acta
geologica
polonica

Vol. 26, No. 1, 83-118 Warszawa 1976

RYSZARD MARCINOWSKI & DIMITR P. NAIDIN

An Upper Albian ammonite fauna from Crimea

ABSTRACT. The paper deals with the Upper Albian ammonites occurring in the transgressive deposits of south-western Crimea in the Soviet Union. On the basis of faunistic and lithological criteria, the stratigraphic subdivision of these deposits is presented, and its scheme compared with those of the platform and geosynclinal areas of Europe and adjacent regions of Asia. In the paleontological part, described are 30 ammonite genera or species, one of which is new: *Prohysteroceras (Goodhallites) tauricense* sp. n. The investigated ammonites represent the families Hamitidae, Scaphitidae, Desmoceratidae, Hoplitidae, Brancoceratidae and Lyelliceratidae, and they bear close resemblances to the assemblages known from western and central Europe.

INTRODUCTION

The paper presents the results of investigations of the Upper Albian ammonites and stratigraphy from the area between the Katsha and Bodrak rivers in the eastern part of the Bakhtshisaray Region in the Highland of Crimea, Soviet Union (*cf.* Fig. 1). This area is only a small section of a lengthy zone of the Upper Albian deposits exposed along the so-called Second Ridge in the south-western Crimean Highland.

Karakash (1907) was the first who discovered the paleontologically documented Albian deposits in the SW Highland of Crimea. These deposits were investigated by Weber, Malysheva & Neyman (1911), Weber & Malysheva (1924), and Weber (1937). A radical change in the structural development of the Crimean Highland during the Albian was evidenced by Muratov (1949, 1960). As a result, a part of the Albian deposits (roughly corresponding to the Lower and Middle Albian) in some regions is lacking due to tectonic upheaval and marine regression, followed by the Upper Albian transgressive succession. In others, the Lower Cretaceous marine sequence continues through the Upper Cretaceous.

Some data on the Upper Albian biostratigraphic zonation in the C mean Highland were supplemented by Muratov (1949, 1960) and Drush chic (1956, 1960). The regional development of the Upper Albian depos

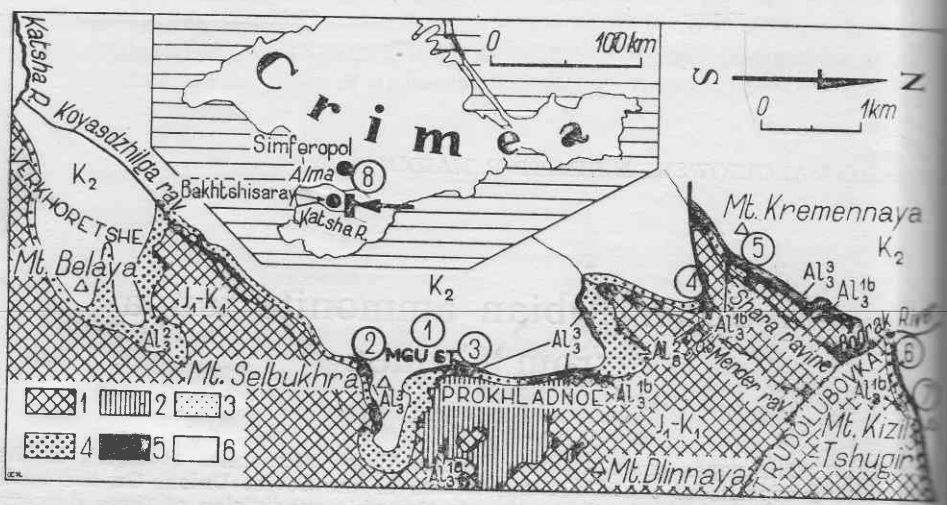


Fig. 1. Geological sketch-map of the area between rivers Katsha and Bodrak in Crimea (arrowed in the inset)

Stratigraphic subdivision of the Upper Albian deposits is presented in Tables 1 and 4; circled numbers denote the investigated profiles (*cf.* Figs 3—4)

1 pre-Albian substrate (Lower and Middle Jurassic, Neocomian and Aptian — J_1—K_1), *2* beds with *Hysteroceras* (Al_3^{1a}), *3* beds with *Scaphites* (Al_3^{1b}), *4* beds with *Mortoniceras* (Al_3^2), *5* beds with *Stoliczkaia* (Al_3^3), *6* Upper Cretaceous (K_2)

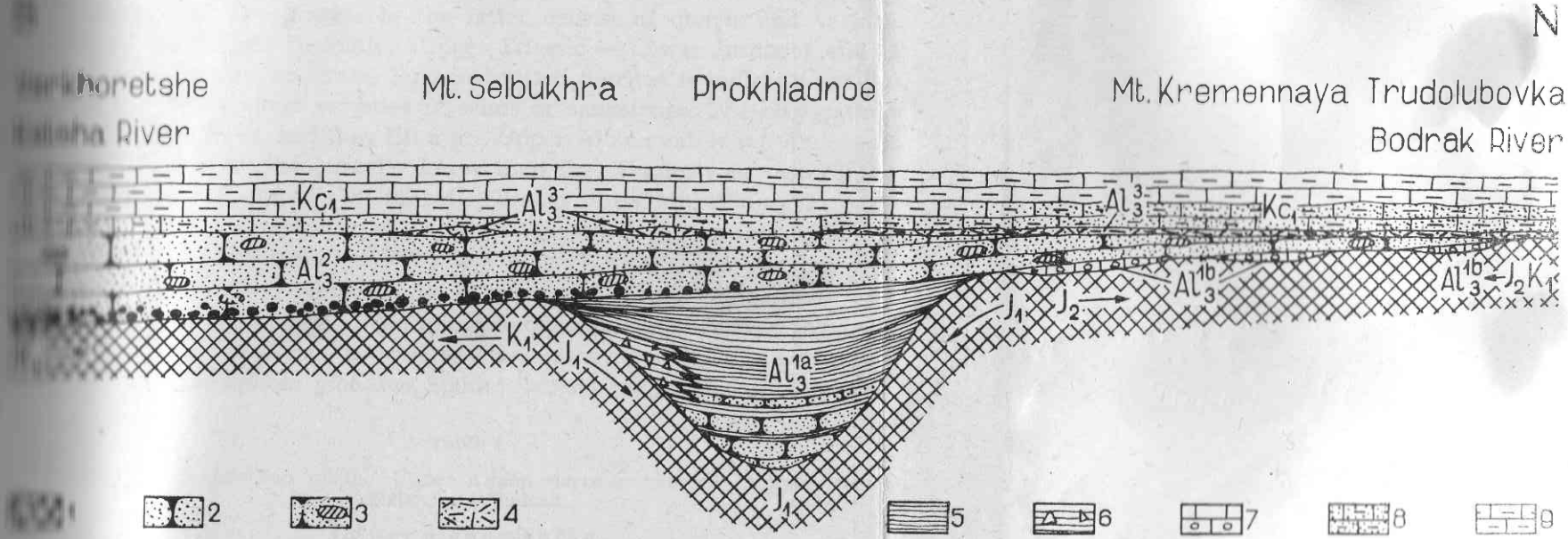
between the Katsha and Bodrak rivers was discussed by Janin (1964), Naidin & Janin (1965).

According to Drushtchic (1956, p. 6; 1960, p. 72), the Upper Albian of this region can be divided into two zones: (*1*) the Hysteroceras orbigny Zone with clays and sands containing *H. varicosum* (Sowerby), *Epihoplites gibbosus* Spath, *Puzosia mayoriana* (d'Orbigny), *Neithea quinquecostata* (Sowerby), and (*2*) the Pervinquieria inflata Zone with quartz-glauconitic sandstones containing *P. inflata* (Sowerby), *Aucellina gryphaeoides* (Sowerby), *Plicatula inflata* (Sowerby), serpulids and abundant associates.

The Upper Albian ammonites of the SW Crimean Highland have not hitherto been described systematically. The collected material from the area between the Katsha and Bodrak rivers presents therefore the first approach to the paleontological and stratigraphical recognition of the Mid-Cretaceous transgressive deposits of Crimea.

Acknowledgements. The authors are cordially thankful to Docent A. Radwański for valuable suggestions during preparation of the paper and critical reading of the manuscript. They are also grateful to Dr. A. Kozłowski for making careful drawings, and to Mrs. K. Boruta for making photos of the ammonites.

