ABHANDLUNGEN DER GEOLOGISCHEN BUNDESANSTALT

Abh. Geol. B.-A. | ISSN 0016–7800 | ISBN 3-85316-14-X | Band 57 | S. 539–553 | Wien, Februar 2002

Cephalopods – Present and Past | Editors: H. Summesberger, K. Histon & A. Daurer

Volgoceratoides and *Koeneniceras* – New Small-Size Lower Aptian Heteromorphs from the Ulijanovsk Region (Russian Platform)

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3 Text-Figures, 3 Tables and 2 Plates

Russia
Russian Platform
Cretaceous
Aptian
Ammonoidea
Heteromorphs

Contents

Volgoceratoides und *Koeneniceras* – Neue kleinwüchsige heteromorphe Ammoniten aus dem Unterapt der Ulijanovsk-Region (Russische Tafel)

Zusammenfassung

Horizontierte Aufsammlungen im Unterapt des Gebiets von Ulijanowsk (Russische Tafel, Wolgatal) erbrachten neue Daten über die Stratigraphie und die Verbreitung der Ammoniten. *Volgoceratoides schilovkensis* gen. & sp. nov. und *Koeneniceras tenuiplicatum* (V. KOENEN 1902) – zwei kleinwüchsige Heteromorphe – werden beschrieben. Der Ammonitenfauna des basalen Unterapts von Ulijanowsk stehen die norddeutschen Faunen sehr nahe. Zwei parallele Zonenfolgen auf Basis der Entwicklung der Deshayesitidae und der Ancyloceratidae werden erstellt. Beide Familien hatten verschiedene ökologische Positionen besetzt und kennzeichnen zwei unterschiedliche Tiefenbereiche im selben Becken.

Abstract

New stratigraphical and ammonite distribution data are given based on bed-by-bed fauna collecting in the Lower Aptian of the Ulijanovsk region (Volga River, Russian platform). *Volgoceratoides* and *Koeneniceras* – two new small-size heteromorph ammonites – are described as a result of revision. It is recognised that the ammonite taxa from the basal Lower Aptian of the Ulijanovsk region show great resemblance with North German sections. Two parallel zonal schemes, based on the development of the families Deshayesitidae and Ancyloceratidae, are offered. Those groups of ammonites occupied a different ecological position and therefore the schemes characterise different bathymetrical regions of the same basin.

1. Introduction

Aptian sections of the Ulijanovsk (Simbirsk) region in the Volga River, Russian Platform, are known because of the extended outcrops and well-preserved ammonites, which are preserved in limy and siderite concretions. Although the investigations of the Aptian deposits and fauna from this region have a long history, the most important works appeared in the 20th century (SASONOVA, 1958; RONOV, SASONOVA & KHAIN, 1964; SASONOVA & SASONOV, 1967; GLASUNOVA, 1961, 1963, 1973). Recently BARABOSHKIN and co-workers restudied several sections be-

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tween Ulijanovsk and Saratov in Middle Povolzhie (BARABOSHKIN, 1998; BARABOSHKIN et al., 1999). These works allowed us to define the Barremian/Aptian boundary, distinguish Aptian Substages in the region and to revise the ammonite stratigraphy. However, familiarisation with the extensive ammonite collections of V.M. EFIMOV, I.A. SHUMILKIN, G.N. USPENSKY, V.A. KRIVOSHEEV from Ulianovsk led G.K. KABANOV and M.O. AGAFONOV (Moscow) to reinvestigate our own collections. Productive work with T.N. BOGDANOVA (VSEGEI), spurred us to work out the new ammonite zonal scheme and to start a revision of the ammonite fauna. In this work we focus on some stratigraphical problems and on the revision of two small heteromorphs, which seem to be new genera.

2. Stratigraphy

2.1. Overview

We used the stratigraphical subdivisions described in the work of BARABOSHKIN (1998) and reproduced in the work of BARABOSHKIN and co-authors (BARABOSHKIN et al., 1999). Members I to VII belong to the Lower Aptian in accordance with those works (Text-Fig. 1).

Member I, clayey-sandy in composition, sharply thins in southward direction (from Ulijanovsk City to Sengiley Town) because of unconformities and condensation in its base and top (softgrounds and erosional surfaces respectively). Ammonites were not found in this interval and the age was determined by the disappearance of the belemnite *Oxyteuthis* and dinocyst and magnetostratigraphical data (BARABOSHKIN et al., 1999).

