotoxus* figured by FARAONI *et al.* (1997: pl. 6, fig. 3) has ribbing close to the real *Campylotoxia campylotoxa.* The other specimens (pl. 6, fig. 1 and 2) are closer to *Thurmanniceras*, because they have a very high point of rib-branching. The record of *C. campylotoxa* from the *Saynoceras verrucosum* Zone, is doubtful in the absence of that species in the lower Upper Valanginian. We think that the sections, described by FARAONI *et al.* (1997) are characterised by the earliest appearance of *Saynoceras verrucosum* and thus of early Late Valanginian age.

*Neocomites teschenensis,* figured by ETTACHFINI *et al.* (1998: fig. 2G) is very similar to *Campylotoxia campylotoxa*, having the same style of ribbing, bipartite in the inner whorls. Unfortunately the other parts of the sample are not well-preserved and complete identification is difficult.

Similar to *Campylotoxia campylotoxa* is *C. brasseuri* (COLLIGNON), which differs by the prevalence of single ribs and by bifurcate tripartite ribs at the end of each cycle of ribbing. Its cycles of ribbing consist of two to four single, one bipartite, and one bifurcate tripartite rib, as is apparent in the type of *Sarasinella brasseuri*, COLLIGNON, 1962: p. 26, fig. 832). The presence of bipartite ribs with a high point of branching indicates similarity of this species with the genus *Thurmanniceras.*

**Distribution**. Lower Valanginian, *Campylotoxia campylotoxa* Zone of Crimea, France, Slovakia, Bulgaria, Pakistan, Morocco; *Haploceras (Neolissoceras) salinarium* Zone of Spain, (?) Upper Valanginian *Saynoceras verrucosum* Zone of Italy.

***Campylotoxia campylotoxa densocostata* subsp. nov.**

Pl. 2, Fig. 7; Pl. 3, Figs. 1a-b, Text-fig. 9, 11

1934 - *Hoplites amblygonium*: STEFANOV, p. 218, pl. VII, fig. 1 (only).
1987 - *Busnardoites campylotoxus*: COMPANY, p. 145, pl. 11, fig. 12, 13; pl. 19, fig. 13.

**Subspecies name:** from Latin *densus* - frequent and *costatus* - ribbed.

**Holotype:** MSU 95/12 a complete specimen of good preservation from bed Kp23/15, condensed horizon on the Lower/Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

**Paratypes:** several fragments of satisfactory preservation from the same locality collected by students of the Geological Faculty, Moscow State University.

**Description:** Moderate, with high trapezoidal whorl-section and weakly keeled venter. Umbilicus relatively narrow, shallow; umbilical wall is vertical to projected, narrow.

Sculpture consists of rare simple ribs, 3-4 - partite and bidichotomic rib, branching at an umbilical tubercle. Ribs terminate by ventro-lateral tubercles, which become subparallel to the plane of symmetry of the shell in adult. Cycles of ribbing are separated by weak constrictions and not very typical for the genus, because single ribs are presented in internal whorls only. Cycles of internal whorls (D<20mm) begin by a simple or bifurcate rib and include also 2 - 3 bifurcate ribs and a tripartite rib terminating the cycle. Cycles of the external whorls (D=20-40mm) each consist of a bifurcate rib and tripartite rib. There are up to 9 cycles per whorl. The cyclicity disappears later (D>50mm) and the ribbing then consists of tripartite bidichotomic ribs with additional branching on one of the branches.

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 95/12 | 52 | 21,5 | 15,5 | 16 | 3 | 30 | -10 | 10-15 | 15 | -5; 90 |
| 95/13 | - | 20 | 14 | - | 3 | 30 | -15 | 15 | 15 | 90 |

**Suture line** (Figure 9): Ventral lobe (V) is narrow, deep and bifurcate; umbilical lobe (U) is tripartite, somewhat asymmetric, strongly deviating inside umbilicus; the first umbilical lobe ($U^1$) is twice shorter than the umbilical lobe (U).

External (V/U) and first lateral ($U/U^1$) saddles are asymmetric, but the former is broader and somewhat shallower than the latter.

**Remarks:** The new subspecies is distinguished from *C. campylotoxa campylotoxa* by denser ribbing, nearly complete absence of single ribs in cycles and development of tripartite ribs on the outer whorls.

The holotype has a weak original damage on the shell of the body-chamber, which is not a change of style of ribbing. All samples came from the horizon of condensation at the Lower/Upper Valanginian boundary. They were met in reworked condition together with *Campylotoxia campylotoxa*. This allows us to expect that their primary distribution was in the *campylotoxa* Zone.

**Distribution:** Lower Valanginian, *Campylotoxia campylotoxa* Zone (?) of Crimea, Lower Valanginian of Bulgaria, *Haploceras (Neolissoceras) salinarium* Zone of Southern Spain.

### *Campylotoxia evoluta* sp. nov.

Pl. 3, Figs. 5a-b

1907 - *Hoplites* cfr. *amblygonius*: KARAKASCH, p. 86, pl. XI, fig. 6a-b.

