Reference section of the north-eastern Caucasus Berriasian

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The North Caucasus, situated at the junction of the large Mediterranean and Boreal paleobiogeographical areas, was the region, in the Berriasian sea basin where fauna of southern and middle Europe and the Russian plain and India developed and intermixed. Representatives of such relatively distant regions appear to have found here favourable bionomical conditions, as indicated by abundant populations of Ammonites and by large-sized individuals.

It should be especially noted that a distinct subdivision of the Berriasian deposits into separate zones and even subzones comparable with contemporary zones of both southeastern Europe and central Russia, is only possible in the northern Caucasus. The Berriasian is wide-spread in the North Caucasus but in outcrops in a narrow strip in mountainous regions, often of rather difficult accessibility. In spite of the well exposed outcrops, the deposits concerned have not been stratigraphically studied in detail, probably because of the incomplete collection of a series of faunal remains and because of the not easily accessible sections.

The structure of the boundary layers of the Jurassic and Cretaceous in the northern Caucasus is partly described in the works of well known Russian geologists [2], [4], [7], [8], although most of their works include only global faunal characteristics of individual lithological series without analyzing Ammonite distribution by layers.

In the whole area treated, the Berriasian is distinctly divided lithologically into a lower, aleuritic and argillaceous formation, and an upper formation of alternating beds of clays, clayey limestones, and organogenous flyschoid limestones. The most complete Berriasian sections are confined to the Gekhi-Uruh interfluve. In other regions of the northeastern Caucasus, parts of this stage are absent.

In the Mesozoic section, the Berriasian black clays or aleurolites are found to the East in conformity with the Tithonian stage with no sign of wash-out or a break in sedimentation. Only to the West (Cheghem, Baksan rivers, etc.), unconformable superposition of the Berriasian to the Upper Jurassic is observed. The terrigeneous deposits containing fauna of the two zones, disappear here from the lower part of the section.

The picture is different at the Berriasian/Valanginian boundary. The stratigraphical break between the stages is distinctly to be seen in most of the area. Basal conglomerates of varying thickness (0,2-0,7 m), composed of limestone fragments and rounded Echinoid nuclei, cemented by carbonate material, lie at the bottom of the Valanginian. According to the literature [2], the Valanginian conformably overlies the Berriasian in the West.

The general character of the Berriasian section is persistent over the whole area, but sharp differences can be seen in both the characteristics and the lithological composition of the underlying Tithonian and the overlying Valanginian strata.

In the northeastern Caucasus, the upper part of the Tithonian is represented by light-grey, layered, organogenous, oolitic limestones and calcarenites with remains of bivalve Mollusks, Gastropods, Brachiopods, and Corals, but without Ammonites.

The Berriasian deposits are distinguished by an abundance of Ammonites and Bivalves. Corals and Brachiopods are locally distributed and confined to definite portions of the section. The Berriasian deposits underlying the Valanginian are composed of massive, white crypto- and fine-grained limestones.

The most typical Berriasian section best characterized by Ammonites is situated on the left bank of the Assa river in the Mag-Sckiabir flume. Its first schematic description was made by RENNGARTEN V. P. [7]. We described this section layer by layer with the respective relationship of faunal remains. In the abund-

ance of fauna, this section may be considered as unique for the whole area of the northern Caucasus and treated as a reference area. Its description is presented below.