Albian deposits between rivers Katsha and Bodrak, and their relation to the substrate (J_1-K_1 – cf. Fig. 1) and to the overlying strata (Lower Cenomanian – Kc_1)



quartz and substrate rocks, 2 sandstones, 3 calcareous glauconitic sandstones, silicified in patches, 4 calcareous glauconitic sandstones with tuffaceous material, 5 clays, 6 clays with blocks of substrate rocks, 7 limestones and calcareous conglomerates, 8 sandy marls with glauconite, 9 marls

SUBDIVISION OF THE INVESTIGATED UPPER ALBIAN DEPOSITS

As appears from the lithological composition and paleontological content, the Upper Albian deposits between Katsha and Bodrak rivers may be subdivided into the three successive units, called here as the *beds* (*cf.* Table 1 and Figs 1—2).

BEDS WITH *HYSTEROCERAS* AND BEDS WITH *SCAPHITES*

The oldest are yellowish-grey, grey and dark-grey limy or, in some places, sandy clays. In the lower part, the clays contain intercalations of yellowish-brown and yellow-brown inequigranular sands or sandstones and conglomerates. The gravels in the latter consist of quartz and various rocks of the Taurica Formation (Upper Triassic — Lower Jurassic), and of the Lower Cretaceous strata. Fine carbonized detritus is indicative of the clays and fine-grained varieties of sands or sandstones. The clays attain a thickness of 80 m, and they fill a pre-Upper Albian valley (*cf.* Figs 2—3), lying therefore hypsometrically lower than the Hauterivian sandstones which build the summits of the Mt. Dlinnaya and Mt. Sheludivaya (*cf.* Figs 1—2). The transgressive character of this sequence was first recognized by Muratov (1949).

From the lower part of these beds exposed in the village of Prokhladnoe, the pelecypods, i.a. *Neithea quinquecostata* (Sowerby), *Plicatula hippites* Pictet & Roux, as well as ammonites *Hysteroceras varicosum* (Sowerby), *Epihoplites gibbosus* Spath, *Puzosia mayoriana* (d'Orbigny)

Table 1

Stratigraphic subdivision of the Upper Albian deposits exposed between rivers Katsha and Bodrak

Lower Cenomanian

Beds with *Stoliczkaia* (Al_3^3):

Stoliczkaia (*Stoliczkaia*) *notha* (Seeley), *Lechites* cf. *gaudini* (Pictet & Campiche)

Beds with *Mortoniceras* (Al_3^2):

Mortoniceras (*Mortoniceras*) *inflatum* (Sowerby), *M.* (*M.*) *pricei* (Spath), *M.* (*M.*) *rostratum* (Sowerby), *Mortoniceras* (*Durnovarites*) *perinflatum* (Spath), *M.* (*D.*) *postinflatum* Spath, various *Puzosia*

Beds with *Hysteroceras* (Al_3^{1a}):	Beds with *Scaphites* (Al_3^{1b}):
Hysteroceras varicosum (Sowerby), *H. orbignyi* (Spath), *Euhoplites ornatus* Spath, *Puzosia* (*Puzosia*) *mayoriana* (d'Orbigny), *Scaphites* (*Scaphites*) cf. *hugardianus* d'Orbigny	*Scaphites* (*Scaphites*) *simplex* Jukes-Browne, *Scaphites* sp. [close to *S. meriani* Pictet & Campiche]

pre-Albian substrate

have been collected by Drushtchic (1960), Janin (1964) and Naidin & Janin (1965). The same outcrops have recently yielded a few minute guards of *Neohibolites* and a mould of *Scaphites (Scaphites)* cf. *hugardianus* d'Orbigny.

The clay deposits of the southern edge of the discussed valley have been reached by boreholes at the Field Station of the Moscow University (= MGU Station) located at the northern slope of the Mt. Selbukhra (cf.

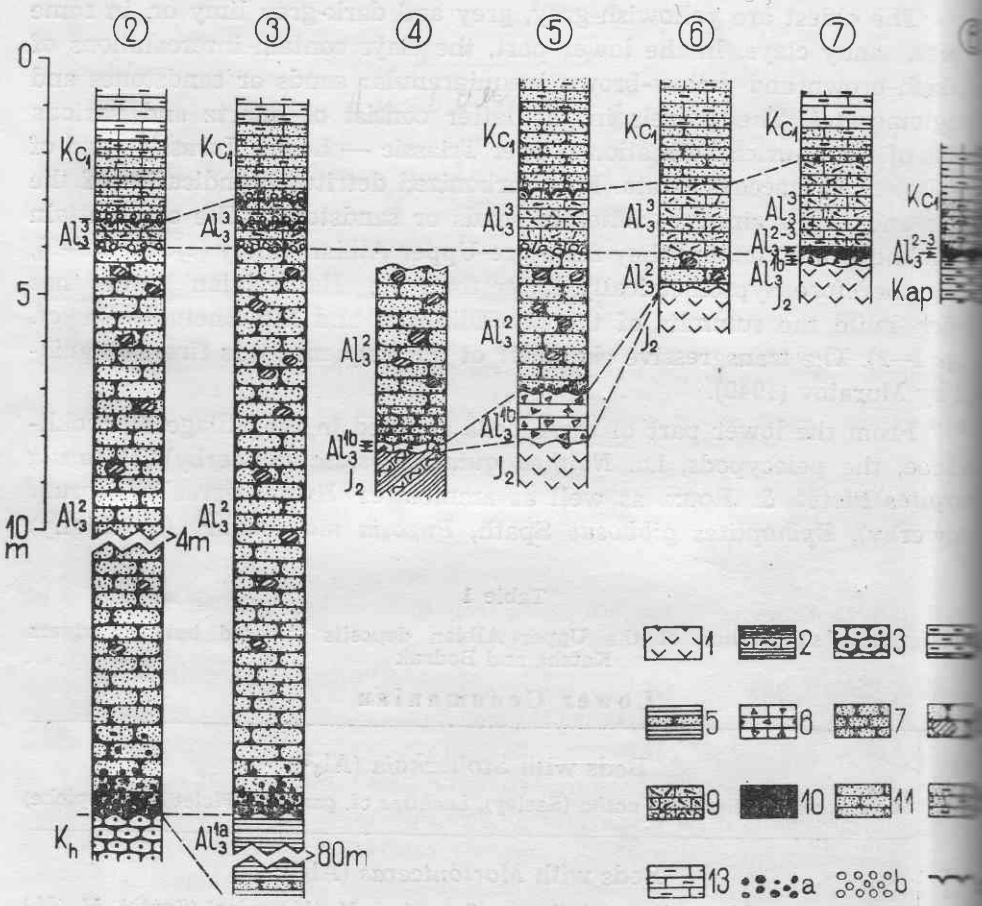


Fig. 3. Profiles (*Nos 2–8*) of the investigated Upper Albian deposits (for their location in Crimea see Fig. 1)

K_h Hauterivian, K_{ap} Aptian, Al_3^{2-3} redeposited fragments from the beds with *Mortoniceras* in the beds with *Stoliczkaia;* other stratigraphic indices as in Figs 1–

Pre-Albian substrate: *1* basic lavas and/or intrusives, *2* siltstones and claystones, *3* calcareous sandstones, *4* clays

Upper Albian: *5* clays with sandstone intercalations at the bottom, *6* limestones with gravels, gravelstones, *7* sandstones rich in glauconite, *8* calcareous glauconitic sandstones, siliceous in patches, *9* calcareous glauconitic sandstones with tuffaceous material, in places (profile No. 5) cross-bedded, *10* calcareous glauconitic sandstones with redeposited fragments from the beds with *Mortoniceras* (*cf.* Fig. 5A, C)

Lower Cenomanian: *11* calcareous glauconitic sandstones, *12* sandy marls with glauconite, *13* marls

a quartz gravels, *b* polymictic gravels, *c* hardgrounds (*cf.* Fig. 6)

Figs 1–2, 4). The lower part of these clays contains blocks (max. 0.5–0.6 m) of the Taurica Formation, Upper Jurassic limestones, as well as of the Lower Cretaceous sandstones and limestones. The ammonites obtained

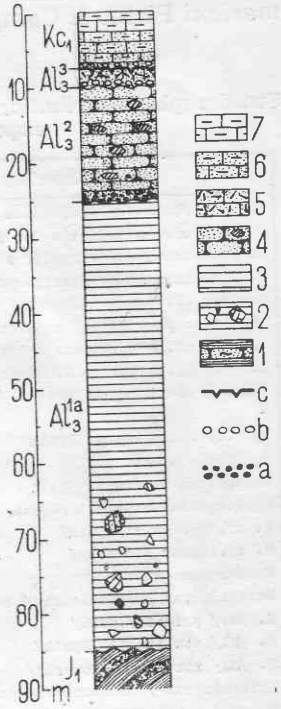


Fig. 4

Compiled profile of the Upper Albian deposits pierced by boreholes at the MGU Station (profile *No. 1* in Fig. 1)