**Species name:** from Latin *evolutus* - unrolled.

**Holotype:** MSU 95/14, complete specimen of good preservation from bed Kp23/15, horizon of condensation on the Lower/Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?), Verkhorechie Village, base of Rezanaya Mt., collected by students of the Geological Faculty, Moscow State University.

**Description:** Moderately evolute with rounded-rectangular (on the early whorls) and trapezoidal (on the late whorls) whorl-section and weakly keeled venter. Umbilicus relatively narrow, shallow; umbilical wall is vertical to overhanging, narrow.

Sculpture is formed by single, 2-3 - partite and rare bidichotomic ribs, branching in the umbilical tubercle. Ribs are terminated by ventro-lateral tubercles, perpendicular to the plane of symmetry of the shell on early whorls and subparallel on later whorls. Ventral and umbilical tubercles of terminal bunches are sometimes more prominent. Cycles of ribbing in the internal whorls (D<25mm) include a simple rib, several bifurcate ribs and tripartite rib terminating the cycle. The cycle consists of simple, bifurcate and tripartite rib in the external whorls (D=35-50mm). There are up to 5 cycles per half a whorl.

**Measurements:**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 95/14 | 49 | 19 | 16 | 18 | 3 | 30 | -20 | 25 | 5 | 90 |

**Remarks**: The new species differs from *C. campylotoxa* in its more open ribbing, less curved ribs and a more depressed whorl-section. It is distinguished from *Campylotoxia brasseuri* by coarser ribbing and by rare simple ribs.

**Distribution:** Lower Valanginian, *Campylotoxia campylotoxa* Zone (?) of Crimea.

### Genus ***Pseudacanthodiscus***
BARABOSHKIN, 1997

1997a - *Pseudacanthodiscus*: BARABOSHKIN, p. 117.
2000 - *Pseudacanthodiscus*: BARABOSHKIN, p. 105.

**Type species:** *Pseudacanthodiscus crymicus* BARABOSHKIN, 1997; Lower Valanginian, *Thurmanniceras pertransiens* Zone of South-West Crimea.

**Diagnosis:** Large, moderately evolute shells, with octagonal whorl-section. Umbilicus relatively narrow with steep umbilical walls.

Cycles of ribbing consist of simple, bifurcate and intercalated ribs on early whorls, being separated by constrictions. Bifurcate ribs branch in the upper third of the whorl-height at a large flattened tubercle, which appears simultaneously with the umbilical tubercle. Ribs terminate by small flat ventro-lateral tubercles, angled with the plane of symmetry of the shell.

**Composition:** *Pseudacanthodiscus crymicus* BARABOSHKIN, 1997; *P. subradiatus* (UHLIG, 1910); (?) *P. kuntzi* (COLLIGNON, 1962).

**Remarks**. *Pseudacanthodiscus* is similar to Early Hauterivian *Acanthodiscus* UHLIG, 1905, with which it was partly identified earlier (NIKOLOV, 1960). It differs from *Acanthodiscus* by coarser sculpture with constrictions in the early whorls, coarse ribbing on late whorls and the ventro-lateral tubercles, which form an obtuse angle with the plane of symmetry of the shell. The inclusion of *P. subradiatus* (UHLIG, 1910) in *Octagoniceras* SPATH, 1924 (SPATH, 1933: p. 804) or in *Neocosmoceras* BLANCHET, 1922 (FATMI, 1977: p. 266; KRISHNA, J., KUMAR, S. & SINGH, I.B., 1982), is not correct, because of the absence of looped ribs and distinctive spines on the last whorl.

*Neocosmoceras kuntzi*, figured by COLLIGNON (1962: p. 16, pl. 180, fig. 806) from the *Berriasella boissieri* Zone of Madagascar possibly should be included in *Pseudacanthodiscus*, because it has the same type of ribbing, grouped in characteristic cycles. We are not sure of the age of this species, which is probably younger.

The other similar genus is the Berriasian *Mazenoticeras* NIKOLOV, 1966 (especially of the *M. breveti* group: see LE HÉGARAT, 1971), which differs by a

less tuberculated venter, presence of bipartite dichotomic ribs and a more evolute adult stage. It is very probable that it is the ancestor of *Pseudacanthodiscus*.

*Pseudacanthodiscus* is also similar to the Upper Berriasian *Transcaspiites* LUPPOV, 1985 (*in* BOGDANOVA *et al.*, 1985), which differs by the absence of the single ribs in cycles, absence of constrictions and less developed umbilical tubercles.

**Distribution:** *Thurmanniceras pertransiens* Zone of South-West Crimea, Lower Valanginian of Bulgaria, the Himalayas and (?) Madagascar.

***Pseudacanthodiscus crymicus***
BARABOSHKIN, 1997

Pl. 3, Figs. 7a-b

1937 - *Acanthodiscus Euthymi*: TZANKOV, p. 61, pl. IV, fig. 2.
1967 - *Acanthodiscus twanensis*: DIMITROVA, p. 125, pl. LXI, fig. 2.
1997a - *Pseudacanthodiscus crymicus*: BARABOSHKIN, p. 118, pl. 38, fig. 1a-b; 2a-b.
2000 - *Pseudacanthodiscus crymicus*: BARABOSHKIN, p. 105, pl. 5, fig. 8a-b, 9a-b.