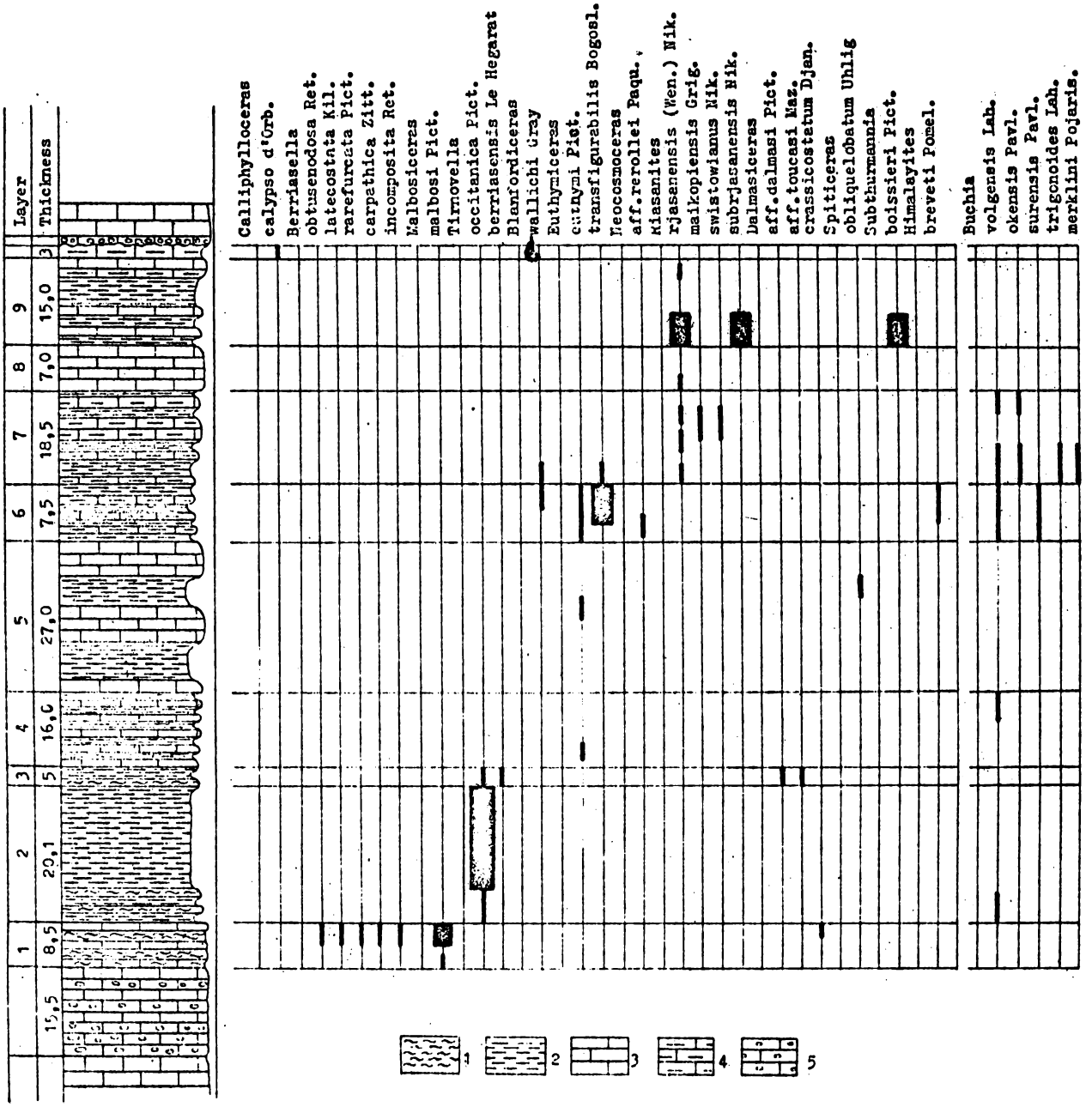

FIG. 1. — *The reference section of the Berriasian of the North-Eastern Caucasus.*
The Mag-Sekyabir flume (the basin of the river of Assa). Compilation of SAKHAROV A. S., 1973.
1 - aleurolites; 2 - carbonate clays; 3 - limestones; 4 - clayey limestones; 5 - limestones of conglomerate appearance.

THE UPPER TITHONIAN

Limestones: dolomitized, creamy-grey, cryptogranular, medium bedded. On their undulating surface, bluish-grey, clayey, medium-bedded limestones with undeterminable remains of bivalve Mollusks superpose without any indication of a break or washout. The rock is conglomeratic in appearance due to inclusions of multiple limestone pebbles. The thickness is 15,5 m.

THE BERRIASIAN

The Tithonian limestones are conformable followed by the Berriasian terrigeneous and carbonate formations.

1. Aleurolites: dirty-grey, fine-grained, calciferous, fine and medium bedded, alternating with calcareous aleurolite layers. Remains of large *Malbosiceras malbosi* PICT., *M.* spp. are found in large quantities in the middle and upper parts of the layer. The thickness is 8,5 m.