1 siltstones and shales (Taurica Formation: Upper Triassic — Liassic), *2* limy clays with blocks derived from the substrate (Taurica Formation, Upper Jurassic limestones, various Lower Cretaceous deposits), *3* limy clays, *4* calcareous glauconitic sandstones, silicified in patches, *5* calcareous glauconitic sandstones with tuffaceous material, *6* sandy marls with glauconite, *7* marls

a quartz gravels, *b* polymictic gravels, *c* hardground; other explanations as for Figs 1—2

from these clays, chiefly from the depth range of 35–60 m (*cf.* Fig. 4) contain i.a. *Hysteroceras varicosum* (Sowerby), *H. orbignyi* (Spath), *Euhoplites inornatus* Spath, *Puzosia mayoriana* (d'Orbigny) (see Table 2). Rarely, minute (juvenile?) guards of *Neohibolites* were found here, while more common were pelecypods, identified by Dr. B. T. Janin as *Inoceramus anglicus* Woods, *I. sulcatus* Parkinson, *Nucula pectinata* Sowerby, *Plicatula gurgites* Pictet & Roux, *Neithea quinquecostata* (Sowerby), *Leda* sp. and others.

These clays are called by the authors as the beds with *Hysteroceras*, and denoted as Al_3^{1a} (*cf.* Tables 1 and 4, and Figs 1–4).

These beds have most likely their stratigraphic equivalent in a very thin horizon (with a thickness varying from 0.1–0.2 to 0.8–1.0 m) of limestones and/or conglomerates, preserved only in separate patches between the northern outskirts of Prokhladnoe and Trudolubovka (*cf.* Figs 1–3 and 5).

Previously, these limestones and conglomerates as having a superficial resemblance to the Hauterivian rocks in the vicinity of Prokhladnoe were referred to the Hauterivian stage. Janin (1964) proved that the Hauterivian fossils in the discussed deposits were redeposited, while of the

Upper Albian fossils there occurred abundant pelecypods with *Aucellina gryphaeoides* (Sowerby), and rare moulds of *Scaphites*.

The present authors have from these deposits one mould of *Scaphites (Scaphites) simplex* Jukes-Browne, two of *Scaphites* sp. [close to *S. (S). meriani* Pictet & Campiche], and two fragments of *Puzosia*.

Table 2

Stratigraphic distribution of the ammonites occurring in the Upper Albian deposits exposed between rivers Katsha and Bodrak

Species	Al_3^{1a}	Al_3^{1b}	Al_3^2	Al_3^3	Outcrops
Hamites /Hamites/ compressus Sowerby	+				MGU Station
H. /H./ aff. attenuatus Sowerby	+				MGU Station
H. /Stomohamites/ virgulatus Brongniart	+				MGU Station
H. /Plesiohamites/ similis /Casey/	+				MGU Station
Hamites sp.	+				MGU Station
Scaphites /Scaphites/ simplex Jukes-Browne		+			Mt. Kremennaya
S. /S./ cf. hugardianus d'Orbigny	+				Prokhladnoe
S. /S./ sp. [close to S. meriani Pictet & Campiche]		+			Mender, Mt. Kremennaya
Puzosia /Puzosia/ mayoriana /d'Orbigny/	+				MGU Station
P. /P./ sharpei Spath			+		Trudolubovka, Alma, Prokhladnoe
P. /P./ cf. communis Spath			+		Koyasdzhilga, Prokhladnoe
P. /Puzosia/ sp.	+				MGU Station
Euhoplites inornatus Spath	+				MGU Station
Hysteroceras orbignyi /Spath/	+				MGU Station
H. cf. orbignyi /Spath/	+				MGU Station
H. varicosum /Sowerby/	+				MGU Station
Hysteroceras sp.	+				MGU Station
Mortoniceras /Mortoniceras/ inflatum /Sowerby/			+		Prokhladnoe
M. /M./ pricei /Spath/			+		Alma, Trudolubovka
M. /M./ stoliczkai /Spath/			+		Mt. Kizil-Tshugir
M. /M./ rostratum /Sowerby/			+		Shara-Mender
Mortoniceras /Durnovarites/ perinflatum /Spath/			+		Shara-Mender, Koyasdzhilga
M. /D./ postinflatum Spath			+		Shara, Shara-Mender
M. /D./ subquadratum subquadratum Spath			+		Alma
M. /D./ vraconense Renz			+		Shara-Mender
M. /Durnovarites/ sp.			+		Shara-Mender
Mortoniceras sp.			+		Shara-Mender, Verkhoretshe
Prohysteroceras /Goodhallites/ tauricense sp.n.			+		Koyasdzhilga
Stoliczkaia /Stoliczkaia/ notha notha /Seeley/			?	+	Selbukhra, Prokhladnoe, Trudolubovka
S. /S./ notha cf. inflata Spath				+	Selbukhra

The discussed limestones and conglomerates are called as the beds with *Scaphites*, and denoted as Al_3^{1b} (*cf.* Tables 2 and 4, and Figs 1–3 and 5).

BEDS WITH *MORTONICERAS*

Both the beds with *Hysteroceras* and those with *Scaphites* are overlapped by the next stratigraphic unit which is developed not only between the Katsha and Bodrak rivers but also wide-spread in other parts of the Second Ridge of the Crimean Highland. Lithologically, these are calcareous, glauconitic sandstones, usually very compact, and greenish-grey or yellowish-grey in colour; they usually contain grey or dark grey silicified patches. In the south of the region, the sandstones at their bottom part are overloaded with gravel of quartz, fine-grained clastics of the Taurica Formation as well as of various Lower Cretaceous rocks. In the south, the

thickness of sandstones reaches 18—20 m. At the right bank of the Katsha River, above the village of Verkhoretshe, they from a picturesque escarpment. Towards the north, the thickness of the sandstones decreases, being at the Mt. Kremennaya not more than 3 m. In some places in the vicinity of Trudolubovka, the cover of these sandstones has completely been destroyed before sedimentation of the successive beds (Al_3^{2-3} — *cf.* profile No. 7 in Fig. 3 and Fig. 5 C) in which only their fragments are to be found.

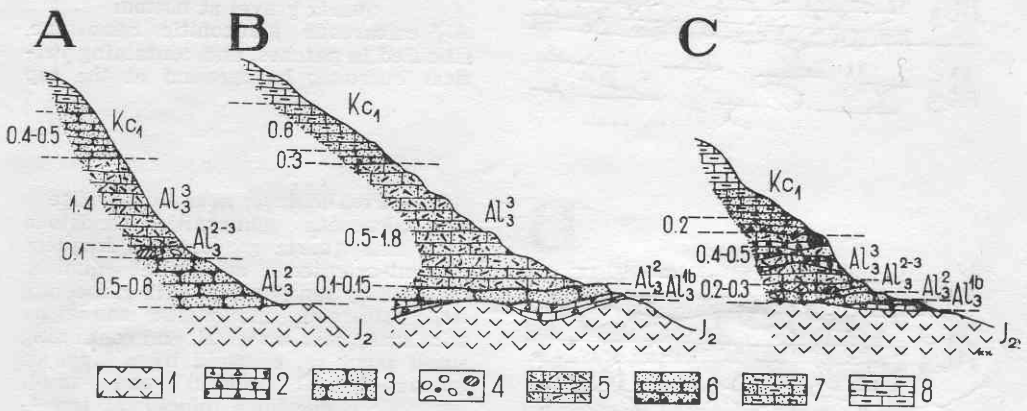


Fig. 5. Detailed sections of the Upper Albian deposits exposed near village Trudolubovka (right edge of the Bodrak river)

A — escarpment of the Bodrak river (profile *No. 6* in Fig. 3)

