

## Genus *Berriasella* (Ammonoidea) and Ammonoid Zonation in the Berriasian of the Crimean Mountains

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**Abstract**—Six *Berriasella* species (Ammonoidea) found in the Berriasian sediments of the Crimean Mountains are *B. jacobi* Maz., *B. callisto* (d'Orb.), *B. subcallisto* (Touc.), *B. oppeli* (Kil.), *B. moesica* Nik. et Man., and *B. chomeracensis* (Touc.), the last two being first encountered. Based on the recognized standard zones *jacobi*–*occitanica*–*boissieri*, the Berriasian of the Crimea is correlated with coeval sections in other Mediterranean areas. Systematic description is presented for all the species.

**Key words:** Crimean Mountains, Berriasian, ammonites, zonal biostratigraphy, correlation.

### INTRODUCTION

Being of a very wide geographic range, the extremely variable *Berriasella* species are most important for zonal subdivision of the Tithonian–Berriasian transition and for determination of the Jurassic–Cretaceous boundary in the Mediterranean region. The species are described in many publications (Mazenot, 1939; Le Hégarat, 1973; Nikolov, 1982; Tavera, 1985; etc.) devoted to Tithonian and Berriasian stratigraphy of southern Europe (France, Spain, and Bulgaria). Based on these investigations, the *Berriasella jacobi* Zone of the corresponding index species is now established to be the lower Berriasian zone in Mediterranean areas.

### BERRIASSELLA SPECIES AND THEIR SIGNIFICANCE FOR THE BERRIASIAN AMMONOID ZONATION

Mazenot (1939) who understood genus *Berriasella* in a very broad sense described among other the species *B. jacobi* Maz., *B. oppeli* (Kil.), *B. callisto* (d'Orb.), *B. subcallisto* (Touc.), *B. oxycostata* (Jacob), *B. picteti* (Jacob), *B. privasensis* (Pict.), and *B. chomeracensis* (Touc.), which belong to the genus in its modern interpretation.

Le Hégarat (1973) who studied the stratotype section in southeastern France described 17 *Berriasella* species. He classed them with subgenera *Berriasella* and *Picteticeras*. The corresponding species listed in his work are (*B.*) *callisto* (d'Orb.), *B. jacobi* Maz., *B. moreti* Maz., *B. oppeli* (Kil.), *B. paramacilenta* (Maz.), *B. privasensis* (Pict.), *B. sabatasi* Le Hégarat, *P. aurose* Le Hégarat, *P. chomeracensis* (Touc.), *P. elmii* Le Hégarat, *P. enayi* Le Hégarat, *P. evoluta* (Le Hégarat),

*P. jauberti* (Maz.), *P. moesica* (Nik. et Man.), *P. oxycostata* (Jacob), and *P. picteti* (Jacob). Le Hégarat reported that *B. jacobi* Maz., *B. moreti* Maz., *B. oppeli* (Kil.), *B. sabatasi* Le Hégarat, *P. aurose* Le Hégarat, *P. chomeracensis* (Touc.), *P. elmii* Le Hégarat, and *P. enayi* Le Hégarat, are mainly characteristic of the *jacobi* Zone of his zonation chart (table), whereas the others are typical of the younger "*grandis*"–*occitanica*–*boissieri* zones of the stratotype. *B. callisto* (d'Orb.) is stratigraphically the youngest species among the listed forms. It was described by Le Hégarat from the *picteti* and *callisto* subzones of the *boissieri* Zone.

Tavera (1985) studied in detail the ammonite distribution throughout the Tithonian and Berriasian sections of southern Spain and described 16 *Berriasella* species. Among them, 11 species *B. jacobi* Maz., *B. oxycostata* (Jacob), *B. elmii* Le Hégarat, *B. mazenoti* Breist., *B. aurose* Le Hégarat, *B. chomeracensis* (Touc.), *B. subcallisto* (Touc.), *B. berthi* (Touc.), *B. moreti* Maz., *B. sabatasi* Le Hégarat, and *B. oppeli* (Kil.) are mainly characteristic of the *jacobi* Zone, as it was defined by Tavera (table). *B. privasensis* (Pict.) and *B. (Hegartella) paramacilenta* (Maz.) were attributed by Tavera to the overlying *andrussowi* Zone, while *B. callisto* (d'Orb.) and *B. picteti* (Jacob) were regarded as characteristic of the *boissieri* Zone. From the Tithonian *Durangites* Zone, Tavera described the new species *B. tithonica* Tavera.

Numerous *Berriasella* forms are known from the Tithonian–Berriasian boundary beds in Bulgaria (Nikolov, 1982). Nikolov stated that the *Transitorius* Zone of the upper Tithonian is the lowermost unit with *Berriasella* species. It is remarkable however that describing a 0.5-m-thick layer of the section he reported that it yields *Paraulacosphinctes transitorius* (Opp.), *Berriasella (picteticeras) chomeracensis*

Zonal subdivision of the Tithonian–Berriasian boundary sediments in the Crimean Mountains and their interregional correlation

Southeastern France, Le Hégarat, 1973			Southeastern France, <i>Colloque...</i> , 1975			Bulgaria, Nikolov, 1982			Spain, Tavera, 1985			Tunisia, Tavera <i>et al.</i> , 1986			Crimean Mountains, after the authors		
System	Stage	Zone	System	Stage	Zone	System	Stage	Zone	System	Stage	Zone	System	Stage	Zone	System	Stage	Zone
Cretaceous	Berriasian	Occitanica	Cretaceous	Berriasian	Occitanica	Cretaceous	Berriasian	Occitanica	Cretaceous	Berriasian	Andrus- sowi	Cretaceous	Berriasian	Neocos- mocerat	Cretaceous	Berriasian	Occita- nica
		Grandis			Grandis			Jacobi			Occitanica			Grandis			
Jurassic	Tithonian	Jacobi	Jurassic	Tithonian	?	Jurassic	Tithonian	Chaperi	Jurassic	Tithonian	Duran- gites	Jurassic	Tithonian	?	Jurassic	Tithonian	?
		Transi- torius			Micro- canthus			Transi- torius			Chomera- censis						

(Touc.), *Malbosiceras chaperi* (Pict.), and *Pseudosubplanites euxinus* (Ret.) (Nikolov, 1982, p. 16). This assemblage includes most likely the redeposited ammonites of different age, since neither in Spain nor in France *P. transitorius* (Opp.) was found in association with *B. chomeracensis* (Touc.) and *P. euxinus* (Ret.). Accordingly, as we think, the *chaperi* Subzone was erroneously placed into the *Transitorius* Zone. Sediments with *Malbosiceras chaperi* and *Delphinella delphinensis* should be younger but not coeval to the *P. transitorius* beds. This was proved by Egoyan (1975). In our opinion, the *chaperi* Subzone of the *Transitorius* Zone distinguished by Nikolov in Bulgaria is actually a part of the Berriasian *jacobi* Zone established in France and Spain (Hoedemaeker and Bulot, 1990), i.e. it should be joined in Bulgaria with the *grandis* Zone. Mixing of ammonites of different age in a single thin bed can be caused by various reasons. Therefore, the *Berriasella* species first appear in Bulgaria not earlier than in the Berriasian.