**Material: Holotype** MSU 94/8, a nearly complete phragmocone and four large fragments from the Lower Valanginian, bed Kp29/54, condensed *Thurmanniceras pertransiens* Zone of the Sbrosovy Log Ravine, Belbek River, South-West Crimea.

**Description:** Large, moderately evolute shells with octagonal whorl-section, high on the outer whorls. Umbilicus relatively broad, shallow with steep to vertical umbilical wall.

The cyclic sculpture is formed by alternating simple, bifurcate and/or intercalated ribs and constrictions. Fine simple ribs are significantly curved in the direction of the aperture. Bipartite and intercalated ribs are thickened and branched in the upper third of the whorl height. Branches are short, directed forward. A large tubercle appears at the point of branching (intercalation) and on the umbilical shoulder. All ribs terminate by small flattened ventro-lateral tubercles, directed with an angle of 75-80° to the plane of the symmetry of the shell.

The cycles of ribbing consist of one or two simple ribs (at the beginning of each cycle), 3-4 bipartite and intercalated ribs on the early whorls (D=20-30mm) and separated by shallow and narrow constrictions. Cycles of the middle whorls (D=30-60 mm) consist oftwo pairs of bipartite and intercalated ribs and one simple rib between them. Outer whorls (D>60-70mm) are ornamented by alternating simple and intercalated ribs, with loss of lateral tubercles.

**Measurements (see table).**

| No. | D | H | W | Du | Wu | $\alpha_1$ | $\alpha_2$ | $\alpha_3$ | $\beta$ | $\gamma$ |
|---|---|---|---|---|---|---|---|---|---|---|
| 94/13 | | 21,5 | 25 | | 7 | | | 20 | 65 | 85 |
| 94/8 | 85 | 30 | 31 | 34 | 7,5 | 0 | 10-15 | 20 | 50 | 70-80 |
| 94/12 | | 46,5 | 42 | | 8 | | | 20 | 50 | 85 |
| 94/9 | | 62,5 | 50 | | 9 | | | 20 | 45 | 85 |

**Remarks:** *Pseudacanthodiscus crymicus* differs from *P. subradiatus* (UHLIG, 1910) by the presence of simple ribs and broad constrictions on the middle whorls, and a very small angle between the ventro-lateral tubercles and the plane of symmetry of the shell.

DIMITROVA (1967) has refigured *Acanthodiscus euthymi* (from TZANKOV, 1937) as *Acanthodiscus twanensis*. It is very similar to large fragments of *Pseudacanthodiscus crymicus,* and differs from *Acanthodiscus* by straightened bi - tripartite ribs.

**Distribution:** Lower Valanginian, *Thurmanniceras pertransiens* Zone of South-West Crimea, Lower Valanginian of Bulgaria.

## Discussion

The results of our investigation of the Valanginian ammonites from Crimea permit a more complete knowledge of the Neocomitidae. We agree with AGUIRRE-URRETA (1998, p. 40) that the replacement of *Karakaschiceras* (and therefore *Bodrakiceras* in the old sense) and *Neohoploceras* in the Subfamily Endemoceratinae SCHINDEWOLF,1966, the endemic ammonites of the North Europe, is unjustified. The character of the development of the morphology and the suture line of the mentioned ammonites compels us to include them into Neocomitinae SALFELD, 1921. We combine the new results in the phylogenetic scheme (Figure 10), which is based on the morphological similarities and the available data on the suture lines (Figure 11).

The Neocomitidae belong in the Superfamily Perisphinctaceae and they have a specific early branching of the internal lobe (I) and displacement of Id branch to the inner side. The sutural lobe is formed as a result of several recurrent branching of the secondary lobes, which are located on the umbilical seam before branching. It is known in *Balkites* BOGDANOVA & KVANTALIANI, 1983, *Berriasella s. l.* and for *Thurmanniceras*. Therefore, the new elements of the suture line in the umbilical seam aspect of Perisphinctaceae are due to branching of the suture lobe. This feature is also typical for the Superfamilies Stephanocerataceae, Desmocerataceae and Hoplitaceae, which have five primary lobes. It allows them to be included the Suborder Perisphinctina (BEZNOSOV & MIKHAILOVA, 1983).