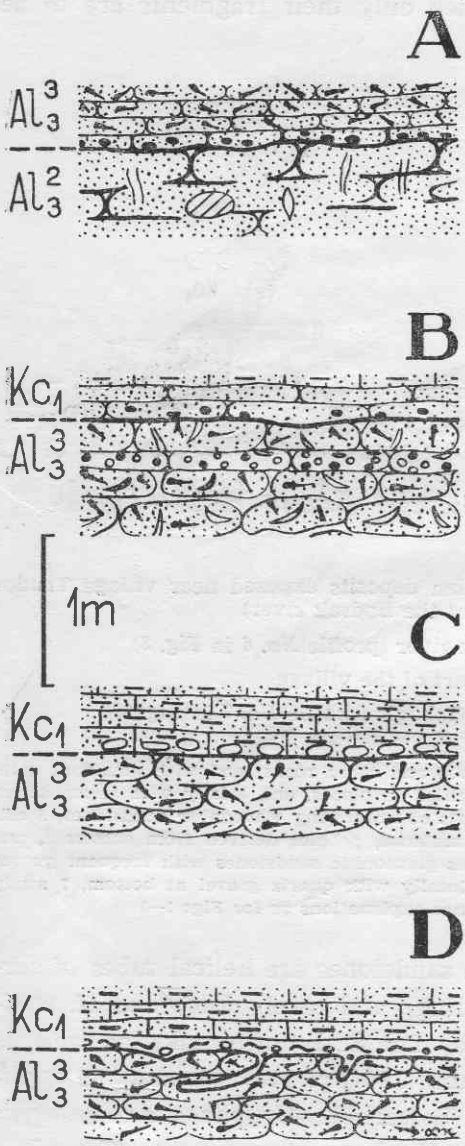
B — northern part of the village

C — southern slope of Mt. Kizil-Tshugir (profile *No. 7* in Fig. 3)

1 effusives, *2* limestones with pebbles of effusives and other rocks, and with abundant pelecypods, *3* calcareous glauconitic sandstones, silicified in places, and locally with phosphatized fauna and quartz pebbles, *4* redeposited fragments of underlying glauconitic sandstones, *5* calcareous glauconitic sandstones with tuffaceous material, pebbles derived from substrate, and with abundant pelecypods *Aucellina*, *6* calcareous glauconitic sandstones with frequent guards of *Neohibolites menjailenkoi* Gustomesov, and locally with quartz gravel at bottom, *7* sandy marls wih glauconite, *8* marls; other explanations as for Figs 1—3

The most common fossils in the sandstones are helical tubes of serpulids, often *Rotularia damesii* (Noetling), and rarely *Filograna* cf. *sollistima* Regenhardt (as determinated by Dr. S. I. Pasternak), as well as moulds or shells of pelecypods (*cf.* Janin 1964, p. 118): *Inoceramus anglicus* Woods, *Aucellina gryphaeoides* (Sowerby), *Gryphaea arduennensis* (d'Orbigny), *Lima canalifera* Goldfuss, *Neithea quinquecostata* (Sowerby), *N. aequicostata* (Lamarck), *Plicatula inflata* Sowerby, and *Pterotrigonia* sp. Less common are gastropods, brachiopods, and echinoids *Holaster leavis* de Luc. The cephalopods are represented by scarce guards of *Neohibolites*,

as well as by moulds of nautiloids *Eutrephoceras* sp. and of poorly preserved ammonites, primarily of the genera *Mortoniceras* [represented i.a. by the species *M. (M.) inflatum* (Sowerby), *M. (M.) pricei* (Spath), *M. (Durnovarites) perinflatum* (Spath), *M. (D.) postinflatum* Spath] and *Puzosia*



A — Mt. Kremennaya
(cf. profile No. 5 in Fig. 3)
Al_3^3 calcareous glauconitic sandstone with tuffaceous material, and with quartz gravel at bottom
Al_3^2 calcareous glauconitic sandstone, silicified in patches, and containing vertical burrows; hardground at the top

B — Prokhladnoe, near Post Office
Kc_1 calcareous glauconitic sandstone with fine quartz gravel, and frequent current-oriented belemnite guards; overlaid by sandy marls with glauconite
Al_3^3 calcareous glauconitic sandstone with tuffaceous material, and containing small burrows; overlaid by a layer of quartz gravel (*white*) and small limonitic concretions (*black*); at top — hard-cemented sandstone with vertical burrows, truncated by a hard-ground surface

C — Mangush ravine, left edge, below the MGU Station
Kc_1 sandy marls with glauconite and well-rounded and well-sorted gravel, primarily of quartz
Al_3^3 calcareous glauconitic sandstone with tuffaceous material; hardground at the top

D — Mt. Tsheger at Prokhladnoe (cf. profile *No. 3* in Fig. 3)
Kc_1 clays with polymictic gravel, overlaid by sandy marls with frequent belemnite guards
Al_3^3 calcareous glauconitic sandstone with tuffaceous material; hardground with burrows at the top

Fig. 6. Detailed profiles at the boundaries between the beds with *Mortoniceras* and with *Stoliczkaia* (Al_3^2/Al_3^3), as well as between the beds with *Stoliczkaia* and the Lower Cenomanian (Al_3^3/Kc_1)

(*cf.* Table 2). Remains of other genera are preserved so poorly that they should not be regarded as determinable.

To the upper part of the sandstones are confined the finds of large *Puzosia*, the shells of which exceed 1 m in diameter.

The discussed sandstones are called as the beds with *Mortoniceras*, and denoted as Al_3^2 (*cf.* Tables 1 and 4, and Figs 1–6).

BEDS WITH *STOLICZKAIA*

The Upper Albian sequence completes with calcareous glauconitic sandstones of dark-green or rusty-brown colour. They contain thin interstalations of quartz gravel and tuffaceous material, the latter mostly recognizable in thin sections. The sandstones vary from compact to loose, whereas their thickness ranges from 1.8 to several centimeters, and in some places they completely wedge out (*cf.* Figs 1–5).

The sandstones contain pelecypods, determined by Dr. B. T. Janin as *Aucellina gryphaeoides* (Sowerby), abundant in places, as well as *Neithea* aff. *sexicostata* (Woods), *Biauris biauriculata* (Lamarck), *Gryphaeostrea canaliculata* (Sowerby), *Liostrea* sp., *Plicatula* sp. and others. There also occur brachiopods, echinoids *Holaster laevis* de Luc, and poorly preserved belemnites *Parahibolites* and *Neohibolites*, the latter represented i.a. by *N. menjailenkoi* Gustomesov, the index species for the Lower Cenomanian. Rare ammonites are preserved as moulds of *Puzosia*, and of *Stoliczkaia (Stoliczkaia) notha notha* (Seeley) and *S. (S.) notha* cf. *inflata* Spath.

The discussed sandstones comprising tuffaceous material are called as the beds with *Stoliczkaia* and denoted as Al_3^3 (*cf.* Tables 1 and 4, and Figs 1–6). The boundaries of this unit, both lower and upper, are of the hardground type (*cf.* Fig. 6).

The base of the overlying Cenomanian deposits between the Katsha and Bodrak rivers is developed as greenish-grey, calcareous glauconitic sandstones or sandy marls, which higher up soon appear to be replaced with marls comprising *Schloenbachia varians* (Sowerby), *Mantelliceras mantelli* (Sowerby), *Puzosia planulata* (Sowerby) and *Neohibolites menjailenkoi* Gustomesov. Locally, at the bottom part of the Cenomanian the latter species displays current-oriented mass occurrences of the "belemnite churchyard" type (*cf.* Alekseev & Naidin 1970; Naidin, Wantchurov & Alekseev 1975).

REGIONAL VALUE OF THE UPPER ALBIAN SUBDIVISION

The biostratigraphic subdivision of the Upper Albian deposits of South England introduced by Spath (1923–1943, pp. 4, 668; 1923a, p. 13; 1926, p. 425 and finally 1941, p. 668), contains two ammonite zones and several subzones (*cf.* Table 3). It corresponds to the succession of ammonites as follows: at the bottom, there occur numerous hysteroceratids accompanied by some mortoniceratids, *Mortoniceras (M.) pricei*

(Spath) in particular; higher up, the representatives of the latter genus become predominant, while at the very top, *Stoliczkaia* makes its appearance.

A similar succession of ammonites is recognizable over a vast area stretching from western and central Europe (*cf.* also Passendorfer 1930; Breistroffer 1936, 1947) as far as to Crimea and Caucasus, the Transcaspian region and Georgia in the Soviet Union (Sokolov 1958; Atabekyan 1960; Atabekyan & Likhatcheva 1960; Luppov, Sirotina & Tovbina 1960; Eristavi 1962; Bogdanova, Luppov & Jakhnin 1963; Drushtchic & Mikhailova 1966; Urmanova & Tashliev 1967). Besides this area, which embraces both the northern platform of the Tethys Ocean as well as a part of this Ocean itself, a similar succession is also known on the southern platform, as evidenced on Madagascar (*cf.* Collignon 1963, 1965).