Member II is more clayey. It is characterised by the only find of one ammonite near the top in the Ulijanovsk section. Although the ammonite assemblage is very poor in the Ulijanovsk region, it becomes much richer southwards. The composition of the member in the Saratov region changes totally from clayey to sandy strata, but ammonites are more common. In the previous work the ammonite from the Ulijanovsk was wrongly determined as *Deshayesites forbesi* CASEY, 1961, but here we agree that it would be better to redetermine it as *Deshayesites* cf. *tenuicostatus* (V. KOENEN, 1902). We use the generic name of *Deshayesites* instead of *Prodeshayesites* (sensu CASEY, 1961 and 1960–1980) because we agree with KEMPER (1995) that *Prodeshayesites* has no morphologically distinct features to separate it from *Deshayesites* (see revision in BOGDANOVA & MIKHAILOVA, 1999). The Saratov ammonite assemblage from member II is richer: *Deshayesites tenuicostatus* (v. KOENEN, 1902), *D.* ex gr. *tenuicostatus* (v. KOENEN, 1902), *D. bodei* (v. KOENEN, 1902) and *D.* aff. *bodei* (v. KOENEN, 1902), *D.* sp. However, heteromorph and deshayesitid ammonites similar to the German succession were not found here.

Member III generally consists of clays and contains the only find of *Deshayesites* cf. *tenuicostatus* (v. KOENEN, 1902). The top of this member is eroded in the Ulijanovsk region. The succession is more complete southward from Ulijanovsk and the transition to the oil shales of member IV is more gradual in the Khavalynsk-Saratov regions. There, in the south, we found the first *Deshayesites volgensis* SASONOVA, 1958 and *D.* sp. 2 to 3 m below the top of member III.

Member IV consists of oil shales with an interrupted layer of diagenetic carbonate concretions ("Aptian slab" horizon of SASONOVA, 1958; GLASUNOVA, 1973), which contains numerous juvenile and adult ammonites. The ammonite assemblage includes *Deshayesites gracilis* CASEY, 1964, *D. volgensis* SASONOVA, 1958, *D. consobrinoides* (SINZOW, 1899), *D. saxbyi* CASEY, 1964, *D.* sp., *Paradeshayesites callidiscus* (CASEY, 1961), *P. imitator* (GLASUNOVA, 1968) (see revision in BOGDANOVA & MIKHAILOVA, 1999) and *Sinzovia trautscholdi* (SINZOW, 1870). Heteromorph ammonites are small and rare: *Volgoceratoides schilovkensis* gen. et sp. nov. (Pl. 1, Fig. 4–6, 9), *Koeneniceras tenuiplicatum* (v. KOENEN, 1902) (Pl. 1, Fig. 1–3, 10), *K.* sp. nov.

Member V is built up mainly from dark clays with the ammonites *Deshayesites multicostatus* SWINNERTON, 1935, *D. consobrinoides* (SINZOW, 1899), *D.* sp., *Paradeshayesites ssengileyensis* (SASONOVA, 1958), *P. imitator* (GLASUNOVA, 1968), *P. topley* (SPATH, 1930), *D. similis* BOGDANOVA,1991. The heteromorph ammonite assemblage includes *Ancyloceras matheronianum* D'ORBIGNY, 1842 (Pl. 1, Fig. 7), *A. mantelli* CASEY, 1960, *Lithancylus* aff. *grandis* (J. DE C. SOWERBY, 1829), *L. glebi* I. MICHAILOVA & BARABOSHKIN, 2001, *L. iogori* I. MICHAILOVA & BARABOSHKIN, 2001, *L. russiensis* I. MICHAILOVA & BARABOSHKIN, 2001, *L. tirolensiformis* I. MICHAILOVA & BARABOSHKIN, 2001. They were found mainly in the upper part of the member. Previously we supposed that there could be a gap in this member in the Ulijanovsk section (BARABOSHKIN et al., 1999), because we did not confirm finds of *Ancyloceras matheronianum* in this section. Recent collecting of this ammonite by I.A. SHUMILKIN and G.N. USPENSKY support the presence of the *Ancyloceras* interval in the Ulijanovsk section, which is half as thick as the Sengiley section.