The ammonites of the lineage *Balkites* - *Luppovella*

*(Planibulliceras) - L. (Neoluppovella)* have equal external and first lateral saddles with sharp reduction of the suture line in the direction of the umbilical seam that reflects the shape of the suture lobe symmetrically deepening towards the umbilical seam (Figure 11). The umbilical lobe in *Luppovella (Planibulliceras)* and *L. (Neoluppovella)* becomes asymmetric and the first lateral saddle becomes much narrower than the external saddle. *Luppovella (Luppovella)* is the latest representative of this lineage, having a very deep asymmetric umbilical lobe, which is somewhat similar to the neocomitinid *Kilianella* and the berriasellinid *Balkites* (Figure 11). The morphology of the ribbing is similar in this lineage, but has developed in two ways:

1. *Luppovella* cycle of ribbing consisting of single, bifurcate and bipartite bidichotomic ribs. Cycles separated from each other by constrictions, which became shallower in the lineage. The other developed feature are the tubercles, which became sharper and appear ontogenetically later in this lineage.
2. *Kilianella* cycle of ribbing consisting of single, bifurcate and bipartite bidichotomic ribs. Cycles separated from each other by constrictions deeper in the early whorls. Umbilical and lateral tubercles usually poorly developed, but ventro-lateral tubercles of the terminal rib of the cycle are very high, well-developed as in *Neohoploceras.*

In the ammonites in the lineage *Berriasella s.l. - Thurmanniceras - Campylotoxia,* the umbilical lobe is tripartite, nearly symmetrical (Figure 11). It is deeper in *Berriasella* than the ventral lobe in *Thurmanniceras* and *Campylotoxia* and the first lateral saddle is much narrower than the external saddle; both saddles or one of them become unequal. The *Thurmanniceras* cycles of ribbing, which is separated by weak constrictions in the earliest whorls, are represented by sinuous single, bifurcate, 3-4 - branch ribs and bidichotomic ribs. Umbilical tubercles are strong, lateral tubercles are poorly developed. Ventrolateral tubercles arc orthogonal or suborthogonal to the plane of symmetry of the shell in *Thurmanniceras,* becoming subparallel in *Campylotoxia.*

The ammonites in the branch *Bodrakiceras - Busnardoites* demonstrate a sharply asymmetric umbilical lobe. In *Busnardoites* this is associated with sharp reduction of the first lateral saddle in contrast to the external saddle. The ornamentation shows the disappearance of the lateral tubercles and increase of the umbilical tubercles with the joining of the ribs in bunches as in *Bodrakiceras constrictum. Neohoploceras* has a deep and narrow umbilical lobe which is weakly asymmetric in the ammonites of the *Bodrakiceras - Neohoploceras* branch. The similarity of the sculpture of both genera is discussed above. The *Neohoploceras* cycle of ribbing notably differs from *Bodrakiceras* by having the complex bidichotomic terminal rib in each cycle with very high and strong tubercles in the ultimate branch and in general by coarser ribbing and a very late effacement of the ornamentation.

The branch *Bodrakiceras - Karakaschiceras,* in contrast to *Neohoploceras,* shows the reduction of lateral and ventral tubercles and early smoothing of the shell. The suture lines of the ammonites in the branch are similar, but the umbilical lobe (U) in *Karakaschiceras* is deeper than the ventral lobe (V).

The lineages *Euthymiceras s.l. - Belbekiceras* and *Euthymiceras s.l. - Distoloceras* are characterised by the almost symmetrical umbilical lobe (U), somewhat deeper than the ventral one (V) and the suture lobe descends to the umbilical seam. Cycles of ribbing in *Belbekiceras* are separated by shallow constrictions and consist of simple, bi- or tripartite ribs, branching on the umbilical shoulder and in the upper third of the lateral sides, being different from *Euthymiceras s.l.*, which usually has intercalated ribs.

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## Explanation of Plates

All the figured specimens are preserved in the collection of the Museum of the Earth of Moscow State University, Nos.94 and 95. Figures in natural size. Photos by E.J. BARABOSHKIN (Moscow State University) and V.T. ANTONOVA (Paleontol. Inst. Russ. Acad. Sci.).

### PLATE 1

Fig. 1 — *Luppovella (Neoluppovella) spinosa* subgen. et sp. nov.; holotype MSU 95/1: a - lateral side, b - venter. Bed Kp23/15, condensed horizon at the Lower/ Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 2 — *Belbekiceras belbekii* BARABOSHKIN, 1997; holotype MSU 94/1: a - lateral side, b - venter. Bed Kp29/54, Lower Valanginian, *Thurmanniceras pertransiens* Zone of Sbrosovy Log Ravine, Belbek River.

Fig. 3 — *Busnardoites* (?) *kojasdjilgensis* sp. nov.; holotype MSU 95/8: a - lateral side, b - venter. Lower Valanginian, *Campylotoxia campylotoxa* Zone of Kojas - Dzhilga Ravine, near Nauchny Town.

### PLATE 2

Fig. 1 — *Bodrakiceras discoideum* (COLLIGNON, 1962); MSU 95/5: a - lateral side, b - apertural view. Lower Valanginian, *Thurmanniceras pertransiens* Zone (?) of Dlinnaya Mt., Prokhladnoe Village.

Fig. 2 — *Bodrakiceras* aff. *discoideum* (COLLIGNON, 1962); MSU 95/7: a - lateral side, b - apertural view. Lower Valanginian, *Thurmanniceras pertransiens* Zone (?) of Dlinnaya Mt., Prokhladnoe Village.