UPPER ALBIAN ON THE RUSSIAN PLATFORM

North of the Tethys, in the southern part of the Russian platform, a hiatus is recorded at the Lower/Upper Cretaceous boundary. In a number of regions, however, the Upper Albian deposits are preserved in small erosional patches. Thus, Dobrov (1915) found in the central part of the platform, in the valley of the Tsna River, ammonites closely related to *Callihoplites vraconensis* (Pictet & Campiche). The finds of *Mortoniceras inflatum* (Sowerby) and *Stoliczkaia dispar* (d'Orbigny) were reported from the vicinity of Kanev on the Dnieper (Arkhangelsky, Krestovnikov & Shatsky 1927), while Bushynsky (1954) discovered *Mortoniceras* cf. *inflatum* (Sowerby) near Kursk. Finally, the authors include in the present paper a description of *Callihoplites* aff. *tetragonus* (Seeley) from the southern part of the Donbass, the region closest to Crimea.

UPPER ALBIAN AMMONITES OF THE CRIMEAN HIGHLAND

The assemblage of the Upper Albian ammonites from Crimean Highland displays a far-reaching resemblance with that of England and France. Almost all the species described in the present paper are known from the classical Upper Albian sections of these countries (*cf.* Spath, 1923–1942; Breistroffer 1947; and Table 3 in the present paper).

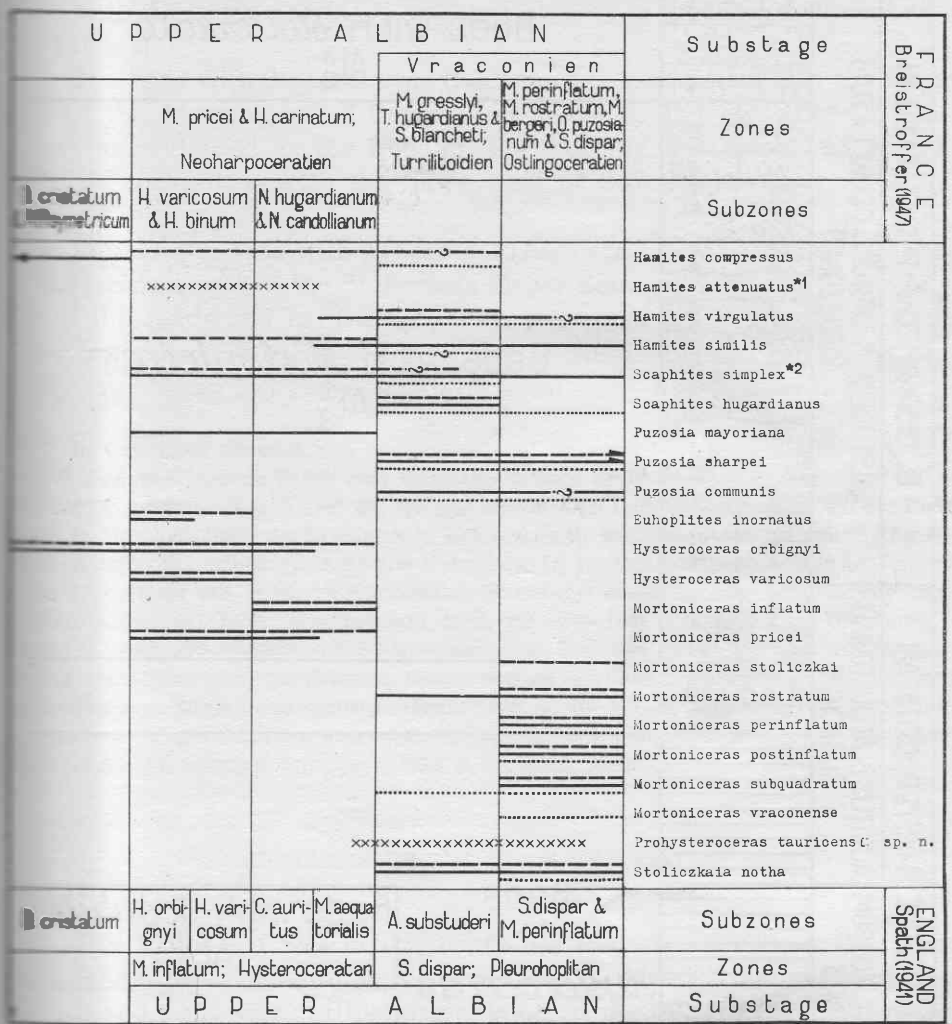
The ammonite assemblage under study is of a wide geographic distribution, as many of its species occur not only in Europe, but also in North Africa, Nigeria, Madagascar, South Africa, India and even in Venezuela and Texas (*cf.* occurrence in the paleontological part of this paper).

When comparing the stratigraphic range of individual species in western Europe it appears that in the Upper Albian deposits of Crimea, all the ammonite zones and subzones of the Upper Albian can be recognized (*cf.* Tables 3–4). A precise recognition of the west European Upper Albian zone or subzone boundaries is not, however, possible here (*cf.* Table 4) due to the following reasons.

Firstly, the ammonite assemblage of Crimea is incomparably poorer than the respective European associations. Some forms, e.g. *Scaphites*, are so rare that their range in the section could not be established. Secondly, no bed-by-bed occurrences of *Mortoniceras* were available. Thirdly, in Crimea, distribution of the Upper Albian ammonites is limited by the

Table 3

Stratigraphic range of the investigated ammonites in the Upper Albian deposits of France and England (correlation *after* Breistroffer 1947); subspecies and assignations *affinis* or *conformis* are omitted (*cf.* Table 2 and paleontological descriptions)



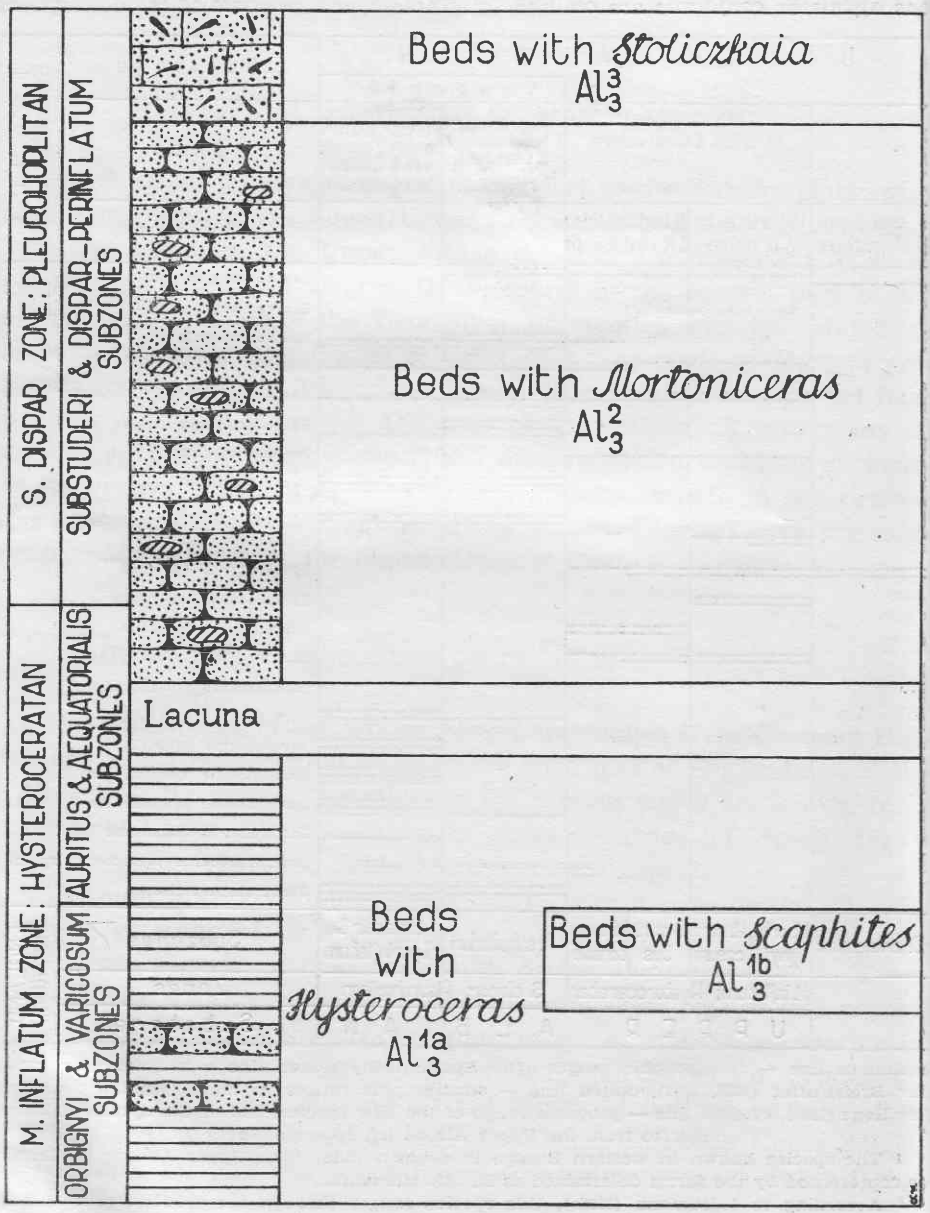
Continuous line — stratigraphic ranges *after* Spath (1942), broken line — stratigraphic ranges after Breistroffer (1936, 1947), dotted line — stratigraphic ranges in the Vraconian stratotype after Renz (1968), crossed line — probable range of the new species, and of the species unknown hitherto from the Upper Albian (*cf.* footnote No. 1)

1 The species known in western Europe in deposits older than Upper Albian; in Crimea, represented by the forms determined as *H.* aff. *attenuatus*.