According to many authors (Behrendsen, 1891; Gerth, 1925, 1926; Krantz, 1926; Leanza, 1945), the *Berriasella* species occur also in Argentina. However, we figured out that most of the described taxa are not the *Berriasella* species proper, as they have either tripled ribs or prominent node-like inflations at the rib branching points or at the ventrolateral shoulders. The true *Berriasella* species, in our opinion, are *B. oppeli* (Kilian) described by Behrendsen (1891) and *B. krantzi* Leanza (Leanza, 1945). Behrendsen probably figured a macroconch *B. oppeli* having  $D = 89$  mm, whereas specimens of this taxon from Western Europe are usually represented by microconchs. In general, *Berriasella* forms from Argentine show endemic traits.

In the upper Tithonian *Substeuerocheras* beds of Mexico, there was found *B. zacatecana* Imlay (Imlay, 1939). *B. cf. picteti* (Kilian) and *B. aff. zacatecana* Imlay are known from the Berriasian of Mexico (Verma and Westermann, 1973), however, their specimens are poorly preserved, being unsuitable for a reliable correlation with the West European forms.

A diverse *Berriasella* assemblage dominated by West European species is known from northern Africa (Tunisia) and Madagascar. Species described in Tunisia (Arnould-Saget, 1951) are *B. oppeli* (Kilian), *B. privasensis* (Pictet), *B. oxycostata* (Jacob), *B. subcalisto* (Toucas), *B. jacobi* Mazenot, *B. moreti* Mazenot, *B. chomeracensis* (Toucas), *B. pseudomoravica* Arnould-Saget, and *B. constricta* Arnould-Saget. Their assemblage is characteristic of the Berriasian *jacobi-occitanica* Zone.

The Berriasian sediments of Madagascar yield *B. privasensis* (Pictet), *B. jacobi* Mazenot, *B. callisto* (d'Orbigny), *B. picteti* (Jacob), and *B. besairiei* Collignon (Collignon, 1960, 1962). Accordingly, the Berriasian *jacobi*, *occitanica*, and *boissieri* zones seem to be distinguishable there.

Species *B. (B.) cf. oxycostata* (Jacob), *B. (B.) aff. chomeracensis* (Toucas), *B. (B.) oppeli* (Kilian), and *B. (Elenaella) sevenieri* (Le Hégarat) are known from the Berriasian of Yemen (Howarth and Morris, 1998). *B. aff. chomeracensis* cannot be referred to the genus *Berriasella* because of tripled ribs, and *sevenieri* form in modern taxonomic nomenclature belongs to the genus *Delphinella*. *B. (B.) oppeli* is represented by two fragments, which are inappropriate, in our opinion, even for identification at the generic level. The *jacobi* Zone is

evidently present in sections of Iraq, since *B. (B.) jacobi* Mazenot was identified there (Howarth, 1992).

In the Himalayas, where Uhlig (1903–1910) found *Hoplites (Berriasella) cf. privasensis* (Pictet), a diverse *Berriasella* assemblage was recently encountered (Liu and Wang, 1987). Chinese researchers recognized here with confidence the *jacobi* Zone that yields species *B. jacobi* Mazenot, *B. cf. sabatasi* Le Hégarat, *B. oppeli* (Kilian), *B. chomeracensis* (Toucas), *B. elmii* Le Hégarat, *B. aurosei* Le Hégarat, *B. subcallisto* (Toucas), *B. besairiei* Collignon, and *B. xizangensis* Liu. Judging from illustrations, the Himalayan *Berriasella* species are rather close to the West European forms.

Among ammonites from New Guinea (Helmcke *et al.*, 1978) there was found *B. (picteticones) moesica* (Nik. et Man.), but its figure has not been published.

Sey and Kalacheva (1999) who studied sections in the southern Primor'ye, the Far East of Russia, described ammonites of genera *Dalmasicerias*, *Pseudosubplanites*, and *Berriasella* from sediments bearing numerous *Buchia* forms of the upper Volgian *Buchia piochii* s.l.–*B. terebratuloides* Zone. In their opinion, the studied ammonites can be attributed the *jacobi* Zone of the Tethyan Berriasian. It is undoubtedly an interesting opinion, however, we should note that all ammonites were identified in the open nomenclature (*Berriasella* ex gr. *jacobi* Maz., *Berriasella?* sp., *Pseudosubplanites* cf. *grandis* (Maz.), *P.* aff. *combesi* Le Hégarat, and *Pseudosubplanites* sp.), and *Dalmasicerias orientale* is a new species. Our revision of ammonites collected by Sey and Kalacheva (collection is deposited in the Central Research Geological Prospecting Museum, St. Petersburg) showed that shell shape and ribbing of *B. ex gr. jacobi* are consistent with the *Berriasella* diagnosis (microconchs with double ribs). At the same time, the shell is devoid of the ribs ventral break characteristic of the genus, and only a slight rib lowering without an interruption is visible in the mid-ventral side. Shells of *Berriasella?* sp. cannot be referred, in our opinion, to the genus *Berriasella* at all.

*Berriasella* species from the Berriasian of the Northern Caucasus and Transcaucasia (Georgia) are as yet imperfectly studied. Khimshiashvili (1976) reported on occurrence of *B. callisto* (d'Orb.), *B. subcallisto* (Touc.), and *B. privasensis* (Pict.) in the Transcaucasia, but only the latter species is described and illustrated in this work. Later on, *B. jacobi* Maz., *B. oxycostata* (Jacob), and *B. privasensis* (Pict.) from the Berriasian of Abkhaziya have been described and figured (Khimshiashvili, 1989). Two former species are interpreted as characteristic of the *jacobi* Zone, and the latter one is attributed to the *occitanica* Zone.

Sakharov (1984) identified and illustrated (but not described) a single species *Berriasella* cf. *callisto* (d'Orb.) from the Uruk River section of the northern Caucasus. Unfortunately, only the lateral view of shell is reproduced. The specimen is a fragment of phragmone, and it is difficult to define, in our opinion, if it is

related by affinity to the genus *Berriasella*. Sey and Kalacheva studied the Berriasian ammonites from the Uruk section (Kolpenskaya *et al.*, 2000), among which they identified *Berriasella (Picteticones) cf. evoluta* Le Hégarat, *B. (P.) cf. jauberti* (Maz.), *B. (P.) sp.*, and *B. (B.) callisto* (d'Orb.). The species were encountered along with representatives of *Euthymiceras*, *Spiticeras*, *Subalpinites*, and *Riasanites* genera. In opinion of Sey and Kalacheva (p. 26), the upper Berriasian part of the Uruk section distinguished as the *Berriasella callisto–Jabronella paquieri* Beds can be correlated with the *callisto* Subzone of the *boissieri* Zone of the stratotype.