2. Clays: dark-grey, almost black, aleuritic, calciferous, distinctly bedded. At the base the clays alternate with beds of dark grey clayey aleurolites. Macro- and microconchs of *Tirnovella occitanica* PICT. are abundant throughout the beds together with *Neocomites* cf. *vasseuri* KIL., *Buchia volgensis* LAH., *Inoceramus neocomiensis* d'ORB., *I. belbekensis* YANIN (1). The thickness is 20,0 m.

3. Aleurolites and clays: dark-grey, calciferous, distinctly bedded. The clays contain *Dalmasiceras* aff. *dalmasi* PICT., *D.* aff. *toucasi* MAZ., *D.* aff. *crassicostatum* DJAN., *D.* spp., *Tirnovella* cf. *occitanica* PICT., *Protocardia subchillana* LEYM. The thickness is 5,1 m.

4. Alternating limestones and marly clays. Limestones: grey, fine-grained, distinctly bedded. Clays: grey, calciferous, aleuritic, micaceous, fine-bedded. Single corals and Ammonites and various bivalve Mollusks: *Barbatia raulini* LEYM., *Lima dubisiensis* PICT. et CAMP., *Laternula agassizi* d'ORB., *Syncyclonema germanica* WOOL., *Gervillia forbesiana* d'ORB., are sometimes found in this layer. The thickness is 16,0 m.

5. Alternating benches of limestone: dark-grey, fine-grained, medium-bedded and clays: grey, calcareous, bedded. In the limestones, *Euthymiceras euthymi* PICT., *E. transfigurabilis* BOGOSL., *E.* spp., *Lima dubisiensis* PICT. et CAMP., *Pterotrigonia caudata* AGAS., *Myophorella loewinson-lessingi* RENNG., *Gervillia anceps* DESH., are found. The thickness is 27,0 m.

6. Alternating argillaceous limestones and clays. Limestones: bluish-grey, argillaceous, fine-grained, bedded, with a great many *serpulae*, bivalve Mollusks, Ammonites. Clays: bluish-grey, very calciferous, aleuritous. *Euthymiceras euthymi* PICT., *E.* aff. *euthymi* PICT., *E. transfigurabilis* BOGOSL., *E.* spp., *Neocosmoceras* aff. *rerollei* PAQU., *Riasanites* sp., *Barbatia raulini* d'ORB., *Buchia volgensis* LAH., *B. surensis* PAVL., *Lima dubisiensis* PICT. et CAMP., *Gervillia forbesiana* d'ORB., *Myophorella leowinson-lessingi* RENNG., were found in the limestones. The thickness is 7,5 m.

7. Alternating argillaceous limestones and clays, analogous to layer 6 above. Usually *Riasanites rjasanensis* (WEN.), *R. maikopiensis* GRIG., *R. swistowianus* NIK., *R.* sp., *Euthymiceras transfigurabilis* BOGOSL., *Blandfordiceras* aff. *wallichi* GRAY, *Himalayites breveti* POMEL., *Barbatia raulini* d'ORB., *Lima dubisiensis* PICT. et CAMP., *Pinna robinaldina* d'ORB., *Gervillia forbesiana* d'ORB., *G. anceps* DESH., *Modiolus gillieroni* PICT. et CAMP., *Buchia volgensis* LAH., *B. okensis* PAVL., *B. trigonoides* LAH., *B. merklini* POJARIS., *Veniella weberi* MORDV., *Myophorella loewinson-lessingi* RENNG., *Sphaera corrugata* SOW., *Toxaster granosus* d'ORB., occur in this layer. Ammonites of the genus *Riasanites* predominate among the Cephalopods. The thickness is 18,5 m.

8. Limestone: grey, fine-grained, medium-bedded, very friable. *Riasanites rjasanensis* (WEN.) NIK. are sometimes found. The thickness is 7,0 m.

9. Alternating limestones and clays. The limestones are bluish-grey, calciferous, indistinctly bedded, slightly aleuritous. In the clays, there are abundant *Subthurmannia boissieri* PICT., *Riasanites rjasanensis* (WEN.) NIK., *R. subrjasanensis* NIK., *R.* aff. *subrjasanensis* NIK. The thickness is 15,0 m.