Fig. 3 — *Bodrakiceras sp.*; MSU 95/6: a - lateral side, b - apertural view. Bed Kp23/15, condensed horizon on the Lower/ Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 4 — *Bodrakiceras constrictum* sp. nov.; holotype MSU 95/4: lateral side. Bed Kp23/15, condensed horizon on the Lower/ Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 5 — *Bodrakiceras* aff. *inostranzewi* (KARAKASCH, 1889); MSU 95/2: a - lateral side, b - apertural view. Bed Kp23/15, condensed horizon on the Lower/Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 6 — *Bodrakiceras inostranzewi* (KARAKASCH, 1889); MSU 95/3: lateral side. Lower Valanginian, *Thurmanniceras pertransiens* (?) Zone of Dlinnaya Mt., Prokhladnoe Village.

Fig. 7 — *Campylotoxia campylotoxa densocostata* subsp. nov.; MSU 95/13: lateral side. Bed Kp23/15, condensed horizon on the Lower/Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

### PLATE 3

Fig. 1 — *Campylotoxia campylotoxa densocostata* subsp. nov.; holotype MSU 95/12: a - lateral side, b - apertural view. Bed Kp23/15, condensed horizon on the Lower/ Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 2 — *Campylotoxia campylotoxa campylotoxa* (UHLIG, 1902); MSU 95/10: a - lateral side, b - apertural view. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt.

Fig. 3 — *Campylotoxia campylotoxa campylotoxa* (UHLIG, 1902); MSU 95/11: lateral side. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt.

Fig. 4 — *Campylotoxia campylotoxa campylotoxa* (UHLIG, 1902); MSU 95/15: a - lateral side, b - apertural view. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt.

Fig. 5 — *Campylotoxia evoluta* sp. nov.; holotype MSU 95/14: a - lateral side, b - apertural view. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt.

Fig. 6 — *Campylotoxia campylotoxa campylotoxa* (UHLIG, 1902); MSU 95/9: lateral side. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone of Verkhorechie Village, base of Rezanaya Mt.

Fig. 7 — *Pseudacanthodiscus crymicus* BARABOSHKIN, 1997; holotype MSU 94/8: a - lateral side, b - venter. Lower Valanginian, *Thurmanniceras pertransiens* Zone of Sbrosovy Log Ravine, Belbek River, bed Kp29/54.

PLATE 4

Fig. 1 — *Karakaschiceras biassalense* (KARAKASCH, 1890); MSU 95/16: a venter, b - lateral side. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Campylotoxia campylotoxa* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 2 — *Neohoploceras submartini* (MALLADA, 1887); MSU 1/93: lateral side. Bed Kp23/15, condensed horizon on the Lower\Upper Valanginian boundary, *Saynoceras verrucosum* Zone (?) of Verkhorechie Village, base of Rezanaya Mt.

Fig. 3 — *Kilianella otopeta* (THIEULOY, 1979) MSU 95/17: lateral side. Lower Valanginian, *Kilianella otopeta* Zone of Mt. Dlinnaya, bed Kp22/6.

Fig. 4 — *Thurmanniceras salientinum* (SAYN, 1907), MSU 95/18: lateral side. Mt. Sheludivaya, the top of southern slope, Lower Valanginian, *Thurmannicreas pertransiens Zone.*

Fig. 5 — *Thurmanniceras* cf. *pertransiens* (SAYN, 1907), MSU 95/19: lateral side. The top of Mt. Sheludivaya. Lower Valanginian, *Thurmannicreas pertransiens Zone.*

Fig. 6 — *Himantoceras* cf. *lessinianum* (FARAONI *et al.,* 1997); MSU 95/20: lateral side. Bed Kp23/45, Upper Valanginian, *Himantoceras trinodosum* Zone of Verkhorechie Village, base of Rezanaya Mt.

Fig. 7 — *Teschenites* sp. *(= Teschenites neocomienseformis* (HOHENEGGER *in* UHLIG, 1902) *sensu* THIEULOY, 1971); MSU 95/21: lateral side. Bed Kp23/50, Upper Valanginian, *Teschenites callidiscus Zone* of Verkhorechie Village, base of Rezanaya Mt.

Fig. 8 — *Eleniceras spinigerum* (VON KOENEN, 1902); MSU 95/22: lateral side. Upper Valanginian of Nauchny, *Eleniceras tauricum* Zone.