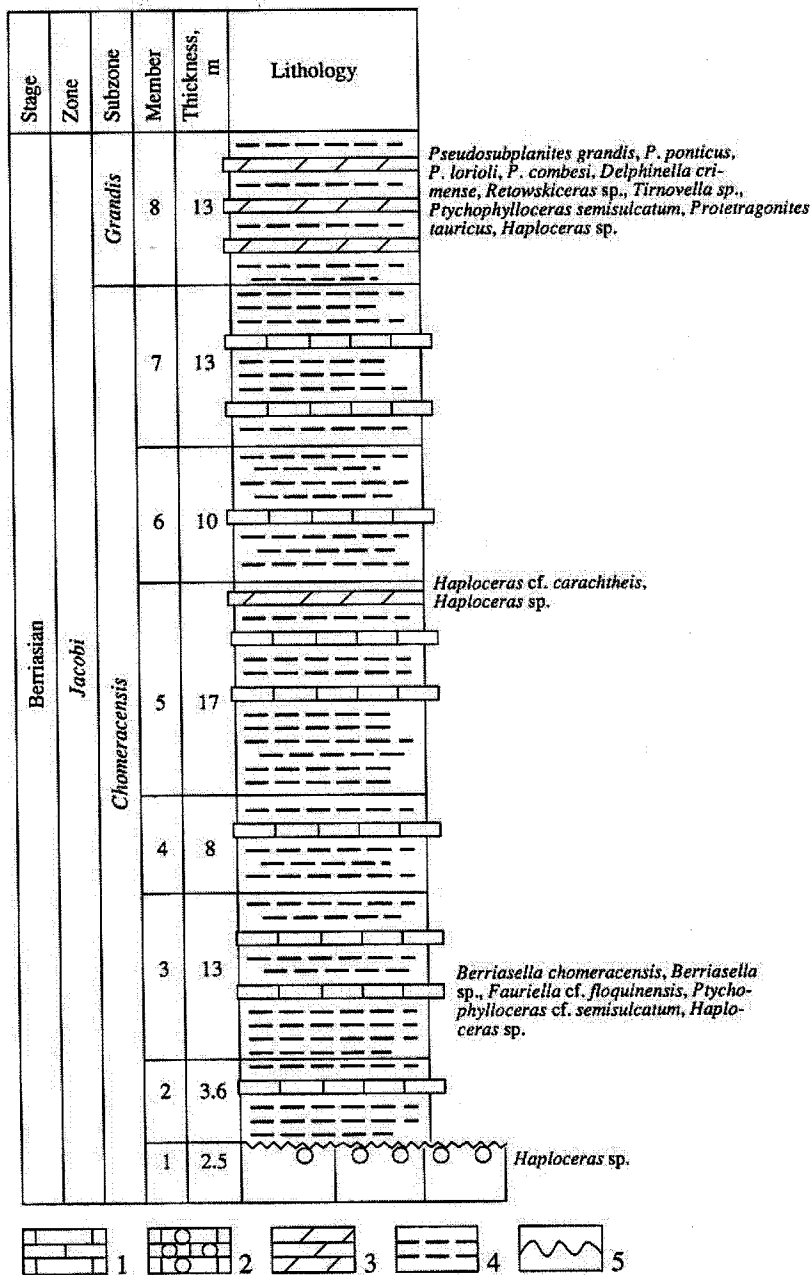
*Berriasella* species from the Crimea are mentioned in a series of publications (Sokolov, 1886; Retowski, 1893; Drushchits, 1960; Lysenko and Popov, 1962; Uspenskaya, 1969; Druschits, 1975; Kvantaliani and Lysenko, 1979; Lysenko and Yanin, 1979; Bogdanova *et al.*, 1981, 1984, 1999; Glushkov, 1997; Arkad'ev, 2002; Arkad'ev and Savel'eva, 2002). According to the present notion, the Crimean *Berriasella* assemblage is characteristic of the *jacobi–boissieri* Zone. However, the frequently occurring species of the assemblage are inadequately studied so far, being attentively considered in a few works only.

## MATERIALS

The studied *Berriasella* specimens have been collected in various periods by Drushchits, Lysenko, Nerodenko, Yanin, Bogdanova, Lobacheva, Prozorovskii, Favorskaya, Glushkov, Savel'eva, and Arkad'ev from Tithonian–Berriasian sediments of the Crimean Mountains. When studying the collection, we identified species *B. jacobi* Maz., *B. moesica* Nik. et Mand., *B. subcallisto* (Touc.), *B. oppeli* (Kil.), *B. callisto* (d'Orb.), and *B. chomeracensis* (Touc.) described below. The collection is stored at the Central Research Geological Prospecting Museum in St. Petersburg (no. 13098).

Four *Berriasella* species (*jacobi*, *oppeli*, *subcallisto*, and *callisto*) were known previously, while the other two represent new forms for the Crimea. Most of the species are referred to the *jacobi* Zone recognizable in sections of Feodosia, eastern Crimea, and the Tonas and Sary-Su River basins. Two specimens of *Berriasella callisto* (d'Orb.) characteristic of the *boissieri* Zone (Le Hégarat, 1973) were found in the central Crimea near the Mramornoe Village, in a separate tectonic block of Berriasian sediments.

The most representative sections of the Tithonian–Berriasian boundary sediments are known in the vicinity of Feodosia. For instance, the section on the Svyatogo Il'i Cape has been studied since the end of the XIX century (Retowski, 1893; Druschits, 1975; etc.). The section located 200 m west of the cape is 80 m thick in total. The famous "Feodosia Marl" bearing the ammonite assemblage described by Retowski represents the uppermost member of the section and is 13 m



Ammonites in the Berriasian section on the Svyatogo Il'i Cape (Feodosia): (1) limestone; (2) brecciated limestone; (3) marl; (4) clay; (5) unconformity.

thick. According to works mentioned above, the marl yields the following species: *Euphyllloceras serum* (Opp.), *Macrophyllloceras beneckeii* (Zitt.), *Ptychophylloceras inordinatum* (Touc.), *P. semisulcatum* (d'Orb.), *Holcophylloceras tauricum* (Ret.), *Biasaloceras liebigi* (Opp.), *Protetragonites tauricus* (Kulj.-Vor.), *Haploceras carachtheis* (Opp.), *H. elimatum* (Opp.), *Haploceras* sp., *Substreblites zonarius* (Opp.), *Spiticeras orientale* (Kil.), *S. proteus* (Ret.), *S. ex gr. theodosia*

(Desh.), *Berriasella oppeli* (Kilian), *B. (?) subcallisto* (Touc.), *Berriasella (?)* sp., *Pseudosubplanites lorioli* (Zit.), *P. grandis* (Maz.), *P. combesi* Le Hégarat, *P. ponticus* (Ret.), *P. subrichteri* (Ret.), *Delphinella berthei* (Touc.), *D. delphinensis* (Kil.), *D. subchaperi* (Ret.), *D. crimense* (Burckh.), *D. obtusenodosa* (Ret.), *Fauriella ex gr. shipkovensis* Nikol. et Man., *Retowskiceras andrussowi* (Ret.), *Retowskiceras* sp., and *Tirnovella* sp.

*Pseudosubplanites* and *Delphinella* species present in the assemblage suggest that the marly member is certainly correlative with the standard Berriasian *jacobi* Zone. The distribution of ammonites throughout this zone has not been studied yet in the Crimean Mountains, as below the Feodosia Marl in the Svyatogo II'i Cape zonal ammonite species, except for *Ptychophylloceras* and *Haploceras* inappropriate for age diagnosis, were not encountered until recently (Bogdanova *et al.*, 1984). In 2001, Arkad'ev and Savel'eva (2002) found ribbed ammonites (berriasellids) in the lowermost part of the section, about 6 to 8 m above the top of the 2-m-thick marker bed of brecciated limestone that is exposed immediately near the water edge and has been considered previously (Druschits, 1975) as the Tithonian–Berriasian boundary horizon (figure). In the 13-m-thick member of greenish gray compact to splinter clay interbedded with ferruginate brown to light brown compact detrital limestones, the following ammonites were identified: *Ptychophylloceras* cf. *semisulcatum* (d'Orb.), *Haploceras* sp., *Berriasella chomeracensis* (Toucas), *Berriasella* sp., and *Fauriella* cf. *floquinensis* Le Hégarat. Dominant form of the assemblage is *Berriasella chomeracensis* (Touc.). In the upper Feodosia Marl member, it is missing. The species was described from the *jacobi* and *grandis* zones of southeastern France (Le Hégarat, 1973) and from the *jacobi* Zone of Spain (Tavera, 1985). In Bulgaria, Nikolov (1982) established a somewhat wider range of this taxon, from the upper Tithonian *Transitorius* to the Berriasian *boissieri* Zone. However, as is noted above, it most likely corresponds to the *jacobi-boissieri* Zone, thus being confined to the Berriasian. *Fauriella floquinensis* was described from the *jacobi-grandis-occitanica* zones (Le Hégarat, 1973), however the Crimean specimens are poorly preserved and unsuitable for the correct identification.