10. Limestones: clayey, bluish-grey, aleuritous, with a great many remains of *Barbatia raulini* LEYM., *Lima dubisiensis* PICT. et CAMP., *Pinna robinaldina* d'ORB., *Gervillia forbesiana* d'ORB., *G. alaudiensis* MATH., *Modiolus gillieroni* PICT. et CAMP., *Protocardia subhillana* LEYM., *Toxaster granosus* d'ORB. The thickness is 3,0 m.

(1) Determination of bivalve mollusks given by FROLOVA-BAGREEVA E. F.

Terrigenous and carbonaceous Berriasian deposits are overlain by the Valanginian limestones with a sharp boundary and with marks of a break in sedimentation, wash-out of underlying rocks, and basal conglomerate at the base.

The conglomerate is composed of rounded limestone fragments: bluish-grey, aleuritous, cemented by carbonate material. Its thickness is not constant and varies between 0,3-0,7 m. Above, it is followed by massive light-grey limestones with Coral remains.

The more varied Ammonite fauna is confined to the lower Berriasian layer (layer 1) in the neighbouring region (the Giseldon river). Here, we collected *Malbosiceras malbosi* PICT., *M. paramimounum* MAZ., *Berriasella obtusenodosa* REG., *B. latecostata* KIL., *B. carpathica* ZITT., *B. rarefurcata* PICT., *B.* aff. *callistoides* BEHR., *B.* cf. *incomposita* RET., *Himalayites* sp., *Neocomites* sp.

Layer 3 along the Uruh river, contains *Tirnovella berriasensis* LE HÉGARAT, *Euthymiceras* cf. *euthymi* PICT., *E. transfigurabilis* BOGOSL., *Riasanites* (?) sp. indet.

Thus, the Berriasian section is characterized by Ammonites from the bottom to the top. Seven complexes of Ammonites are clearly distinguished, allowing the determination of 4 zones: *Berriasella latecostata*, *Tirnovella occitanica*, *Euthymiceras euthymi*, *Riasanites rjasanensis*.

The oldest complex is composed of various Berriasellides, allowing the determination of the zone of *Berriasella latecostata* (layer 1): *Malbosiceras malbosi* PICT., *M. paramimounum* MAZ., *M.* spp., *Berriasella latecostata* KIL., *B. carpathica* ZITT., *B. rarefurcata* PICT., *B. obtusenodosa* RET., *B.* cf. *incomposita* REG., *B.* aff. *callistoides* BEHR., *Dalmasiceras crassicostatum* DJAN.

The second and third complexes characterize the *Tirnovella occitanica* zone (layers 2 and 3). The lower part of the zone (layer 2) contains the homogeneous species but is extremely rich in respect to the quantity of the *Tirnovella* Ammonite complex, and especially *Tirnovella occitanica* PICT., *Neocomites* cf. *vasseuri* KIL., *Inoceramus neocomiensis* d'ORB., *I. belbekensis* YANIN are found among them.

In addition, for the first time in the Berriasian of the northeastern Caucasus, *Buchia volgensis* LAH. appears in these beds. In proceeding up the section, the number of *Buchia* increases and the greatest number of them are found in the upper part of the section in the *Euthymiceras euthymi* zone.

Due to the exclusive presence of *Tirnovella occitanica* PICT., deposits where this fauna is developed (layer 2) are treated as the *Tirnovella occitanica s. str.* zone.

Layer 3 is characterized by a great number of *Dalmasiceras* aff. *dalmasi* PICT., *D.* aff. *toucasi* MAZ., *D.* aff. *crassicostatum* DJAN, and *Tirnovella occitanica* PICT. are found among them. Forming organically the *Tirnovella occitanica* zone, this complex, however, is characterized by the predominance of *Dalmasiceras* and, for this reason, the beds containing this fauna, are singled out by us in the *Dalmasiceras dalmasi* subzone.

Layers 4, 5 and 6, from the *Euthymiceras euthymi* zone on the basis of the wide distribution of *Euthymiceras* Ammonites. In the lower beds, these Ammonites are relatively rare although in the upper beds, they evidently predominate in the faunal complex. In its turn, the zone is subdivided into two subzones: *Tirnovella berriasensis* and *Euthymiceras euthymi s. str.*

The *Tirnovella berriasensis* subzone complex consists of rare *Tirnovella berriasensis* LE HÉGARAT, *Euthymiceras* cf. *euthymi* PICT. It is interesting to note that in this part of the section, single Corals are found in limestone beds which cannot be found in the rest of this section.