2 According to Wiedmann (1965a), this species ranges through the whole Upper Albian

successive facies: the genus *Hysteroceras* occurs primarily in clays and, more rarely, in sandstones, while *Mortoniceras* is confined exclusively to glauconitic sandstones, and finally *Stoliczkaia* is encountered only in sandstones with tuffaceous material distributed at the top of the sequence.

Table 4
Position of the investigated Upper Albian deposits in the stratigraphic schema of Spath (1941)



In Western Europe the genus *Hysteroceras*, independantly of facies, occurs alongside with *Mortoniceras*, and *Mortoniceras* alongside with *Stoliczkaia* (*cf.* Table 3).

The available data allow to correlate the major part of the beds with *Hysteroceras* (Al_3^{1a}) with the lower part of the Mortoniceras inflatum Zone (orbignyi and varicosum Subzones — *cf.* Table 4). The uppermost beds with *Hysteroceras* correspond probably to the higher part of the M. inflatum Zone, as *Hamites (S.) virgulatus* Brongniart occurs (*cf.* Table 3) with *Hysteroceras varicosum* (Sowerby). The beds with *Hysteroceras* (Al_3^{1a}) and these with *Mortoniceras* (Al_3^{2}) are separated by a break in sedimentation (*cf.* Table 4).

The beds with *Mortoniceras* (Al_3^{2}) may be correlated with the upper part of the Mortoniceras inflatum Zone (auritus and aequatorialis Subzones), as evidenced by the finds of *Mortoniceras (M.) pricei* and *M. (M.) inflatum*, as well as with the major part of Stoliczkaia dispar Zone (*cf.* Tables 3—4).

Finally, the beds with *Stoliczkaia* (Al_3^{3}) are likely to correspond only to the topmost part of the Stoliczkaia dispar Zone (*cf.* Table 4). These beds are of the condensed nature and, thus, the upper boundary of the latter Zone being itself the Lower/Upper Cretaceous boundary, cannot be precisely established in Crimea, similarly as in other European regions.

In Crimea a redeposition horizon is well developed in the vicinity of Trudolubovka on the Bodrak River and near the village of Partizany on the Alma River (cf. Fig. 3, profiles *Nos* 7 and 8). At the top of the Lower Cretaceous in Sardinia, Demat & Massari (1965) distinguished a horizon with condensed fauna, embracing the interval from the orbignyi to dispar Subzones. In the epicontinental area of Poland, some deposits at the Albian/Cenomanian boundary are also stratigraphically condensed (Cieśliński 1959; Marcinowski 1974, pp. 183—184). Furthermore, the same is with the standard sections of Switzerland and England. Thus, in the middle part of the type-Vraconian sandstones, large, bottom derived fragments do occur being indicative of a subaqueous erosion (Renz 1968, p. 10—11). In England, the Cambridge Greensand ("Pleurohoplitan") is also condensed and yields ammonites of the three topmost Albian horizons (*cf.* Spath 1923, p. 49; 1926, p. 423).

REMARKS ON THE TERM VRACONIAN

The Vraconian was distinguished by Renevier (1868) in the Swiss Jura for the beds containing, in his opinion, a mixed fauna of the Albian (Gault) and Cenomanian (Rotomagian). According to Renevier (1897, Table 4) his stage Vraconian together with Albian and Rotomagian (Cenomanian s. str.) from a Cenomanian "series" as a part of the Upper Cretaceous. The term Vraconian has got a wide application in particular among French geologists. It has been and still is very popular in some other countries, for example in Rumania (Chiriac 1960; Mutiu 1969, 1972, 1974; Stefa-

nescu & Zamfirescu 1964). Some authors followed Renevier in referring it to the Upper Cretaceous, whereas others placed it at the top of the Lower Cretaceous. At present, the Vraconian is mostly regarded as embracing the topmost horizons of the Albian, and being understood as the terminal Albian.

The stratigraphic range and faunal characteristics of the Vraconian, chiefly on the basis of French sections were studied in details by Breistroffer (1936, 1947, 1965, 1967). According to him (*cf.* primarily Breistroffer 1947), sous-étage Vraconien (= the Pleurohoplitan or Stoliczkaian) forms the topmost substage of the Albian. A similar view is also presented by Destombes & Destombes (1965).

Renz (1968) and Renz & Luterbacher (1965) revised the ammonite fauna (comprising about 125 forms) and gave a new description of the Vraconian stratotype located near the village of La Vraconne, 2.2 km NW of the town Ste-Croix in the Canton de Vaud, Switzerland. They recognized that the type of the Vraconian corresponded to the substuderi and dispar-perinflatum Subzones (*cf.* Table 3), that is the Cambridge Greensand of South England which was well stratigraphically defined by Spath (1923—1943, 1923a, 1926). In such a situation, a recommendation by the *Colloque sur le Crétacé inférieur* in Lyon, 1963, to eliminate the Vraconian from the scheme of the Albian Stage subdivision (*cf.* Conclusions générales, 1965, p. 832) should be reminded here, and the standard zonation should only be used for stratigraphic correlations.

VRACONIAN IN THE USSR

In the Russian geological tradition the term Vraconian (*"Wrakon"* in Russian) was introduced in 1899 by Semenov as a synonym for the Upper Albian substage of the Mangyshlak section in the Transcaspian Region. The problem of distinguishing the Vraconian substage on the Russian platform was discussed by Mazarovich (1917); Arkhangelsky (1922); Arkhangelsky, Krestovnikov & Shatsky (1927). Later, Eristavi (1951) distinguished this substage in the Transcaucasian Region, while in the Transcaspian Region it was discussed again by Sokolov (1958, 1966) and Savelev (1969).

In Crimea, it was Weber (1937) who first used the term Vraconian. In the section on the Katsha River, at the village of Vershkhoretshe she distinguished:

2) Vraconian substage — greenish-grey, friable glauconitic sandstones (1—1.5 m) with *Neohibolites, Aucellina, Inoceramus concentricus* Parkinson.

1) Lower and Middle Albian — greenish-grey, hard glauconitic sandstones (10 m) with *Puzosia sharpei* Spath, *Holaster laevis* de Luc, *Serpula* sp.

The units 2 and 1 of Weber correspond in the present paper to Al_3^3 and Al_3^2 respectively.

In later years, Muratov (1949) distinguished the glauconitic sandstones with *Aucellina* (units 1 and 2 of Weber) and referred them to the Vraconian. The latter term has become popular with the Crimean field geologists. On the whole, however, it is of quite limited application in the Soviet Union. Most of the authors avoid this term, which is fully accepted by the present writers.

REFERENCES

ALEKSEEV A. S. & NAIDIN D. P. 1970. Uporjadochennoe zaleganie rostrov belemnitov v cenomanskikh otlozheniakh jugo-zapadnoj chasti Gornogo Kryma. *Izv. Vyschej Shkoly, Geol. i Razvedka*, **9**, 47–51. Moskva.

ARKHANGELSKY A. D. 1922. Obzor geologicheskogo stroenija Evropejskoj Rossii. T. 2. *Srednjaja Rossija*. Izd. Geol. Kom., 1–465. Petrograd.

— , KRESTOVNIKOV V. N. & SHATSKY N. S. 1927. Cenomanskye i tretichnye fosfority Juzhno-Russkoj vpadiny. *Fosfority SSSR*. Izd. Geol. Kom., 45–63. Leningrad.

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

— & LIKHATCHEVA A. A. 1960. Verkhnemelovye otlozhenija Zapadnogo Kopet-Daga. *Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI), new series*, **62**, 1–242. Leningrad.

BOGDANOVA T. N., LUPPOV N. P. & JAKHNIN E. J. 1963. K stratigrafii aptskikh i albskikh otlozhenij Tuarkyra. *Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI), new series*, **109**, 75–97. Leningrad.