The above ammonite assemblage from lower beds of the Svyatogo II'i Cape section is most likely indicates the Berriasian age, correlative with that of the *jacobi* Zone. Characteristic Tithonian ammonites have not been found yet at this site. Based on distribution patterns of ammonite, Arkad'ev subdivided the *jacobi* Zone of the studied section in two, the lower *Berriasella chomeracensis* (figure, Members 1–7) and the upper *Pseudosubplanites grandis* (Figure, Member 8) subzones (Arkad'ev and Savel'eva, 2002).

## SYSTEMATIC DESCRIPTION

Family Berriasellidae Spath, 1922

Genus *Berriasella* Uhlig, 1905

(=*Stenoceras* Uhlig, 1911 (non d'Orbigny, 1849); *picteticeras* Le Hégarat, 1973)

**Type species:** *Ammonites privasensis* Pictet, 1867; Berriasian, southeastern France.

**Diagnosis.** Discoid shell with slightly convex flanks and a rounded venter; umbilicus wide, stepped; ribbing

thin, represented by bifurcating and simple ribs. On the venter, ribs are interrupted by a furrow, clearly visible on juvenile whorls and commonly indistinct (to complete disappearance) on the last whorl.

**Species composition and distribution:** *Berriasella tithonica* Tavera – upper Tithonian, *Durangites* Zone in Spain; *B. zacatecana* Imlay – upper Tithonian of Mexico; *B. privasensis* (Pictet) – Berriasian, *occitanica* Zone in southeastern France, Tunisia, Algeria, Bulgaria, Caucasus, and Himalayas, Berriasian in Madagascar; *B. callisto* (d'Orbigny) – Berriasian, *boissieri* Zone (*picteti*, *callisto* subzones) in the Crimea, France, Italy, and Bulgaria, Berriasian in Madagascar, Berriasian *boissieri* Zone and Valanginian, *Otopeta* Zone in Spain; *B. subcallisto* (Toucas) – Berriasian, *jacobi-occitanica* zones (*subalpina* Subzone) in the Crimea, Bulgaria, and France, *jacobi* Zone in Spain and Himalayas, Berriasian in the Caucasus, Algeria, and Tunisia; *B. chomeracensis* (Toucas) – Berriasian, *jacobi* Zone (*chomeracensis* Subzone) in the Crimea, *jacobi* Zone in southeastern France, Spain, and Himalayas, *jacobi-boissieri* zones in Bulgaria, *chomeracensis* Zone in Tunisia; *B. oppeli* (Kilian) – Berriasian, *jacobi-occitanica* zones in the Crimea and Bulgaria, *jacobi* Zone in Spain, southeastern France, and Himalayas, Berriasian in Silesia, Romania, Tunisia, and Argentina(?); *B. jacobi* Mazenot – Berriasian, *jacobi* Zone in the Crimea, Caucasus, Bulgaria, southeastern France, Spain, Iraq, and Himalayas, *chomeracensis-pseudogroteanum* zones in Tunisia, Berriasian in Madagascar; *B. moreti* Mazenot – Berriasian, *jacobi* Zone in southeastern France, Spain, Bulgaria, and Tunisia; *B. elmii* Le Hégarat – Berriasian, *jacobi* Zone in southeastern France, Bulgaria, and Himalayas; *B. aurousei* Le Hégarat – Berriasian, *boissieri* Zone in southeastern France, Bulgaria, and Himalayas; *B. sabatasi* Le Hégarat – Berriasian, *jacobi* Zone in southeastern France; *B. enayi* Le Hégarat, Berriasian, *jacobi* Zone in southeastern France and Bulgaria; *B. evoluta* Le Hégarat – Berriasian, *boissieri* Zone (*paramimounum-picteti* subzones) in southeastern France; *B. oxycostata* (Jacob) – Berriasian, *jacobi* Zone in southeastern France, Tunisia, Romania, Bulgaria, and Caucasus; *B. picteti* (Jacob) – Berriasian, *boissieri* Zone (*picteti* Subzone) in France, Bulgaria, and Madagascar, Berriasian in Mexico; *B. mazenoti* Breistroffer – Berriasian, *jacobi* Zone in southeastern France and Bulgaria, Berriasian in Tunisia; *B. vranensis* Nikolov – Berriasian, *boissieri* Zone in Bulgaria; *B. subeudichotoma* Nikolov – Berriasian, *jacobi* Zone in Bulgaria; *B. moesica* Nikolov et Mandov – Berriasian, *jacobi-boissieri* zones (*paramimounum* subzone) in Bulgaria and France, *jacobi-occitanica* zones in the Crimea, Berriasian in New Guinea (?); *B. fitchevi* Nikolov – Berriasian, *boissieri* Zone (*picteti* Subzone) in Bulgaria; *B. bebrovensis* Nikolov – Berriasian, *boissieri* Zone (*picteti* Subzone) in Bulgaria; *B. preslavensis* Nikolov – Berriasian, *occitanica* Zone in Bulgaria; *B. momtchilovi* Nikolov – Berriasian, *boissieri* Zone (*callisto* Subzone) in Bulgaria; *B.*

*pseudomoravica* Arnould-Saget – Berriasian in Tunisia; *B. constricta* Arnould-Saget – Berriasian in Tunisia; *B. krantzi* Leanza – Berriasian in Argentina; *B. xizangensis* Liu – Berriasian, *jacobi* Zone in Himalayas; *B. besairiei* Collignon – Berriasian in Madagascar.

**Remarks.** The genus *Berriasella* was initially considered in a broad sense. Mazenot (1939) included in it the forms with tubercles and with fasciculate and polygyrate ribs. After subsequent revision, these ammonites were mainly excluded from the genus and distinguished as separate genera: *Fauriella* Nikolov, 1966; *Tirnovella* Nikolov, 1966; *Strambergella* Nikolov, 1966; *Delphinella* Le Hégarat, 1973; *Pseudosubplanites* Le Hégarat, 1973; *picteticeras* Le Hégarat, 1973; and *Hegaratella* Nikolov et Sapunov, 1977. The distinguished genera are unclearly distinct or close in morphology. Because of numerous transitional forms, it is difficult to discriminate these genera. Researchers often referred the same species to different genera. That is why Tavera (1985) included some problematic taxa into the initial genus *Berriasella* as *Berriasella* subgenera, e.g., *Berriasella* s.s., *Hegaratella*, *Pseudosubplanites*, along with the new subgenus *Busnardoiceras*. Tavera considered the genus *Strambergella* as synonym of *Fauriella* and *Picteticeras* synonym of *Berriasella* (*Berriasella*). However, this approach to taxonomy of berriasellids failed to determine clear distinctions between the genera in question.

Examination of numerous papers devoted to *Berriasella* forms leads to conclusion that researchers refer sometimes the forms with simple (double and single) and composite (polygyrate or fasciculate) ribbing to the same taxon, and this complicates classification further. In our opinion, only the species with bifurcate and solitary ribs should be included into the genus *Berriasella*.