A great number of representatives of *Euthymiceras* and *Neocosmoceras* are found in the *Euthymiceras euthymi s. str.* subzone. It is significant that *Euthymiceras euthymi* PICT. and similar species are found in the lower half of the subzone although, in the upper half, *Euthymiceras transfigurabilis* BOGOSL. are prevalent among which *Riasanites* aff. *rjasanensis* (WEN.) NIK. are found.

The *Euthymiceras* zone deposits are overlain by clay and carbonate formations of the *Riasanites rjasanensis* zone (layers 7, 8, 9, 10) in which two different Ammonite complexes are clearly marked. The lower complex characterizes the *Riasanites rjasanensis s. str.* subzone and the upper complex, the *Subthurmannia boissieri* subzone.

The presence of *Riasanites* Ammonites is common to two subzones of the *Riasanites rjasanensis* zone.

The representatives of Riasanites, *R. rjasanensis* (WEN.) NIK., *R. rjasanensis* (WEN.) NIK. *maikopiensis* GRIG., *R. swistowianus* NIK., *R. subrjasanensis* NIK., dominate in the *Riasanites rjasanensis s. str.* subzone (layer 7, 8). *Euthymiceras transfigurabilis* BOGOSL., *Blandfordiceras* aff. *wallichi* GRAY, *Negreliceras negreli* MATH. and very large *Himalayites breveti* POMEL; are to be found here.

The *Subthurmannia boissieri* subzone (layers 9, 10) is in the uppermost part of the Berriasian stratigraphic scheme where there are many Ammonites, but they are rather homogeneous in respect to species. Here, large *Subthurmannia boissieri* PICT., *Riasanites rjasanensis* (WEN.) NIK. and relatively small *Riasanites subrjasanensis* NIK. may be found.

If seven clear complexes of Ammonites are distinguished on the basis of vertical expansion by means of which the section may be divided into zones and subzones, it is impossible to divide the Berriasian in a similar manner using the bivalve Mollusks. It may be noted that in the *Tirnovella occitanica* zone, the bivalve mollusks are extremely rare, although in the *Euthymiceras euthymi* and *Riasanites rjasanensis* zones there are many *Buchia*, *Lima*, *Myophorella*, and *Gervillia* in all studied section of the northeastern Caucasus. In addition, the representatives of the latter three species from organogenous formations form, exclusively, the remains of these organisms.

When considering the *Subthurmannia boissieri* subzone, it can be seen that the variety of bivalve Mollusks decreases and only in the upper part of the zone, near the top of the stage, there is a blue-grey aleuritic limestone bed containing a great number of *Toxaster granosus* d'ORB., among which *Lima dubisiensis* PICT. et CAMP. and *Gervillia forbesiana* d'ORB., are often found.

In the Valanginian deposits overlying the Berriasian deposits, fossils are extremely rare. It is sufficient to note that RENNGARTEN V. P. [7] has found the only example of *Thurmanniceras thurmanni* PICT. in the northeastern Caucasus near Kichmalka river, which permits fixing of the age of these beds.

Thus, the stratigraphic scheme of the Berriasian stage is as follows (table 1).

Zone	Subzone	Ammonites
Riasanites rjasanensis	*Subthurmannia boissieri*	*Subthurmannia boissieri* PICT., *Riasanites rjasanensis* (WEN.) NIK., *R. subrjasanensis* NIK.
	Riasanites rjasanensis s. str.	*Riasanites rjasanensis* (WEN.) NIK., *R. rjasanensis* (WEN.) NIK. *maikopiensis* GRIG., *R. subrjasanensis* NIK., *R. swistowianus* NIK., *Euthymiceras transfigurabilis* BOGOSL., *Himalayites breveti* POMEL, *Blanfordiceras* aff. *wallichi* GRAY.
Euthymiceras euthymi	*Euthymiceras euthymi* s. str.	*Euthymiceras euthymi* PICT., *E. transfigurabilis* BOGOSL., *Neocosmoceras* aff. *rerollei* PAQU., *Riasanites* aff. *rjasanensis* (WEN.) NIK., *R.* aff. *subrjasanensis* NIK., *Spiticeras obliquel obatum* UHLIG.
	Tirnovella berriasensis	*Tirnovella berriasensis* LE HEGARAT, *Euthymiceras* sp., *Riasanites* (?) sp. indet., *Dalmasiceras* sp.
Tirnovella occitanica	*Dalmasiceras dalmasi*	*Dalmasiceras* aff. *dalmasi* PICT., *D.* aff. *toucasi* MAZ., *D.* aff. *crassicostatum* DJAN., *Tirnovella occitanica* PICT., *Neocomites* cf. *vasseuri* KIL.
	Tirnovella occitanica s. str.	*Tirnovella occitanica* PICT.
	Berriasella latecostata	*Malbosiceras malbosi* PICT., *M. paramimounum* MAZ., *Berriasella latecostata* KIL., *B. obtusenodosa* RET., *B. rarefurcata* KIL., *B. carpathica* ZITT., *B.* cf. *incomposita* RET., *Dalmasiceras crassicostatum* DJAN.