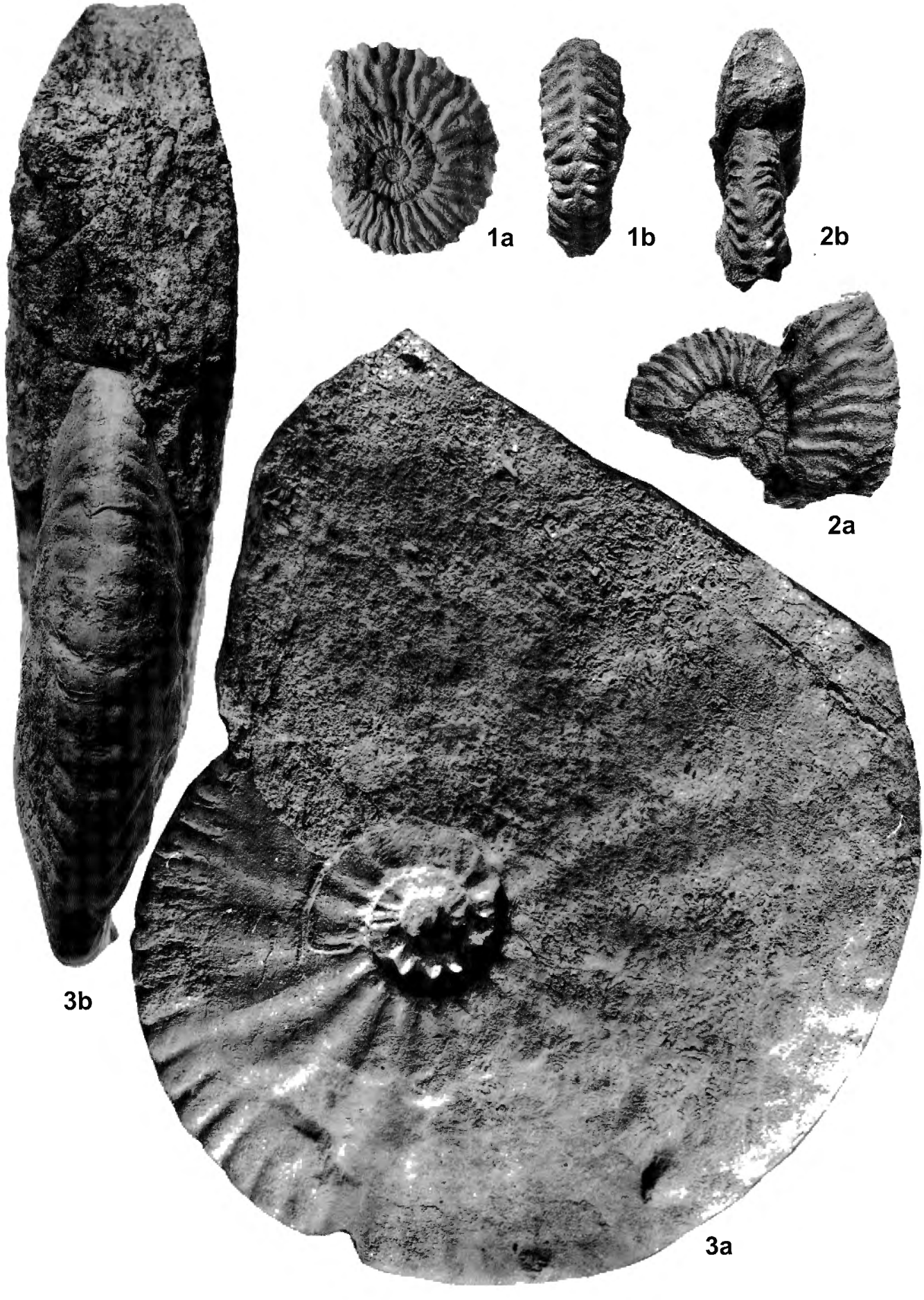


PLATE 1