One more important diagnostic feature of *Berriasella* species is the siphonal furrow on the venter. According to our experience and published data, the furrow on the venter is changing in morphology during the ontogeny.

*Berriasella* forms from Western Europe are of a medium, rarely, large size. A furrow on the venter is usually distinct on juvenile whorls, being either retained or indistinct to complete disappearance on adult whorls. The Crimean *Berriasella* species we studied are small to medium in size. Among them, there are specimens with distinct furrow (microconchs) and those showing its gradual disappearance from juvenile toward last whorls. According to our observations, a furrow on the venter can be seen (1) as a narrow deep groove breaking the ribs, (2) as a shallow flute touching the upper part of ribs without a break, and (3) as a weak lowering of ribs in the mid-venter without their interruption. There are gradual transitions between these distinctive features observable sometimes in the same specimen. As the available Crimean specimens are poorly preserved (deformed internal moulds lacking shelly layer), we find it difficult to assess ultimately the

taxonomic significance of the ventral furrow. Thus all the attempts of using this feature to divide the genus *Berriasella* in two groups of shells with or without furrow (Mazenot, 1939; Druschits, 1960) were unsuccessful. In our opinion, the ventral furrow is mainly characteristic of inner whorls of *Berriasella* species and, to a lesser extent, of outer ones.

In general, we agree with diagnosis of the genus *Berriasella* described by Wright *et al.* (1996) in their "Treatise on Invertebrate Paleontology," where bifurcate and single ribs and a ventral furrow on inner whorls are regarded as diagnostic features.

Considering the genus *Berriasella*, Tavera (1985) distinguished subgenus *Busnardoiceras* with the type species *Parapallasiceras busnardoii* Le Hégarat, which, unlike the true *Berriasella* species, shows polygyrate and fasciculate ribbing. Other researchers described similar forms as different *Berriasella* species. In our Crimean collection, there are such forms as well. From our standpoint, they and similar forms should be attributed to the genus *Busnardoiceras* Tavera, as the above distinctive features clearly differ it from other generic taxa.

#### *Berriasella jacobi* Mazenot, 1939

Plate, figs. 1 and 2

*Hoplites carpathicus* Toucas, 1890, p. 602, Pl. 17, figs. 10 and 11.

*Hoplites callisto* Toucas, 1890, p. 600, Pl. 17, fig. 3.

*Berriasella jacobi* Mazenot, 1939, p. 54, Pl. 4, figs. 1–5; Arnould-Saget, 1953, p. 33, Pl. 3, fig. 11 (not Pl. 4, fig. 1); Collignon, 1960, Pl. 165, figs. 668 and 669; Le Hégarat et Remane, 1968, p. 25, Pl. 5, figs. 1 and 2; Liu and Wang, 1987, Pl. 1, fig. 6, Pl. 2, fig. 7; Khimshiashvili, 1989, p. 9, Pl. 4, figs. 3 and 4.

*Berriasella* (*Berriasella*) *jacobi* Le Hégarat, 1973, p. 56, Pl. 6, figs. 9–12, Pl. 38, figs. 3, 6, and 7; Sapunov, 1979, p. 173, Pl. 55, fig. 3; Nikolov, 1982, p. 51, Pl. 8, figs. 4–8; Tavera, 1985, p. 238, Pl. 33, figs. 7–9, 11 (not fig. 10).

**Shape.** Shell small, semi-involute, moderately inflated, with gently convex flanks; venter wide, slightly rounded; whorl section rounded-rectangular; umbilicus wide, stepped, with steep wall.

**Sculpture.** Flanks are ornamented with bifurcate and rarely simple ribs. Among about 40 inner ribs present on the last whorl, there are three to four simple ribs. Originating on the umbilical wall, ribs are posteriorly deflected a little on umbilical shoulder and cross the flank almost straightly or slightly incurved anteriorly. Towards the aperture, ribs are incurved stronger. On mid-whorl or slightly above ribs bifurcate forming equal branches, with the posterior one slightly deflected backward.

In various specimens, the ventral furrow is of different morphology. In specimen 1/13098, an indistinct furrow runs across the ribs but does not interrupt them

at the beginning of the last whorl, while at the end of the whorl there is a distinct narrow furrow interrupting the ribbing. In contrast, juvenile whorls of specimens

2/13098 and 3/13098 have a distinct furrow that becomes obscure closer to aperture, where ribs cross the venter at a right angle.

Dimensions (mm) and number of ribs per whorl

Specimen	D	H	D <sub>u</sub>	W	H/D	D <sub>u</sub> /D	W/D	Rib number	
								outer	inner
2/13098	28.5	13.5	—	10	0.47	—	0.35	—	—
1/13098	30	12.5	8.5	9.5	0.42	0.28	0.32	—	40
3/13098	32	13	10	—	0.41	0.31	—	78	41
4/13098	36.5	13.5	12.5	—	0.37	0.34	—	—	—

**Comparison and remarks.** The described specimens, especially no. 1/13098, are most similar to forms figured by Mazenot (1939) and Sapunov (1979). *B. jacobii* Maz. differs from other *Berriasella* species by a relatively more inflated shell. In one of the specimens figured by Tavera (1985, Pl. 33, fig. 10), a bidichotomous rib is clearly visible on the adult whorl. Ribbing of this kind is atypical of the genus *Berriasella*, and we did not include that specimen in synonymy.

**Distribution.** Berriasian, the *jacobii* Zone in the Crimea, Caucasus, Bulgaria, southeastern France, Spain, Iraq, and Himalayas; *chomeracensis-pseudogroteanum* zones in Tunisia; Berriasian in Madagascar.

**Material.** Five specimens (1–5/13098) from the central (Sary-Su River) and eastern (Feodosia region, Barakol'skaya Valley) Crimea, collected by Druschits and Yanin.

*Berriasella moesica* Nikolov et Mandov, 1967  
Plate, figs. 6 and 7.

Dimensions (mm) and number of ribs per half a whorl

Specimen	D	H	W	D <sub>u</sub>	H/D	W/D	D <sub>u</sub> /D	Number of ribs	
								outer	inner
6/13098	42.5	18	—	—	0.42	—	—	58	30

**Comparison and remarks.** In distinction from other *Berriasella* species, ribs of *B. moesica* are thinner and more frequent. Two specimens referred by Nikolov and Mandov to *B. moesica* Nik. et Man. have clearly seen fasciculate ribbing (Nikolov and Mandov, 1967, Pl. 1, figs. 2 and 4). Since we limit the genus *Berriasella* to forms with bifurcate and single ribs only, these specimens cannot be assigned to it.

**Distribution.** Berriasian, *jacobii-boissieri* zones (*paramimounum* subzone) in Bulgaria and France; *jacobii-occitanica* zones in the Crimea.

**Material.** Four specimens (6–9/13098) from the eastern Crimea (Feodosia region, Sultanovka Village)

*Berriasella moesica*: Nikolov et Mandov, 1967, p. 41, Pl. 1, figs. 1 and 3 (not figs. 2 and 4).

*Berriasella (Berriasella) moesica*: Le Hégarat, 1973, p. 77, Pl. 8, fig. 8; Pl. 39, figs. 10 and 11.

*Berriasella (Picteticeras) moesica*: Nikolov, 1982, p. 71, Pl. 16, figs. 1–6.

**Shape.** Discoid shell with wide, almost parallel flanks and narrow-rounded venter; cross-section of the last whorl strongly compressed, highly extended; umbilicus wide, stepped, with steep wall.