TABL. 1. — *The Stratigraphic scheme of the Berriasian of the North-Eastern Caucasus* Compilation of A. S. SAKHAROV, 1973.

The analysis of the faunal distribution in Jurassic/Cretaceous boundary beds in the northeastern Caucasus, showed that the Berriasian deposits of this region were characterized by a very rich and diversified fauna which is well preserved and rather evenly distributed in the section. Neither accidental accumulations of Ammonoides nor condensed layers are often found in the Upper Jurassic sedimentations of geosyncline areas.

In the Berriasian there is a clear change of faunal complexes and in some cases, a great number of species do not pass from one bed to another. Such a characteristic of the Ammonite complex change in the section provides a strong base for both the elaboration of the zonal stratigraphic scheme and the correlation with the neighbouring areas and typical regions of the Berriasian development (southeastern France). The correlation with the latter is easier due to the similar composition of the different faunal complexes and their location on the section.

It may be noted that each element of the stratigraphic scheme of the northeastern Caucasus Berriasian is rather precisely comparable to that of southeastern France, northeastern Bulgaria, the northwestern Caucasus, Mangyshlak, and the Russian platform.

The lower element of the northeastern Caucasus Berriasian scheme, i.e., the *Berriasella latecostata* zone, contains a great number of Berriasellides (typical mediterranean organism) among which *Malbosiceras malbosi* PICT., *M. paramimounum* MAZ., *Berriasella latecostata* KIL., *B.* aff. *callistoides* BEHR., and *B.* cf. *incomposita* RET. are found only in the Berriasian although *Berriasella carpathica* ZITT., *B. rarefurcata* PICT., and *B. obtusenodosa* RET. are more wide-spread in the South of France, in the Crimea, and the northern Caucasus, and characterize not only the Berriasian, but the upper part of the Tithonian as well. According to the faunal characteristics of the Berriasian lower zone, the Crimea [3] and northeastern Bulgaria [6] are the most similar to the northeastern Caucasus in the *Berriasella grandis* zone, which contains *Malbosiceras malbosi* PICT., *M. paramimounum* MAZ., *Berriasella carpathica* ZITT., and others, found in the *Berriasella latecostata* zone of the northeastern Caucasus. In turn, the beds containing this fauna are correlated with the *Pseudosubplanites grandis* zone of southeastern France [13], [14].

The *Tirnovella occitanica* zone of the northeastern Caucasus is smaller in extent than this same zone in southeastern France. We have subdivided it into two subzones: *Tirnovella occitanica s. str.*, and *Dalmasiceras dalmasi*, whereas the *Tirnovella occitanica* zone consists of four subzones in southeastern France.

The *Tirnovella occitanica s. str.* assuredly correlates with the *Tirnovella subalpina* and *Berriasella privasensis* subzones of LE HÉGARAT G. scheme [13], [14] on the basis of the common *Tirnovella occitanica* PICT. species, which is widely spread in comparable beds of southeastern France.

It is highly significant that the *Dalmasiceras dalmasi* subzone both in the northern Caucasus and in the South of France, is characterized exclusively by representatives of *Dalmasiceras* species among which *Tirnovella occitanica* PICT. is sometimes found.