Member VI has a silty-clayey composition and contains two levels with different ammonite assemblages. The Deshayesitidae ammonite assemblage is uniform for the whole interval: *Deshayesites* aff. *rarecostatus* BOGDANOVA, KVANTALIANI & SCHARIKADZE, 1979, *D.* sp., *Paradeshayesites ssengileyensis* (SASONOVA, 1958) and *Cheloniceras* ex gr. *cornuelianum* (D'ORBIGNY, 1841). Several specimens of nautiloid *Cymatoceras* aff. *bifurcatum* (OOSTER, 1858), *C. karakaschi* SHIMANSKY, 1975, *C.* cf. *karakaschi* SHIMANSKY, 1975 were also found there. Two different ammonite assemblages were determined in the member. The lower one contains *Proaustraliceras tuberculatum**) (SINZOW, 1870) (= *Ancyloceras simbirskensis* JASYKOV sensu LAHUSEN, 1874; = *Australiceras simbirskense* (SINZOW, 1872) sensu GLASUNOVA, 1973, BARABOSHKIN, 1999) (Pl. 2, Fig. 1–2), "*A. rossicus*" (SASONOVA, 1958 non CASEY; = *"Crioceras gracile"*: SINZOW, 1905), "*A.*" sp., *Proaustraliceras laticeps* (SINZOW, 1905), *Toxoceratoides* sp., *Pseudoaustralicaras pavlowi* (VASSILIEVSKY, 1908), while the upper one includes *Audouliceras renauxianum* (D'ORBIGNY, 1842) (Pl. 2, Fig. 3) and *Toxoceratoides* ex gr. *royerianus* (D'ORBIGNY, 1842).

*) *Australiceras (Proaustraliceras)* we consider as a separate genus as it was, in fact, convincingly shown by BENGTSON & KAKABADZE (1999).

Text-Fig. 1. ►▷►
Scheme of localities and the Ulijanovsk, Kremenki, and Sengiley sections.
1 = sands; 2 = silts; 3 = laminated sandy clays; 4 = clays; 5 = oil shales; 6 = clayey limestones; 7 = limestones; 8 = bioturbation; 9 = siderite concretions; 10 = sulphide concretions; 11 = phosphorites; 12 = shell detritus; 13 = contacts: a: softgrounds, b: erosional surfaces; 14 = member No. (after BARABOSHKIN, 1998).
15–20 = finds of fauna: 15 = *Deshayesites*; 16 = *Volgoceratoides*/*Koeneniceras*; 17 = *Ancyloceras*; 18 = *Audouliceras*/*Proaustraliceras*; 19 = *Tropaeum*; 20 = *Oxyteuthis*.
21 = stratigraphic lines between a = stages/substages, b = members and c = beds.