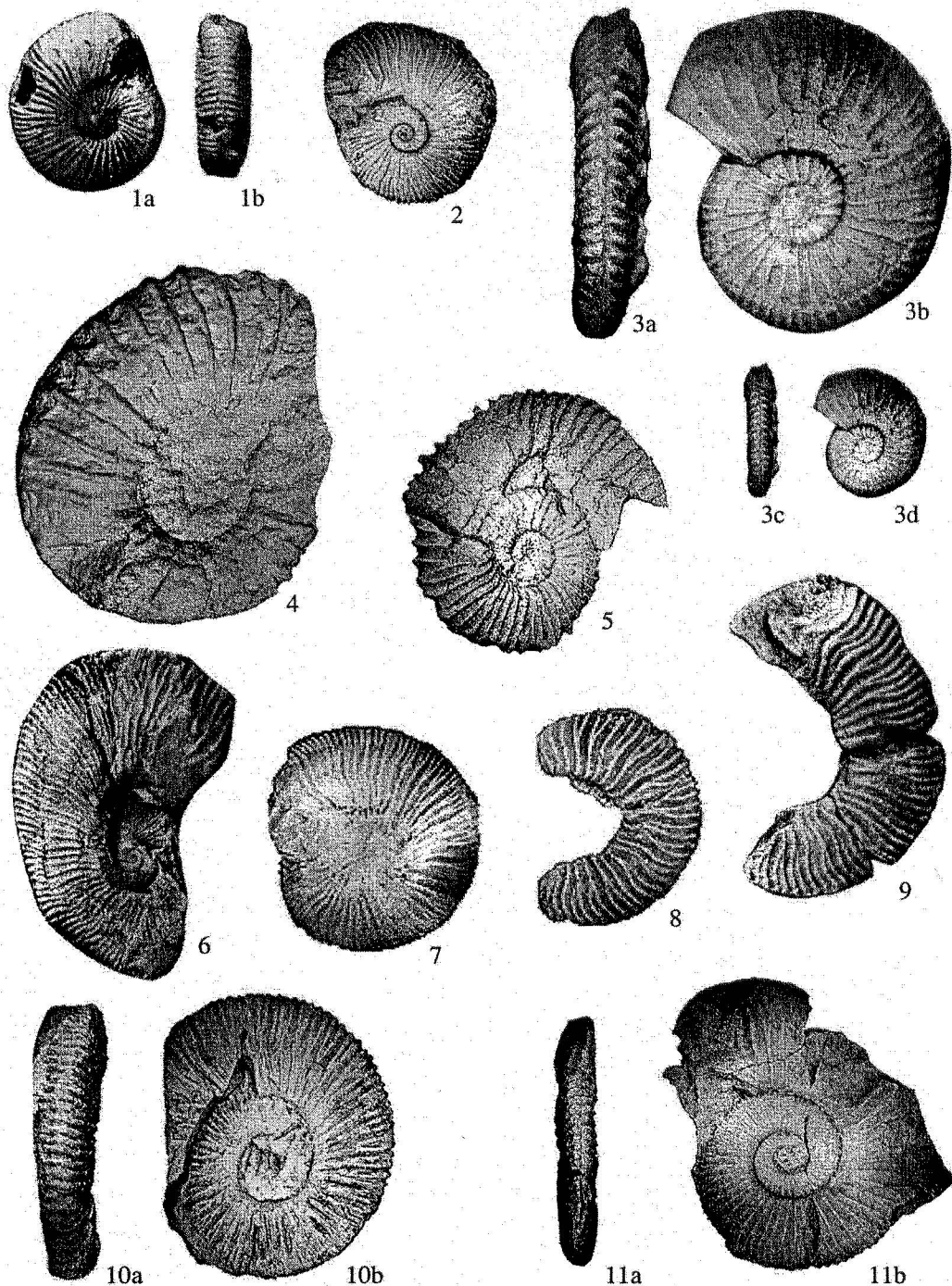
**Sculpture.** Flanks are ornamented with thin, dense, mostly bifurcate ribs (58–60 inner ribs per a half whorl). Ribs single or intermediate (starting from mid-whorl) are rare (1–2 per whorl). Originating on umbilical wall, ribs straightly cross flanks, being slightly incurved in the middle closer to aperture. At about upper one third of flank, ribs bifurcate into equal branches. Aperture is preserved in specimen 6/13098. A narrow furrow interrupting ribs is on the venter.

and the Tonas River basin, collected by Druschits and Bogdanova.

*Berriasella subcallisto* (Toucas, 1890)  
Plate, figs. 10 and 11.

*Hoplites calisto* var. *subcalisto*: Toucas, 1890, p. 601, Pl. 17, figs. 4 and 5.

*Berriasella subcalisto*: Mazenot, 1939, p. 53, Pl. 3, figs. 11 and 14 (not figs. 12 and 13); Arnould-Saget, 1953, p. 32, Pl. 3, fig. 9; Nikolov, 1960, p. 159, Pl. 4, figs. 1 and 3; Pl. 5, fig. 4; Dimitrova, 1967, p. 101, Pl. 48, fig. 8; Le Hégarat et Remane, 1968, Pl. 5, fig. 4.



**Plate.** *Berriasella* species from the Berriasian of the Crimean Mountains.

(1, 2) *Berriasella jacobi* Mazenot: (1) 1/13098, lateral (a) and ventral (b) views; central Crimea, Sary-Su River; Berriasian, *jacobi* Zone, collected by Druschits; (2) 3/13098, lateral view; eastern Crimea, Feodosia region, Barakol'skaya Valley; Berriasian, *jacobi* Zone, collected by Druschits. (3) *Berriasella oppeli* (Kilian), 17/13098, ventral (c) and lateral (d) views, (a, b) the same ( $\times 2.5$ ); eastern Crimea, Feodosia region; Berriasian, *jacobi* Zone, collected by Druschits. (4, 5) *Berriasella chomeracensis* (Toucas): (4) 23/13098,  $\times 1.5$ ; (5) 22/13098, lateral view,  $\times 4.0$ ; eastern Crimea, Feodosia, Svyatogo II'i Cape; Berriasian, *jacobi* Zone, *chomeracensis* Subzone, collected by Arkad'ev and Savel'eva. (6, 7) *Berriasella moesica* Nikolov et Mandov: (6) 7/13098, lateral view; eastern Crimea, Feodosia; Berriasian, *occitanica* (?) Zone, collected by Druschits; (7) 6/13098, lateral view; central Crimea, Tonas River; Berriasian, *jacobi* Zone, collected by Bogdanova. (8, 9) *Berriasella callisto* (d'Orbigny): (8) 20/13098, lateral view; (9) 21/13098, lateral view; central Crimea, Mramornoe Village; Berriasian, *boissieri* Zone, collected by Lysenko. (10, 11) *Berriasella subcallisto* (Toucas): (10) 10/13098, ventral (a) and lateral (b) views; eastern Crimea, Nanikovo Village, Koklyuk; Berriasian, *jacobi* Zone, collected by Druschits; (11) 12/13098, ventral (a) and lateral (b) view; eastern Crimea, Sultanovka (Yuzhnoe) Village; Berriasian, *jacobi* Zone, collected by Nerodenko.



*Berriasella (Berriasella) subcallisto*: Le Hégarat, 1973, p. 66, Pl. 39, fig. 2 (not Pl. 6, figs. 3–6); Nikolov, 1982, p. 56, Pl. 10, fig. 2; Pl. 11, fig. 1; Tavera, 1985, p. 245, Pl. 34, fig. 3, Fig. 19/M; Liu and Wang, 1987, Pl. 2, fig. 10.