The *Euthymiceras euthymi* zone is found in the Berriasian of the northeastern Caucasus and, for this reason, our scheme differs from that suggested by LE HÉGARAT G. [13] for the Berriasian of southeastern France.

We have subdivided the *Euthymiceras euthymi* zone into two subzones: *Tirnovella berriasensis* and *Euthymiceras euthymi s. str.* The widely spread *Euthymiceras* Ammonites are united in these two zones. In the lower subzone they are sporadic. In addition, in the upper section, the rapid increase in the representatives of this species with respect to quality and genus, can be seen.

The *Tirnovella berriasensis* and *Euthymiceras euthymi* zones are correlated with the *Malbosiceras paramimounum* of southeastern France mainly due to the presence of the great number of *Euthymiceras* and *Neocosmoceras* Ammonites in these beds, among which *Euthymiceras euthymi* PICT. may be considered the most typical. This species is common to both the *Malbosiceras paramimounum* subzone in the South of France and the *Euthymiceras euthymi s. str.* subzone of the northern Caucasus. It should be noted that in the northern Caucasus, in addition to the above-mentioned species, the other representatives of this genus which are unknown in France, occur. Among the latter is *Euthymiceras transfigurabilis* BOGOSL. characterizing the transient layers of the *Euthymiceras euthymi* and *Riasanites rjasanensis* zones.

LE HÉGARAT G. [14] leaves blank the place between the *Malbosiceras paramimounum* and the *Berriasella picteti* subzone in his scheme. It probably corresponds to the *Riasanites rjasanensis s. str.* subzone of the stratigraphical scheme of the Berriasian of the northeastern Caucasus.

Owing to the presence of the numerous Ammonites of the genus *Riasanites: R. rjasanensis* (WEN.) NIK., *R. subrjasanensis* NIK., *R. swistowianus* NIK., this part of the stratigraphic scheme should be correlated with the equivalent units in the scheme of the Berriasian of Mangyshlak and the Russian plain. *Euthymiceras transfigurabilis* BOGOSL., is common in this complex, and *Blandfordiceras* aff. *wallichi* GRAY, *Himalayites breveti* POMEL (the representatives of the southern part of the Tethys) appear in the northern Caucasus. In the Russian plain, the latter do not occur.

	North-Eastern France (G. Le Hegarat, J. Remane, 1968; G. Le Hegarat, 1971; P. Donze G. Le Hegarat, 1972)		North-Eastern Bulgaria (T. Nikolov 1969)	North-Western Caucasus (N. P. Luppov, V. L. Egojan 1952, 1973)	North-Eastern Caucasus		Mangyshlak (A. A. Saveliev, V. P. Vassilenko 1963)	Russian plain (I. G. Sasonova 1972)	North Sibiria (V.N. Sachs, N. J. Schulgina 1972)
Valanginian	*pertransiens*		*Kilianella roubaudiana*	*Thurmanniceras thurmanni*	*Thurmanniceras thurmanni*		*Echinopygus rostractus*	*Pseudogarnieria undulatoplicatilis*	*Neotollia klimovskiensis*
Berriasian	*Boissieri*	*callisto*	*Subthurmannia boissieri*	*Berriasella boissieri*	*R. rjasanensis*	*Subthurmannia boissieri*		*Surites spasskensis*	*Bojarkia mesezhnikowi*
		picteti							*Surites analogus*
				Riasanites rjasanensis		*Riasanites rjasanensis* s. str.	*Riasanites rjasanensis*	*Riasanites rjasanensis*	*Hectoroceras kochi*
	Occitanica	*paramimouna*			*E. euthymi*	*Euthymiceras euthymi* s. str.	*Euthymiceras euthymi*		
						T. berriasensis			
		dalmasi		*Berriasella pontica*	*T. occitanica*	*Dalmasiceras dalmasi*			*Chetaites sibiricus*
		privasensis				*Tirnovella occitanica* s. str.			
		subalpinus							
	grandis		*Berriasella grandis*		*Berriasella latecostata*				
Tithonian	*jacobi*			*Virgatosphinctes transitorius*				*Craspedites kaschpuricus*	*Chetaites chetae*

Tabl. 2. — *The Correlation of the stratigraphic schemes of the Berriasian of the Mediterranean and Boreal areas.*
Compilation of A. S. Sakharov 1973.