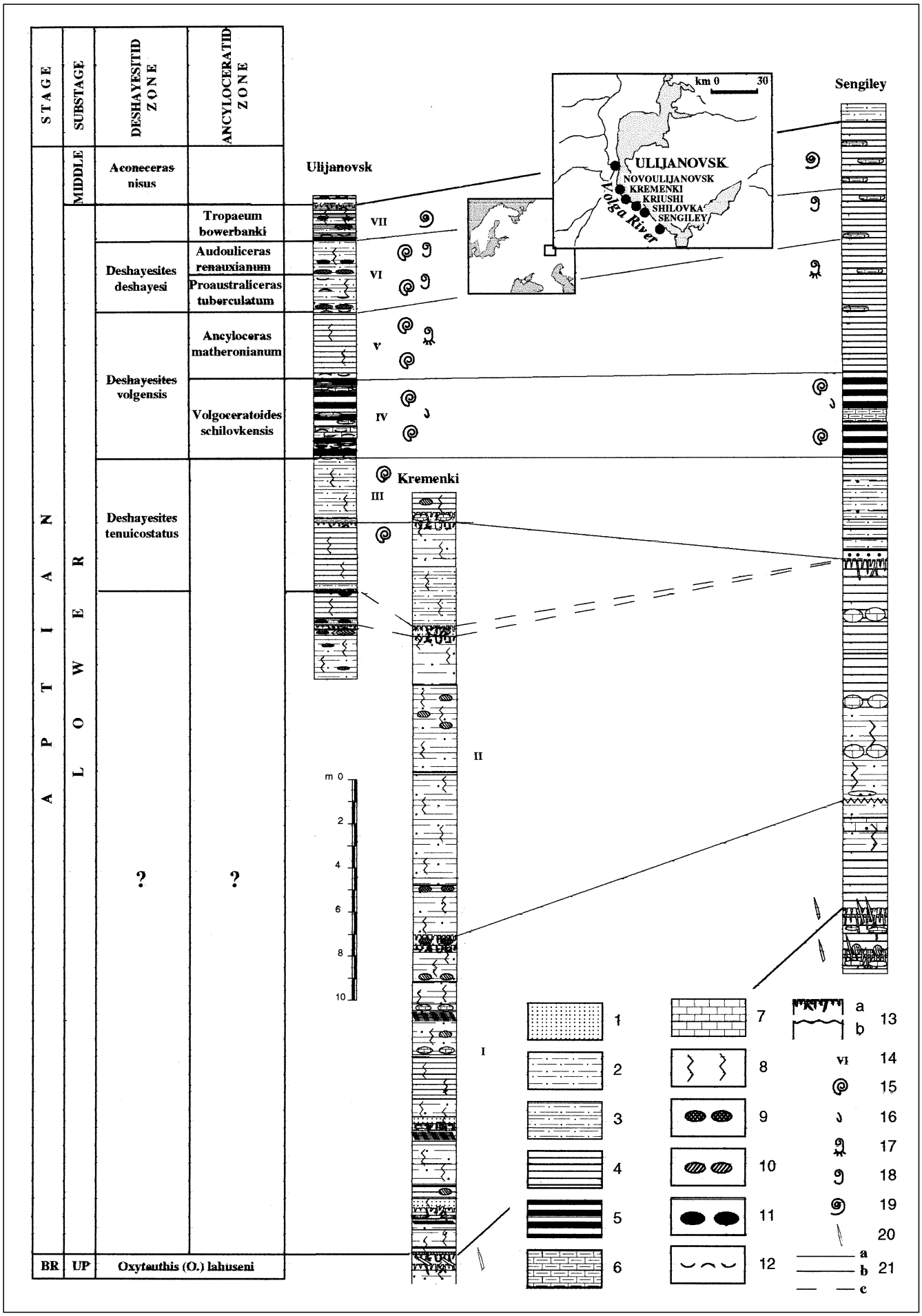


Table 1.
Lower Aptian ammonite zonation of the Ulijanovsk region and its correlation with England and German zonations.

STAGE	SUBSTAGE	R.Casey, 1961; R.Casey et al., 1998 England		E.Kemper, 1995 Germany	E.Yu.Baraboshkin, 1998 Ulijanovsk Region	This paper, Ulijanovsk Region	
		ZONE	SUBZONE	ZONE	ZONE	DESHAYESITID ZONE	ANCYLOCERATID ZONE
APTIAN	MIDDLE (part)	Cheloniceras martinioides (part)	Epicheloniceras debile	Tropaeum drewi + Tropaeum tenuinodosum	Aconeceras nisus	Aconeceras nisus	
	LOWER	Tropaeum (Tropaeum) bowerbanki	Cheloniceras meyendorffi	Tropaeum bowerbanki + Dufrenoyia furcata	Tropaeum bowerbanki		Tropaeum bowerbanki
			Dufrenoyia transitoria				
		Deshayesites deshayesi	Deshayesites grandis	Deshayesites deshayesi	Deshayesites grandis	Deshayesites deshayesi	Audouliceras renauxianum
			Cheloniceras parinodum				Proaustraliceras tuberculatum
		Deshayesites forbesi	Deshayesites annelidus	?	beds with Deshayesites consobrinoides	Deshayesites volgensis	Ancyloceras matheronianum
			Deshayesites calllidiscus				
			Deshayesites kiliani				
			Deshayesites fittoni		Deshayesites deshayesi		Volgoceratoides schilovkensis
		Prodeshayesites fissicostatus	Prodeshayesites obsoletus	Deshayesites tenuicostatus	Deshayesites forbesi	Deshayesites tenuicostatus	
			Prodeshayesites bodei	Deshayesites bodei	?	?	
BAR	UPP	WEALDIAN		Parancyloceras bidentatum	Oxyteuthis (Oxyteuthis) lahuseni	Oxyteuthis (Oxyteuthis) lahuseni	

It is very probable that GLASUNOVA's *"Australiceras" apticum*, *"A." altum*, based on *"A." rossicus*, *"A." solidum* and *"A." jasykowi* (SINZOW, 1905), which should be referred to *Proaustraliceras*, characterise the lower part of this member, but their reality needs further investigations.