**Shape.** Shell is of medium size; flanks slightly convex, high; venter narrowed, flat-rounded. Whorl section highly extended, oval in shape. Umbilicus wide, stepped, with low, steeply inclined wall.

**Sculpture.** Flanks are ornamented with bifurcate and rare single ribs (2 to 3 per whorl). Ribs bifurcate at the middle or within upper one third of the whorl, with

posterior branches slightly deflected backward. On the phragmocone, ribs straightly cross flanks, while on the body chamber they are slightly incurved anteriorly. Ornamentation of venter is somewhat different in various specimens. In specimen 10/13098, a narrow furrow interrupting ventral ribs extends almost throughout the adult whorl ( $D = 45\text{--}50$  mm). At the end of the whorl, furrow is missing and ribs cross venter at a right angle. In specimen 14/13098 ( $D = 25\text{--}30$  mm), siphonal furrow is indistinct, causing the lowering of uninterrupted ribs.

Dimensions (mm) and number of ribs per whorl

Specimen	D	H	W	$D_u$	H/D	W/D	$D_u/D$	Number of ribs	
								outer	inner
11/13098	28	10.5	7	10.5	0.38	0.25	0.38	–	45
12/13098	47	17	–	18	0.36	–	0.38	89	46
10/13098	57	18	–	15.5	0.32	–	0.27	80	42

**Comparison and remarks.** A furrow on venter is an inconsistent character of described ammonites. *B. subcallisto* (Touc.) can be likely considered as a transitional species between *Pseudosubplanites* and *Berriasella* forms. We refer it to the genus *Berriasella* on condition that the forms with trifurcate ribs, for instance, those illustrated by Le Hégarat (1973, Pl. 6, figs. 3–6), are excluded from the genus.

*B. subcallisto* (Touc.) differs from *B. jacobi* Mazenot by less thick whorls that increase slower, from *B. privasensis* (Pictet) by less coarse and frequent ribbing, and from *B. callisto* (d'Orb.) by a higher point of rib bifurcation.

**Distribution.** Berriasian, *jacobi-occitanica* (*subalpina* Subzone) zones in the Crimea, Bulgaria, France; *jacobi* Zone in Spain and Himalayas; Berriasian in the Caucasus, Algeria, and Tunisia.

**Material.** Seven specimens (10–16/13098) from the eastern Crimea (Feodosia region, Sultanovka Village, Barakol'skaya Valley), collected by Druschits, Yanin, Nerodenko, and Bogdanova.

*Berriasella oppeli* (Kilian, 1889)  
Plate, fig. 3.

Dimensions (mm) and number of ribs per whorl

Specimen	D	H	W	$D_u$	H/D	W/D	$D_u/D$	Number of ribs	
								outer	inner
18/13098	20	7.5	5.2	5.7	0.38	0.28	0.29	77	41
17/13098	23	10.5	4.5	6.5	0.46	0.20	0.28	62	31

**Comparison and remarks.** *B. oppeli* (Kil.) has ventral furrow well seen particularly on earlier whorls. According to this character, our specimens (micro-

*Ammonites calisto*: Zittel, 1868, p. 100, Pl. 20, figs. 1–4 (not fig. 5).

*Perisphinctes oppeli*: Kilian, 1889, p. 662.

*Berriasella oppeli*: Mazenot, 1939, p. 49, Pl. 3, figs. 1–3, 5–8 (not fig. 4); Arnould-Saget, 1953, p. 27, Pl. 3, figs. 1, 2, and 4; Nikolov, 1960, p. 160, Pl. 3, figs. 3 and 7; Druschits, 1960, p. 275, Pl. 20, fig. 3 (not fig. 2).

*Berriasella (Berriasella) oppeli*: Le Hégarat, 1973, p. 58, Pl. 5, figs. 1 and 2; Pl. 38, figs. 4 and 5; not Patruilius and Avram, 1976, p. 172, Pl. 4, figs. 1–4; Nikolov, 1982, p. 52, Pl. 9, figs. 1–6; Tavera, 1985, p. 252, Pl. 35, figs. 3–5, Fig. 19/K; Liu and Wang, 1987, Pl. 1, fig. 8.

**Shape.** Small microconchs ( $D$  up to 23 mm); shell strongly compressed laterally, with almost parallel flanks and narrow rounded venter; whorls oval in cross-section, highly extended; umbilicus wide, stepped, with steeply inclined umbilical wall fluently grading into the flank.

**Sculpture.** Flanks are decorated with bifurcate and rare single ribs (3–5 per whorl) originating on the umbilical wall. Ribs cross the flank straightly or are slightly incurved. Bifurcation points are at a half or two thirds of the whorl height. On venter, ribs are interrupted by a distinct narrow furrow crossing them at a right angle. The furrow extends throughout the last whorl.

conchs) are closely similar to species figured by Zittel (1868, Pl. 20, fig. 3). Specimens pictured by Patruilius and Avram (1976, Pl. 4, figs. 1–4) are lacking the dis-

tinct ventral furrow, and we do not include them in synonymy of *B. oppeli* (Kil.).

The specimen figured by Druschits (1960, Pl. 20, fig. 2) is small, showing fasciculate ribbing and should be referred most likely to *Pseudosubplanites lorioli* (d'Orb.). *B. oppeli* (Kil.) differs from similar *B. callisto* (d'Orb.) and *B. subcallisto* (Touc.), as they have no ventral furrow.

**Distribution.** Berriasian, *jacobi-occitanica* zones in the Crimea and Bulgaria; *jacobi* Zone in Spain, southeastern France, and Himalayas; Berriasian in Silesia, Romania, Tunisia, and Argentina (?).

**Material.** Three specimens (17–19/13098) from the eastern Crimea (Feodosia region, Nanikovo Village, Barakol'skaya Valley), collected by Druschits and Bogdanova.

*Berriasella callisto* (d'Orbigny, 1847)

Plate, figs. 8 and 9.

*Ammonites calisto*: d'Orbigny, 1847, p. 551, Pl. 213, figs. 1 and 2; not Zittel, 1868, p. 100, Pl. 20, figs. 1–5.

*Ammonites (Perisphinctes) calisto*: Favre, 1880, p. 37, Pl. 3, figs 6 and 7 (not fig. 5).

Dimensions (mm) and number of ribs per half a whorl

Specimen	D	H	W	D <sub>0</sub>	H/D	W/D	D <sub>u</sub> /D	Number of ribs	
								outer	inner
20/13098	41?	15.5	–	–	0.38?	–	–	36	20

**Comparison and remarks.** In addition to forms with bifurcate and single ribs, researchers (Favre, 1880; Mazenot, 1939; Le Hégarat et Remane, 1968; Nikolov, 1982; Tavera, 1985) referred to *B. callisto* (d'Orb.) ammonites with polygyrate and fasciculate ribbing. We exclude such specimens from the genus *Berriasella* and, correspondingly, from the synonymy of *B. callisto* (d'Orb.). The described species differs from similar *B. subcallisto* (Toucas) by a lower point of rib branching.

**Distribution.** Berriasian (*boissieri* Zone, *pictet-callisto* subzones) in the Crimea, France, Italy, and Bulgaria; Berriasian in Madagascar; Berriasian (*boissieri* Zone)–Valanginian (*Otopeta* Zone) in Spain.