BREISTROFFER M. 1936. Les subdivisions du Vraconien dans le Sud-Est de la France. *Bull. Soc. Géol. France, Sér.* **5**, **6** (1–3), 63–68. Paris.

— 1947. Sur les zones d'ammonites dans l'Albien de France et d'Angleterre. *Trav. Lab. Géol. Facul. Sci. Univ. Grenoble*, **26**, 17–104. Grenoble.

— 1965. Vues sur les zones d'ammonites de l'Albien. Colloque sur le Crétacé inf. (Lyon 1963). *Mém. Bureau rech. géol. et minières*, **34**, 311–312. Paris.

— 1967. Justification du Vraconien comme sous-étage mésocrétacé. *C. R. Acad. Sci. Paris*, **264**, Sér. *D* (7), 888–889. Paris.

BUSHYNSKY G. I. 1954. Litologija melovykh otlozhenij Dneprovsko-Doneckoj vpadiny. *Trudy Inst. Geol. Nauk AN SSSR*, **156**, 1–307. Moskva.

CASEY R. 1961. A monograph of the Ammonoidea of the Lower Greensand. *Palaeontogr. Soc. (Monogr.)*, Part **2**, 45–118. London.

CHIRIAC M. 1960. Reprezentanti ai familiei Turrilitidae Meek in cretacicul Dobrogei de Sud. *Studii si cercet. geol.*, **3** (5), 449–474. Bucuresti.

CHLEBOWSKI R. 1962. The Albian ammonites at Chełmowa Góra [*in Polish*]. *Przegl. Geol.*, No. 4–5, 223–228. Warszawa.

CIEŚLIŃSKI S. 1959. The Albian and Cenomanian in the northern periphery of the Holy Cross Mts. *Prace IG (Trav. Inst. Geol.)*, **28**, 1–95. Warszawa.

— 1960. Biostratigraphy and fauna of the Albian in Poland, without the Albian of the Alpine geosyncline. *Prace IG (Trav. Inst. Geol.)*, **30** (2), 5–30. Warszawa.

CLARK D. L. 1965. Heteromorph ammonoids from the Albian and Cenomanian of Texas and adjacent areas. *Mem. Geol. Soc. Amer.*, **95**, 1–68. New York.

COLLIGNON M. 1963. Atlas des fossiles caractéristiques de Madagascar (Ammonites). Albien. *Serv. Géol. Tananarive*, **10**, 1–184. Tananarive.

— 1964. Atlas des fossiles caractéristiques de Madagascar (Ammonites). Cenomanien. *Serv. Géol. Tananarive*, **11**, 1–152. Tananarive.

— 1965. Rapport sur l'étage Albien. Colloque sur le Crétacé inf. (Lyon 1963). *Mém. Bureau rech. géol. et minières*, **34**, 313–318. Paris.

— 1966. Les Céphalopodes crétaces du bassin côtier de Tarfaya. *Notes et Mém. Serv. Géol. Maroc*, No. 175, 1–148. Rabat.

DESTOMBES P. & DESTOMBES J. P. 1965. Distribution zonale des ammonites dans l'Albien du bassin de Paris. Colloque sur le Crétacé inf. (Lyon 1963). *Mém. Bureau rech. géol. et minières*, **34**, 255–270. Paris.

DIENI I. & MASSARI F. 1965. Le Crétacé inférieur d'Orasei (Sardigne) et ses analogies avec celui du Sud-Est de la France. Colloque sur le Crétacé inf. (Lyon 1963). *Mém. Bureau rech. géol. et minières*, **34**, 795—799. Paris.

DOBROV S. A. 1915. Ocherk geologicheskogo stroenija fosforitovykh zalezhej v oblasti srednego techenija r. Cny (Tambovskaja gubernija). *Trudy Kom. Mosk. Sel.-Khoz. Inst. po Issl. Fosforitov, ser. I. Otchet po geol. issl. fosforitovykh zalezhej*, **7**, 245—312. Moskva.

DRUSHTCHIC V. V. 1956. Nizhnemelovye ammonity Kryma i Severnego Kavkaza. Izd. Mosk. Univ., 1—150. Moskva.

— 1960. Stratigrafija nizhnemelovykh otlozhenij Kryma. *In:* Atlas nizhnemelovoj fauny Severnogo Kavkaza i Kryma, 53—74. Moskva.

— & MIKHAILOVA I. A. 1966. Biostratigrafija nizhnego mela Severnogo Kavkaza. Izd. Mosk. Univ., 1—190. Moskva.

ERISTAVI M. S. 1951. O faune vrakonskogo podjarusa Gruzii. *Soobshchenija AN GSSR*, **12** (2), 95—102. Tbilisi.

— 1955. Nizhnemelovaja fauna Gruzii. *Monogr. Inst. Geol. i Mineral. AN GSSR*, **6**, 1—224. Tbilisi.

— 1961. Ammonity apta i alba Severnogo Kavkaza. *Trudy Geol. Inst. AN GSSR*, **12** (17), 41—77. Tbilisi.

— 1962. Podrazdelenie nizhnego mela Alpijskoj zony. *Monogr. Inst. Geol. AN GSSR*, **11**, 1—103. Tbilisi.

GLAZUNOVA A. E. 1952. Novye i maloizvestnye verkhnealbskie ammonity gornoj Turkmenii. Sbornik „Paleontologija i stratigrafija". *Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI)*, 90—107. Moskva.

— 1953. Ammonity apta i alba Kopet-Daga, Malogo i Bolshogo Balkhanov i Mangyshlaka. *Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI)*, 1—156. Moskva.

HAKENBERG M. 1969. Albian and Cenomanian between Małogoszcz and Staniewice, SW border of the Holy Cross Mountains. *Studia Geol. Pol.*, **26**, 1—126. Warszawa.

JANIN B. T. 1964. K stratigrafii verkhnego alba Bakhtchisarajskogo rajona Kryma. *Sbornik Voprosy regionalnoj geologii SSSR*. Izd. Mosk. Univ., 113—120. Moskva.

JUKES-BROWNE A. J. 1875. On the relations of the Cambridge Gault and Greensand. *Quart. J. Geol. Soc. London*, **31**, 256—316. London.

KARAKASH N. I. 1907. Nizhnemelovye otlozhenija Kryma i ikh fauna. *Trudy Sanktpetersburgskogo obshchestva estestvoispytatelej. Otd. Geol. i Mineral.*, **32** (5), 1—482. Peterburg.

KENNEDY W. J. 1971. Cenomanian ammonites from Southern England. *Special Papers in Palaeontology*, **8**, 1—133. London.

KHALILOV A. G., ALIEV G. A. & ASKEROV R. B. 1974. Nizhnyj mel jugo-vostochnogo okonchanija Malogo Kavkaza (Stratigrafija i paleogeografija). *Izd. Inst. Geol. AN ASSR*, 1—183. Baku.

LUPPOV N. P., SIROTINA E. A. & TOVBINA S. Z. 1960. K stratigrafii aptskikh i albskikh otlozhenij Kopet-Daga. *Trudy Vses. N.-Issl. Geol. Inst. (VSEGEI), new series*, **42**, 156—173. Leningrad.

MANIJA A. A. 1974. Stratigrafija i ammonity senomanskikh otlozhenij Juzhnoj Turkmenii. *Sbornik „Stratigrafija i fauna molluskov verkhnemelovykh i paleocenovykh otlozhenij Juzhnoj i Vostochnoj Turkmenii"*, 84—162. Ashkhabad.

MARCINOWSKI R. 1974. The transgressive Cretaceous (Upper Albian through Turonian) deposits of the Polish Jura Chain. *Acta Geol. Pol.*, **24** (1), 117—217. Warszawa.

MAZAROVICH A. N. 1917. O golte Juzhnogo Povolzhja. *Bjull. Mosk. Obshch. Ispytatelej Prirody. Prilozhenija k protokolam*, 23—35. Moskva.

MURATOV M. V. 1949. Tektonika i istorija razvitija Alpijskoj geosinklinalnoj oblasti juga Evropejskoj chasti SSSR i sopredelnykh stran. *Tektonika SSSR*, **2**, 1–510. Moskva.

— 1960. Kratkij ocherk geologicheskogo stroenija Krymskogo polustrova. Moskva.

MUTIU R. 1969. Contributii la studiul paleontologic si stratigrafica al depozitelor albiene din platforma duna. *Studii si cercet geol., geofiz., geogr., Ser. geologie*, **14** (2), 497–510. Bucuresti.