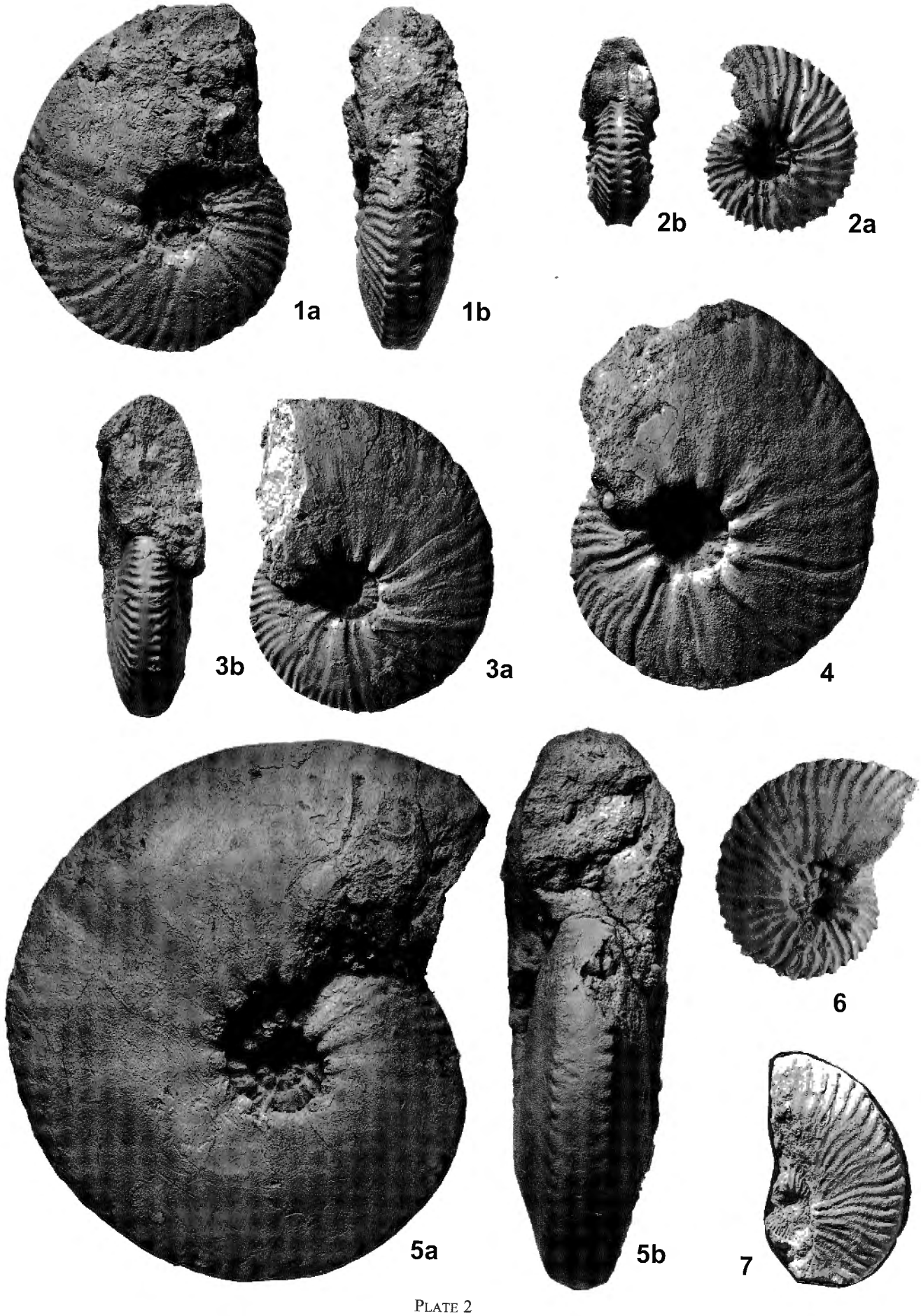


PLATE 2

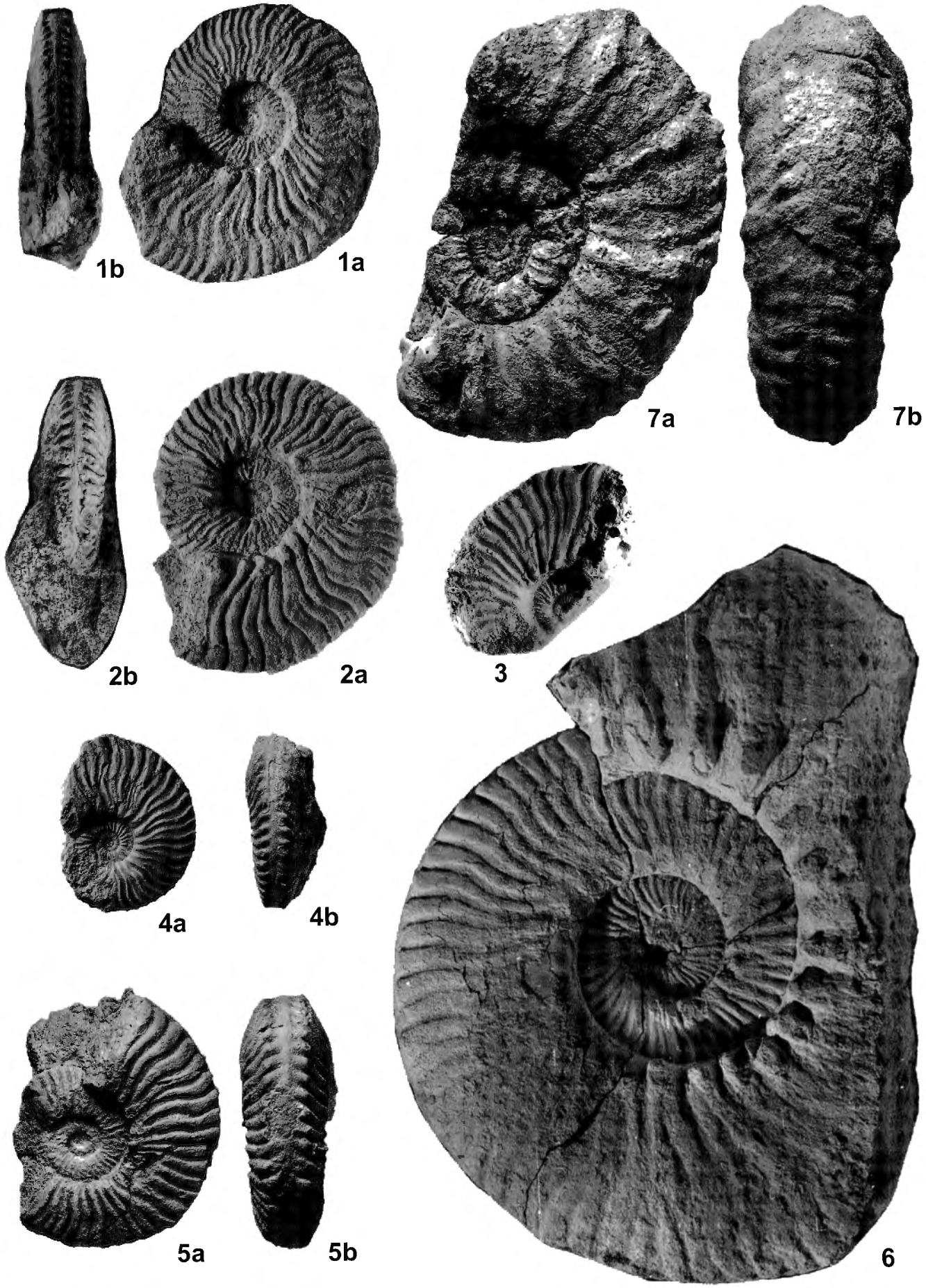