In southward direction this member becomes more and more sandy. In the Saratov region it is represented by cross-bedded sands and sandstones, which contain quite rare large *Deshayesites* and do not contain any heteromorphs.

Member VII is the uppermost Lower Aptian member of rhythmical alternation of cross-bedded silts and clays with the rare giant ammonites *Tropaeum (Tropaeum) bowerbanki* J. DE C. SOWERBY, 1837 (Pl. 1, Fig. 8) and T. sp. This member becomes increasingly sandy towards south.

2.2. Interpretation

We now think that a phylogenetically "uniform" biostratigraphical scheme is preferable to the synthetic Deshayesitid-Ancyloceratid-Douvilleiceratid zonation, which is usually used for Lower Aptian biostratgraphy (CASEY, 1961, 1960–1980; CASEY, BAYLISS & SIMPSON, 1998; KEMPER, 1967, 1995 and many others including the authors) because of three major reasons:

1) Different groups of the mentioned ammonites took different ecological (and bathymetrical) positions in the basin (WESTERMANN, 1990; BENGTSON & KAKABADZE, 1999), which strongly affected their facial distribution (see in particular, KAKABADZE, 1981). We recognised this effect when comparing the Ulijanovsk relatively deep-water and Saratov shallow-water deposits: the former contain heteromorphs, while they are almost absent in the latter.
2) The distribution of Deshayesitidae and Ancyloceratidae was additionally controlled by temperature: *Deshayesites*, *Paradeshayesites Proaustraliceras*, *Ancyloceras**), the new genera *Volgoceratoides* and *Koeneniceras* are found only in the Northern Hemisphere, while *Audouliceras* and *Tropaeum* are recognised in both hemispheres (DAY, 1969; KLINGER & KENNEDY,1977; KAKABADZE, 1981; BENGTSON & KAKABADZE, 1999), where they occupy two belts in the temperate latitudes.

*) We strongly doubt that the *Ancyloceras* found in Zululand (KLINGER & KENNEDY, 1977) are really *Ancyloceras*.

3) Both 1 and 2 determine that the time-space distribution of phylogenetically different lineages may be expected to differ in different regions (BARABOSHKIN, 1999). It defines the provincialism of biostratigraphical zones (ARKELL, 1946). It means that there could be stratigraphical "overlaps" or "gaps" between adjacent zones if we use a phylogenetically "mixed" zonal index successions.

Therefore under favourable conditions ("if possible") we prefer to use a double biostratigraphic nomenclature based on the principles above and we consider that the Lower Aptian of the Ulijanovsk region demonstrates the principles.

In accordance with the ammonite distribution we can propose biostratigraphical zonation for the Lower Aptian of the Ulijanovsk region (Table 1), based on two phylogenetically different lineages: the families Deshayesitidae and Ancyloceratidae of the same ancyloceratid stock (WRIGHT et al., 1996).

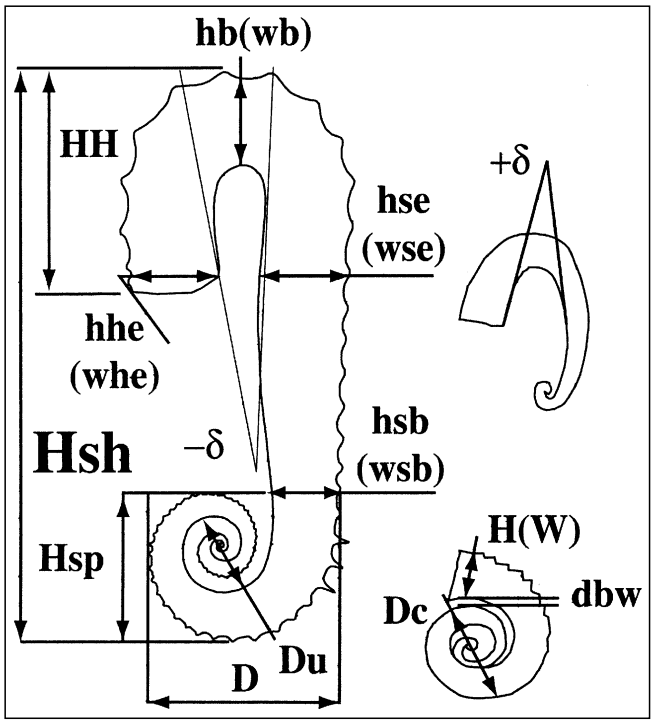
The current ammonite position of member I cannot be determined because of the absence of ammonites. The Deshayesitid zonation is as follows:

1) *Deshayesites tenuicostatus* Zone (member II and the lower part of member III): *Deshayesites tenuicostatus* (v. KOENEN, 1902), *D.* ex gr. *tenuicostatus* (v. KOENEN,1902), *D. bodei* (v. KOENEN, 1902) and *D.* aff. *bodei* (v. KOENEN, 1902), *D.* sp. The ammonite assemblage is very similar to the *Deshayesites tenuicostatus* Zone in KEMPER's sense (1967, 1973). However, the Zone cannot be splitted into *Bodei* Zone and *Tenuicostatus* Zones (KEMPER, 1995), because in the Saratov region both index-species were found together without any sign of reworking.
   The presence of both index-species defines their biostratigraphical position and makes possible a correlation with the *Fissicostatus* Zone of England (CASEY, 1960–1980, 1961) and *Bodei-Tenuicostatus* Zones of Germany (KEMPER, 1967, 1973, 1995). Correlation with the Turkmenian and North Caucasus successions (BOGDANOVA, 1978; BOGDANOVA & MIKHAILOVA, 1999) and SE France (DELANOY, 1995a, 1997) is more difficult because of the absence of those ammonites.
2) The *Deshayesites volgensis* Zone (top of member III – member V) consists of two ammonite levels, which probably will be divided as subzones in the future. Members III–IV contain *Deshayesites gracilis* CASEY, 1964, *D. volgensis* SASONOVA, 1958, *D. consobrinoides* (SINZOW, 1898), *D. saxbyi* CASEY, 1964, *D.* sp., *Paradeshayesites callidiscus* (CASEY, 1961), *P. imitator* (GLASUNOVA, 1968). The position of this interval could be compared with the upper part of the *Forbesi* Zone of England by the presence of *Deshayesites gracilis*, *D. saxbyi* and *Paradeshayesites callidiscus* (CASEY, 1960–1980, 1961). The other deshayesitids are known from the Russian Platform. *Deshayesites volgensis* SASONOVA (1958) is very close to *Deshayesites forbesi* CASEY (1961), which is probably a junior synonym of the former one. However, we agreed to leave the name *Forbesi* Zone before the relation of *forbesi* and *volgensis* species will be more clear.
3) Member V contains *Deshayesites multicostatus* SWINNERTON, 1935, *D. consobrinoides* (SINZOW, 1898), *D. similis* BOGDANOVA,1991, *D.* sp., *Paradeshayesites ssengileyensis* (SASONOVA, 1958), *P. topley* (SPATH, 1930), *P. imitator* (GLASUNOVA, 1968). Co-occurrence of *Paradeshayesites topleyi* and *Deshayesites multicostatus* indicates the transition between the *Forbesi* and *Deshayesi* Zones of England (CASEY, 1960–1980, 1961). The species *topleyi* was reported also from the *Weissi* and basal *Deshayesi* Zones of Turkmenia (BOGDANOVA, 1978) – i.e. it takes a stratigraphical position, similar to England.
4) The *Deshayesites deshayesi* Zone (member VI) *Deshayesites* aff. *rarecostatus* BOGDANOVA, KVANTALIANI & SCHARIKADZE, 1979, *D.* sp., *Paradeshayesites ssengileyensis* (SASONOVA, 1958). The species *Deshayesites rarecostatus* is known from the *Deshayesites dechyi-D. deshayesi* Zone of Daghestan (BOGDANOVA, KVANTALIANI & SHARIKADZE, 1979). A find of *Cheloniceras* ex gr. *cornuelianum* (D'ORBIGNY, 1841) confirms the *Deshayesi* Zone (CASEY, 1960–1980, 1961; CASEY, BAYLISS & SIMPSON, 1998; DELANOY, 1995a, 1997).