**Material.** Two specimens (20–21/13098) from the central Crimea (Mramornoe Village) collected by Lysenko.

*Berriasella chomeracensis* (Toucas)

Plate, figs. 4 and 5.

*Hoplites callisto* var. *chomeracensis*: Toucas, 1890, p. 601, Pl. 17, figs. 8 and 9.

not *Hoplites calisto*: Kilian, 1889, p. 661, Pl. 31, fig. 3; not Toucas, 1890, p. 600, Pl. 17, fig. 3 (= *Berriasella jacobi* Mazenot).

*Hoplites calisto*: Retowski, 1893, p. 260, Pl. 3, fig. 1a.

*Berriasella callisto*: Mazenot, 1939, p. 56, Pl. 4, figs. 7–10, 12 (not figs. 6 and 11); Nikolov, 1960, p. 158, Pl. 3, figs. 5 and 6; Pl. 4, fig. 2; Pl. 5, fig. 3; Dimitrova, 1967, p. 101, Pl. 48, fig. 6; Le Hégarat et Remane, 1968, p. 29, Pl. 1, fig. 7 (not Pl. 2, fig. 1).

*Berriasella (Berriasella) callisto*: Le Hégarat, 1973, p. 53, Pl. 4, figs. 1–3; Pl. 38, fig. 11; Nikolov, 1982, p. 58, Pl. 11, figs. 5 and 6; Pl. 12, figs. 1–5 (not fig. 6); Pl. 13, figs. 1 and 2 (not fig. 3); Tavera, 1985, p. 256, Pl. 35, figs. 8 and 9 (not fig. 7), Fig. 19/N.

**Shape.** Judging from two broken specimens, shell is evolute, with gently convex flanks. Venter is narrow-rounded; whorl cross-section oval in shape, highly extended; umbilicus wide, with steep wall.

**Sculpture.** Flanks are ornamented with bifurcate and rare single ribs originating on umbilical wall. Ribs straightly cross flanks, being cranked in the aperture area. Ribs bifurcate at the mid-flank or somewhat lower, with the posterior branch deflected backward. The described specimens lack ventral furrow; ribs cross the venter straightly.

*Berriasella chomeracensis*: Mazenot, 1939, p. 62, Pl. 6, figs. 1–7; Arnould-Saget, 1953, p. 36, Pl. 4, fig. 4, Pl. 6, fig. 5; Nikolov, 1960, p. 161, Pl. 4, figs. 4–6, not Pl. 5, fig. 1; Dimitrova, 1967, p. 102, Pl. 48, fig. 4; Liu and Wang, 1987, Pl. 2, fig. 3.

*Berriasella (picteticeras) chomeracensis*: Le Hégarat, 1973, p. 70, Pl. 39, fig. 12, not Pl. 7, figs. 3 and 4; Sapunov, 1979, p. 175, Pl. 56, fig. 3; Nikolov, 1982, p. 65, Pl. 14, figs. 1–5.

*Berriasella (picteticeras) cf. chomeracensis*: Patruilus and Avram, 1976, p. 176, Pl. 5, fig. 5.

*Berriasella (Berriasella) chomeracensis*: Tavera, 1985, p. 244, Pl. 34, fig. 5, Fig. 19/F.

**Shape.** Shells mostly small, with flattened flanks; umbilicus wide, stepped, with low steep wall.

**Sculpture.** Flanks are ornamented with simple single and bifurcate ribs. Originating on the umbilical wall, ribs of umbilical shoulder are slightly deflected posteriorly and cross flanks straightly or being incurved a little anteriorly. Nearby the body chamber, ribs are incurved stronger. Specimens with the diameter up to 16–

18 mm are decorated with straight single ribs only. Double ribs appear on shells with  $D \approx 20$  mm. Ribs bifurcate at the second thirds of the whorl height, and then posterior branches become deflected backward. Single inserted

ribs rarely occur. Ribbing is thin and frequent on juvenile whorls in contrast to more coarse and sparse ribs of adult whorls. Ventral ribs are interrupted by a sharp furrow, near which the rib endings are somewhat thickened.

Dimensions (mm) and number of ribs per whorl

Specimen	D	H	W	$D_u$	H/D	W/D	$D_u/D$	Number of ribs	
								outer	inner
22/13098	16	6.5	6	—	0.41	0.38	—	30	30
23/13098	22.5	10	7.5	—	0.44	0.33	—	36	32
24/13098	54	20	21	—	0.37	0.39	—	69?	34

**Comparison and remarks.** In distinction from other *Berriasella* species, *B. chomeracensis* has sharp ribbing and single ribs on initial whorls. The Crimean specimens are most similar to forms described by Tavera (1985) from Spain and by Sapunov (1979) from Bulgaria. In our opinion, single ribs on initial whorls represent a distinctive feature that puts in a doubt the species affiliation the genus *Berriasella*. However, the unbiased comparison between *Berriasella* species is impossible until their complete morphogenesis and undulations of lobe line are known.

**Distribution.** Berriasian, *jacobi* Zone (*chomeracensis* Subzone) in the Crimea, *jacobi* Zone in south-eastern France, Spain, and Himalayas, *jacobi-boissieri* zones in Bulgaria, *chomeracensis* Zone in Tunisia.

**Material.** Four specimens (22–25/13098) from the Eastern Crimea (Feodosia region, Svyatogo Il'i Cape and Dvuyakornaya Bay) collected by Arkad'ev and Savel'eva.

## CONCLUSIONS

Revising collection of *Berriasella* species from Crimea, we identified six species, among which *B. moesica* Nik. et Man. and *B. chomeracensis* (Touc.) are first encountered. *B. jacobi* Maz. is characteristic of the Berriasian lower zone. *B. moesica* Nik. et Man. and *B. subcallisto* (Touc.) are likely indicative of younger Berriasian horizons (the *occitanica* Zone) present in the section, since the former is known in the stratotype area from *jacobi-boissieri* zones and the latter from the *jacobi-occitanica* zones. In southeastern France, *B. oppeli* (Kil.) is characteristic of the *jacobi* Zone and of the *jacobi-occitanica* zones in Bulgaria. *B. callisto* (d'Orb.) implies that *boissieri* Zone is most likely present in Crimean sections, since in France, Spain, Italy, and Bulgaria it is known only from that stratigraphic level, although in Spain it ranges from the Berriasian *boissieri* to the Valanginian *Otopeta* Zone. *B. chomeracensis* (Touc.) is characteristic of the lowermost Berriasian beds or the *chomeracensis* Subzone (Arkad'ev and Savel'eva, 2002).

New data on ammonite distribution in the Feodosia section are consistent with data on ammonoids from Tunisia (Memmi and Salaj, 1975). Based on materials from Tunisia, Tavera *et al.* (1986) distinguished the upward succession of *chomeracensis*, *pseudogroteranum*, and *grandis* zones in the lower Berriasian (Table). In Tunisia, *B. chomeracensis* is also characteristic of the lower Berriasian section, however it coexists here with other *Berriasella* species (*B. oppeli*, *B. jacobi*) and *Delphinella* (*D. delphinensis*, *D. berthei*). In the Crimea, *B. chomeracensis* has not been identified yet separately or in association with other *Berriasella* species. Evidently the *chomeracensis* Zone range in Tunisia is greater than that of *chomeracensis* Subzone in the Crimean Mountains. The problem of the *jacobi* Zone base and, correspondingly, of the Tithonian upper boundary is still open. The described *Berriasella* species imply that Berriasian sequence of the Crimean Mountains includes the standard *jacobi*, *occitanica*, and *boissieri* zones.

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