PLATE 3

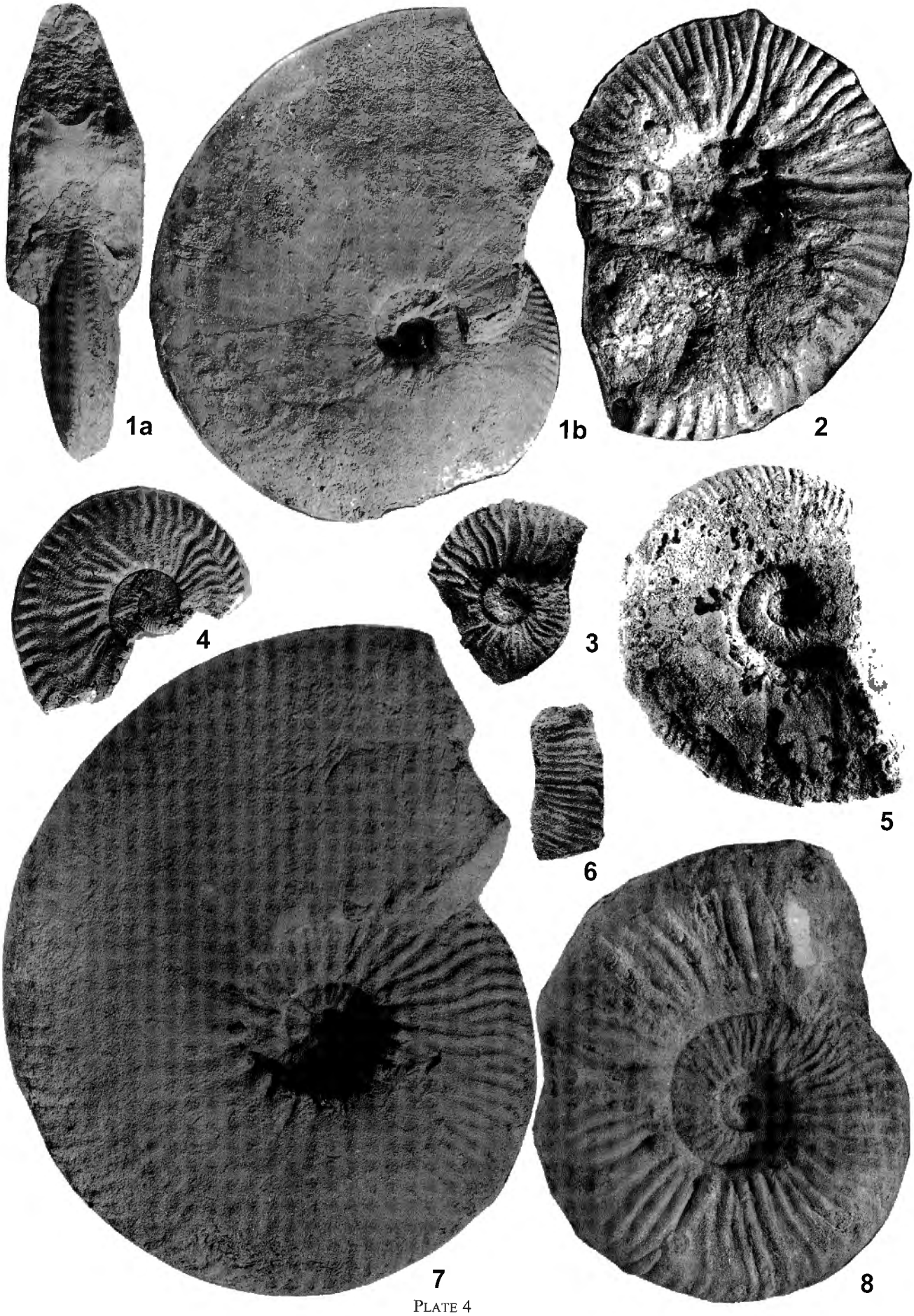


PLATE 4