The Ancyloceratid Zonation is represented as follows (Table 1):

1) *Volgoceratoides schilovkensis* Zone (member IV): *Volgoceratoides schilovkensis* gen. et sp. nov. (Pl. 1, Fig. 4–6,9), *Koeneniceras tenuiplicatum* (v. KOENEN, 1902) (Pl. 1, Fig. 1–3,10), *K.* sp. nov. Both new genera are known from the *Weissi* Zone of Germany (see below), which corresponds to the *Forbesi* Zone of England (BOGDANOVA, 1978; DELANOY, 1995a, 1997).
2) *Ancyloceras matheronianum* Zone (member V): *Ancyloceras matheronianum* D'ORBIGNY, 1842, *A. mantelli* CASEY, 1960, and a rich *Lithancylus* assemblage: *L.* aff. *grandis* (J. DE C. SOWERBY, 1829), *L.* glebi I. MICHAILOVA & BARABOSHKIN, 2001, *L.* igori I. MICHAILOVA & BARABOSHKIN, 2001, *L. russiensis* I. MICHAILOVA & BARABOSHKIN, 2001, *L. tirolensiformis* I. MICHAILOVA & BARABOSHKIN, 2001. *Lithancylus grandis* is known from the *Deshayesites deshayesi* Zone (CASEY, 1960–1980), but recently *Lithancylus* cf. *grandis* together with *Ancyloceras* cf. *matheronianum* were reported from the *Deshayesites annelidus* Subzone of the *Forbesi* Zone of England (CASEY, BAYLISS & SIMPSON, 1998). *Ancyloceras* cf. *matheronianum* was also recognised in the *Weissi* Zone of SE France (DELANOY, 1995a, 1997). It confirms therefore their distribution around the *Forbesi/Deshayesi* transition similar to that of the deshayesitids (see above).
3) *Proaustraliceras tuberculatum* Zone (lower part of member VII): *Proaustraliceras tuberculatum* (SINZOW, 1870), *Proaustraliceras laticeps* (SINZOW, 1905), *Toxoceratoides* sp. Representatives of *Proaustraliceras* are known mainly from the upper part of the *Deshayesites grandis* Subzone (*Deshayesi* Zone) of England and the basal *Tropaeum bowerbanki* Zone (CASEY, BAYLISS & SIMPSON, 1998) and from the Lower Aptian of other regions (KAKABADZE, 1981). The index-species was reported also from the Lower Aptian of the Northern Caucasus (EGOYAN, 1989).
4) *Audouliceras renauxianum* Zone (upper part of member VII): *Audouliceras renauxianum* (D'ORBIGNY, 1841) (Pl. 1, Fig. 3) and *Toxoceratoides* ex gr. *royerianus* (D'ORBIGNY, 1842). *Audouliceras renauxianum* is known from the Lower Aptian of SE France (THOMEL, 1964; DELANOY, 1997), and the Caucasus (KAKABADZE, 1981). In England, however, it has not been found.
5) *Tropaeum bowerbanki* Zone (member VIII): *Tropaeum (Tropaeum) bowerbanki* J. DE C. SOWERBY, 1837 and *T.* sp. The zonal index-species is a characteristic fossil of the *Bowerbanki* Zone of England (CASEY, 1960–1980, 1961, CASEY, BAYLISS & SIMPSON, 1998).

Assuming the zonation above, we have to note that the ancyloceratid zonation in the muddy facies of the Povolzhie region seems to be more detailed and easily recognizable than the deshayesitid one.



Text-Fig. 2.
Scheme of ammonite measurements.
H = Height of the whorl; W = Width of the whorl; dbw = Distance between whorls in heteromorphs; Hsh = Height of the shell; Hsp = Height of the spiral part of the shell; hsb = Height of the spiral bend; wsb = Width of the spiral bend; hse = Height of the shaft; wse = Width of the shaft bend; hb = Height of the hook; wb = Width of the hook bend; HH = Height of the hook; hhe = Height in the end of the hook; whe = Width in the end of the hook; D = Diameter of the shell; Du = Diameter of umbilicus; Dc = Diameter of the spiral part of the shell in the place of formation of the large-scaled; δ = Hook angle ("+" and "–" for the angle are used in case of backward and outward direction of the hook).