— 1972. Noi contributii la studiul paleontologic si stratigrafic al depozitelor albiene din platforma moesică. *Studii si cercet. geol., geofiz., geogr. Ser. geologie*, **17** (1), 131–150. Bucuresti.

— 1974. Notă asupra faunei vraconiene-cenomaniene din bazinul Rucăr. *Petrol. si gaze*, **25** (5), 248–251. Bucuresti.

NAIDIN D. P. & JANIN B. T. 1965. Nekotorye osobennosti geologicheskogo stroenija okrestnostej s. Prokhladnogo (Krym, Bakhtchisarajskij rajon). *Biul. Mosk. Obshch. Isp. Prirody Otd. Geol.*, **40** (3), 75–81. Moskva.

— , WANTCHUROV I. A. & ALEKSEEV A. S. 1975. Primenenie metodov matematicheskoj statistiki pri izuchenii rostrov cenomanskikh belemnitov. *Bjull. Mosk. Obshch. Ispytatelej Prirody, Otd. Geol.*, **50** (4), 81–94. Moskva.

ORBIGNY A. 1840–1842. Paléontologie française. Terrains crétacés. *I.* Céphalopodes, 1–662. Paris.

OWEN H. G. 1971. Middle Albian stratigraphy in the Anglo-Paris Basin. *Bull. Brit. Mus. Nat. Hist. (Geology), Suppl.* **8**, 1–164. London.

PASSENDORFER E. 1921. Sur le crétacé hauttatrique de la Tatra. *Spraw. PIG (Bull. Serv. Géol. Pol.)*, **1** (2/3), 217–250. Warszawa.

— 1930. Étude stratigraphique et paléontologique du Crétacé de la série hauttatrique dans les Tatras. *Prace PIG (Trav. Serv. Géol. Pol.)*, **2** (4), 511–676. Warszawa.

PICTET F. J. 1847–1854. *In:* PICTET F. J. & ROUX W. Description des mollusques fossiles qui se trouvent dans les Grès Verts des environs de Genève. *Mèm. Soc. Phys. Hist. Nat. Genève*, **11** (1847), 257–412; **12** (1849), 157–287; **13** (1854), 73–173 and 489–558.

— & CAMPICHE G. 1858–1864. Description des fossiles du terrain crétacé des environs de Sainte-Croix. *Mat. Paléont. Suisse*, **1** (1858–1860), 1–380; **2** (1861–1864), 1–752. Genève.

RENEVIER E. 1868. Notices géologiques et paléontologiques sur les Alpes vaudoises et les régions environmants. *V.* Complément de la fauna de Cheville. *Bull. Soc. vaudoise Sci. Nat.*, **9**, 389–479.

— 1897. Chronographie géologique. *C. R. du Congrès géol. Intern, 6e session (1894, Zürich)*, 524–695. Lausanne.

RENZ O. 1968. Die Ammonoidea im Stratotyp des Vraconnien bei Sainte-Croix (Kanton Waadt). *Schweiz. Paläont. Abh. (Mém. Suisse Paléont.)*, **87**, 1–99. Basel.

— 1971. Die Gattungen *Hysteroceras* Spath und *Mortoniceras* Meek (Ammonoidea) aus den Anden Venezuelas. *Ecl. Geol. Helv.*, **64** (3), 569–609. Basel.

— 1972. Die Gattungen *Puzosia* Bayle, *Bhimaites* Matsumoto und *Desmoceras* Zittel (Ammonoidea) im oberen Albien Venezuelas. *Ecl. Geol. Helv.*, **65** (3), 701–723. Basel.

— & LUTERBACHER H. 1965. Die Mittlere Kreide von La Vraconne bei Ste-Croix (Kt. Waadt). *Bull. Ver. Schweiz. Petrol.-Geol. u.-Ing.*, **31** (81), 76–101.

REYMENT R. A. 1955. The Cretaceous Ammonoidea of southern Nigeria and the southern Cameroons. *Bull. Geol. Surv. Nigeria*, **25**, 1–112. Lagos.

SAVELEV A. A. 1969. Materialy k biostratigrafii vrakonskikh otlozhenij Mangyshlaka. *Trudy Vses. Neft. N.-Issl. Geologorazved. Inst. (VNIGRI)*, **268**, 80–83. Leningrad.

SEMENOV V. P. 1899. Faune des dépôts crétacés de Manghychlak et quelques autres localités de la province Transcaspienne. *Trav. Soc. Imp. Natur. St.-Pétersbourg*, **28** (5), 1—178. Pétersbourg.

SHARPE D. 1853—1857. Description of the fossil remains of Mollusca found in the Chalk of England. 1. Cephalopoda. *Palaeontogr. Soc. (Monogr.)*, 1—68. London.

SOKOLOV M. I. 1958. Stratigrafija i facii albskikh otlozhenij Zapadnoj Turkmenii, Juzhnogo Ustjurta i Mangyshlaka. *Trudy Vses. Aerogeol. Tresta*, 4, 3—16. Moskva.

— 1966. Zonalnoe raschlenenie i facii albskikh i verkhnemelovykh otlozhenij Zakaspija. *Bjull. Mosk. Obshch. Ispytatelej Prirody, Otd. Geol.*, **41** (4), 56—72. Moskva.

SPATH L. F. 1921. On Cretaceous Cephalopoda from Zululand. *Ann. South Afr. Mus.*, **12**, part 7 (16), 217—321. London.

— 1922. On Cretaceous Ammonoidea from Angola, collected by Professor J. W. Gregory. *Trans. Roy. Soc. Edin.*, **53**, part 1 (6), 91—160. Edinburgh.

— 1923—1943. A monograph of the Ammonoidea of the Gault. *Palaeontogr. Soc. (Monogr.)*, parts **1** (1923), 1—72; **5—16** (1927—1943), 137—787. London.

— 1923a. Excursion to Folkestone, with notes on the zones of the Gault. *Proc. Geol. Assoc.*, **34** (1), 70—76. London.

— 1926. On the zones of the Cenomanian and the Uppermost Albian. *Proc. Geol. Assoc.*, **37** (4), 420—426. London.

STEFANESCU M. & ZAMFIRESCU M. 1964. Iviri noi de Vraconian-Cenomanian în zona conglomeratelor de Ciucas-Zăganu. *Studii si cercet. geol., geofiz., geogr., Ser. Geologie*, **9** (1), 61—72. Bucuresti.

URMANOVA S. H. & TASHLEV M. S. 1967. Albskie otlozhenija Centralnogo, Gjaurskogo, Vostochnogo Kopet-Daga i Gornogo Badkhyza. *Izv. AN TSSR, Ser. Fiz.-Tekhn., Khim. i Geol. Nauk*, **5**, 117—124. Ashkhabad.

VAN HOEPEN E. C. N. 1951. Die gekielde Ammoniete van die Suid-Afrikaanse Gault. Pervinquieridae, Arestoceratidae, Cainoceratidae. *Paleont. Navorsing Nasion. Mus.*, **1** (7), 285—344. Bloemfontein.

WEBER G. F. 1937. Ot Jalty cherez d. Kokkoz do Bakhtchisaraja. *Putevoditel Juzhnoj Ekskursii (Krym), 17 sessija Mezhd. Geol. Kongressa (Moskva)*, 48—58.

— & MALYSHEVA V. S. 1924. Sur la stratigraphie du Mésocrétacé et du Néocrétacé de la Crimée. *Bull. Soc. Géol. France, sér.* **4**, **33** (5—6), (1923), 193—204. Paris.

— , — & NEYMAN O. F. 1911. Podrazdelenie verkhnego mela Kryma. Otchet geol. komiteta za 1911 god. *Izv. Geol. Kom.*, **31** (1), (1912), 37—39.

WIEDMANN J. 1962. Ammoniten aus der Vascogotischen Kreide (Nordspanien). I. Phylloceratina, Lytoceratina. *Palaeontographica, Abt. A*, **118**, 119—241. Stuttgart.

— 1965a. Origin, limits, and systematic position of *Scaphites*. *Palaeontology*, **8**, 397—453. London.

— 1965b. Sur la possibilité d'une subdivision et des corrélations du Crétacé inférieur Iberique. Colloque sur le Crétacé inf. (Lyon 1963). *Mém. Bureau rech. géol. et minières*, **34**, 819—823. Paris.

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

WRIGHT C. W. 1957. *In:* R. C. MOORE (*Ed.*) *Treatise on Invertebrate Paleontology*, Part L (Mollusca 4), 80—437. Lawrence.

— & WRIGHT E. V. 1951. A survey of the fossil Cephalopoda of the Chalk of Great Britain. *Palaeontogr. Soc. Monogr.*, 1—40. London.