The *Subthurmannia boissieri* subzone of the *Riasanites rjasanensis* zone crowns the scheme of the Berriasian of the northeastern Caucasus. The numerous specimens of the *Subthurmannia boissieri* PICT., *Riasanites rjasanensis* (WEN.) NIK., *R. subrjasanensis* NIK., are characteristic of it.

The first species, which gave the subzone its name, is widely common in the upper part of the Berriasian of southern Europe, the Crimea and the northern Caucasus. However, in Bulgaria, the complex of Ammonites characterizing the *Subthurmannia boissieri* zone is characterized by a great variety of species. The same can be observed in southeastern France where it is divided into two subzones [14] with different complexes of *Berriasellidae*, but the presence of *Subthurmannia boissieri* PICT. is typical of both.

As can be seen from the analysis of the geographic range of the Ammonites and the correlation of the stratigraphical schemes of the Berriasian of the northeastern Caucasus with those of some regions of the Mediterranean area, southeastern France bears the greatest resemblance in faunal content to the northern Caucasus.

The correlation of the subzone *Riasanites rjasanensis s. str.* with that of the Russian plain does not seem difficult. It is somewhat complicated to correlate the *Subthurmannia boissieri* zone of the Mediterranean area with the *Surites spasskensis* zone of the Russian plain of the Boreal area. However, the recent stratigraphical investigations conducted in Kujawi [15] showed that the Ammonites of genus *Riasanites* were found there (although sporadically) in the deposits of the *Surites spasskensis* zone together with the Ammonites of the genus *Surites: S. subtziekwinianus* BOGOSL., *S.* cf. *kozakowianus* BOGOSL., *S.* cf. *spasskensis* NIK. In the Russian plain, *Riasanites* are absent in the *Surites spasskensis* zone. Thus it is seen that the species *Riasanites rjasanensis* (WEN.) NIK., in the Berriasian of Poland has wide stratigraphical range up to the top of the Berriasian.

The same phenomenon is observed in the northeastern Caucasus, but instead of *Surites* (one of the youngest genera of the Ammonites of the Berriasian of the Russian plain), *Subthurmannia boissieri* PICT. occurs. This is an index-species of the top zone of the Berriasian in the stratotype in the South of France, in Bulgaria, and in the Crimea. In the northern Caucasus, *Subthurmannia boissieri* PICT. and *Riasanites rjasanensis* (WEN.) NIK. are widespread. Thus the *Subthurmannia boissieri* and *Surites spasskensis* zones can be identified as the uppermost units in the stratigraphical scheme of the Berriasian of various paleobiogeographical areas.

The correlation of the sections of the Berriasian of the northeastern Caucasus, Mangyshlak, and the Russian plain, shows that the lower part of the Berriasian deposits is absent both in Mangyshlak and in the central regions of the Russian platform. The Berriasian deposits appear in Mangyshlak beginning with the *Euthymiceras euthymi* zone, and in the Russian plain beginning with the *Riasanites rjasanensis* zone.

The Berriasian of the northeastern Caucasus, which enables us to make a detailed division of the stage according to the Ammonite fauna, serves as a connecting link between the contemporaneous deposits of the Mediterranean and the Boreal provinces. Its lower horizons, which are lacking in the Russian platform, are characterized by the typical representatives of the Mediterranean area and they are correlated with those of southeastern France.

Beginning with the *Riasanites rjasanensis* zone, the Ammonites of the genera *Euthymiceras*, *Riasanites*, *Subthurmannia* as well as the southern genera, which enable the correlation of the upper elements of the scheme of the Berriasian of the Mediterranean and Boreal areas, predominate in the faunal complex of the northern Caucasus. Only the Bivalvia of the genus *Buchia*, which appears in the deposits of the *Tirnovella occitanica* zone and is abundant in the *Euthymiceras euthymi* zone, is the truly Boreal organism contained in the Berriasian of the northern Caucasus.

Analysing the faunal composition of the Berriasian, Valanginian, and Tithonian stages as a whole, the author believes that the Berriasian is a peculiar step of evolution of Ammonite fauna. It has more genera in common with the underlying Tithonian deposits than with the overlying Valanginian deposits. Most likely, the Berriasian should be singled out as an independent stage of the upper part of the Jurassic system.

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