3. Systematic Palaeontology

For the descriptions we use mainly standard terms and dimensions. Most of them are figured in Text-Fig. 2. The others, missing in the picture, are: α_1 = Angle between ribs and the direction of the shaft (or radius in spiral forms); α_3 = Angle between branches of ribs.

The collection of ammonites is deposited in the Moscow State University (MSU), in the collections of I.A. MIKHAILOVA and E.J. BARABOSHKIN and in the Museum of the Paleontological Institute, Moscow (PIM).

Genus: *Volgoceratoides* I. MICHAILOVA & BARABOSHKIN, gen. nov.

Ancyloceras (pars) – VON KOENEN, 1902, S. 331.
Toxoceratoides (pars) – KLINGER & KENNEDY, 1977, p. 305.
Toxoceratoides (pars) – AGUIRRE URRETA, 1986, p. 295.

Generic name: from the Volga River and greek keras: horn, oides: type, form.

Type species: *Volgoceratoides schilovkensis* gen. et sp. nov. Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zone. Right bank of the Volga River, Ulijanovsk region, Shilovka Village.

Diagnosis: Small hamulicones with an arc-like (broadly unrolled spiral) early stage, well-developed shaft in the middle stage and a hook on the late stage. The embryonic stage and initial camera are unknown. The smallest height of a whorl in the initial part of arcs in two samples is less than 1 mm. So logistics suggest that the arc is initiated just after the first whorl. The living chamber covers half of a shaft and a hook. The sculpture of the shaft is represented by simple ribs with two rows of small tubercles – lateral and ventral. It is replaced by biplicate and intercalated ribs with disappearance of the ventral row of tubercles on the hook.

Suture line: Simple because of the small size of the *Volgoceratoides* shell (Text-Fig. 3A). The bipartite ventral lobe is complicated by two lateral teeth. Tripartite umbilical (U), internal (I) and dorsal (D) lobes are subsymmetrical. The deep and broad umbilical lobe is the largest, while the internal lobe is the smallest. Saddles are bipartite and the external saddle (V/U) is asymmetric.

Composition: *Volgoceratoides schilovkensis* I. MICHAILOVA & BARABOSHKIN, gen. et sp. nov., *V. biplicatus* (v. KOENEN, 1902).

Remarks: Hamulicones similar to our samples were figured in the work of v. KOENEN (1902) as *Ancyloceras biplicatum*. KLINGER & KENNEDY (1977) considered the *biplicatum* type as a species of *Toxoceratoides*. AGUIRRE URRETA (1986) too considered this ammonite to belong to *Toxoceratoides*, but has discussed a conventionness of this (p. 296). V. KOENEN's samples are represented by fragments of hook and cannot give a complete idea of the species *biplicatum*. This species has only one row of tubercles (ventral). Unfortunately, the specimen of v. KOENNEN, numbered as GPIG No. 103–104 in the collection of Geologisch-Paläontologisches Institut der Universtät Göttingen, was not found. Our samples, which are more complete, have two rows of tubercles with the lateral row disappearing before the beginning of hook. The other distinguishing feature of v. KOENEN's samples is that the front branch of the bifurcate ribs of the hook is significantly curved forward. These features force us to propose *schilovkensis* as a new species.

The new genus differs from *Toxoceratoides* and from *Helicancylus* by the absence of thickened trituberculate ribs and the presence of bipartite ribs on the hook.

The new genus is also similar to the Upper Barremian *Hamulinites* [in particular to the group of "*Eoleptoceras (Tzankoviceras) tzankovi* MANOLOV, 1962" = *Hamulinites parvulus* sensu VAŠICEK & WIEDMANN, 1994]. It differs from *Hamulinites* by the smaller size of the hook, by the presence of bipartite ribs on the hook bend and by bituberculate ribs on the beginning of the shaft. The later feature recalls *Karsteniceras*, which is spirally coiled in early stages and has no hook.

Hamiticeras (in particular the type-species *H. pilsbryi* ANDERSON, 1938) is also close to the new genus, but is clearly distinguished by the intercalation of thick tuberculate and fine ribs on the shaft.

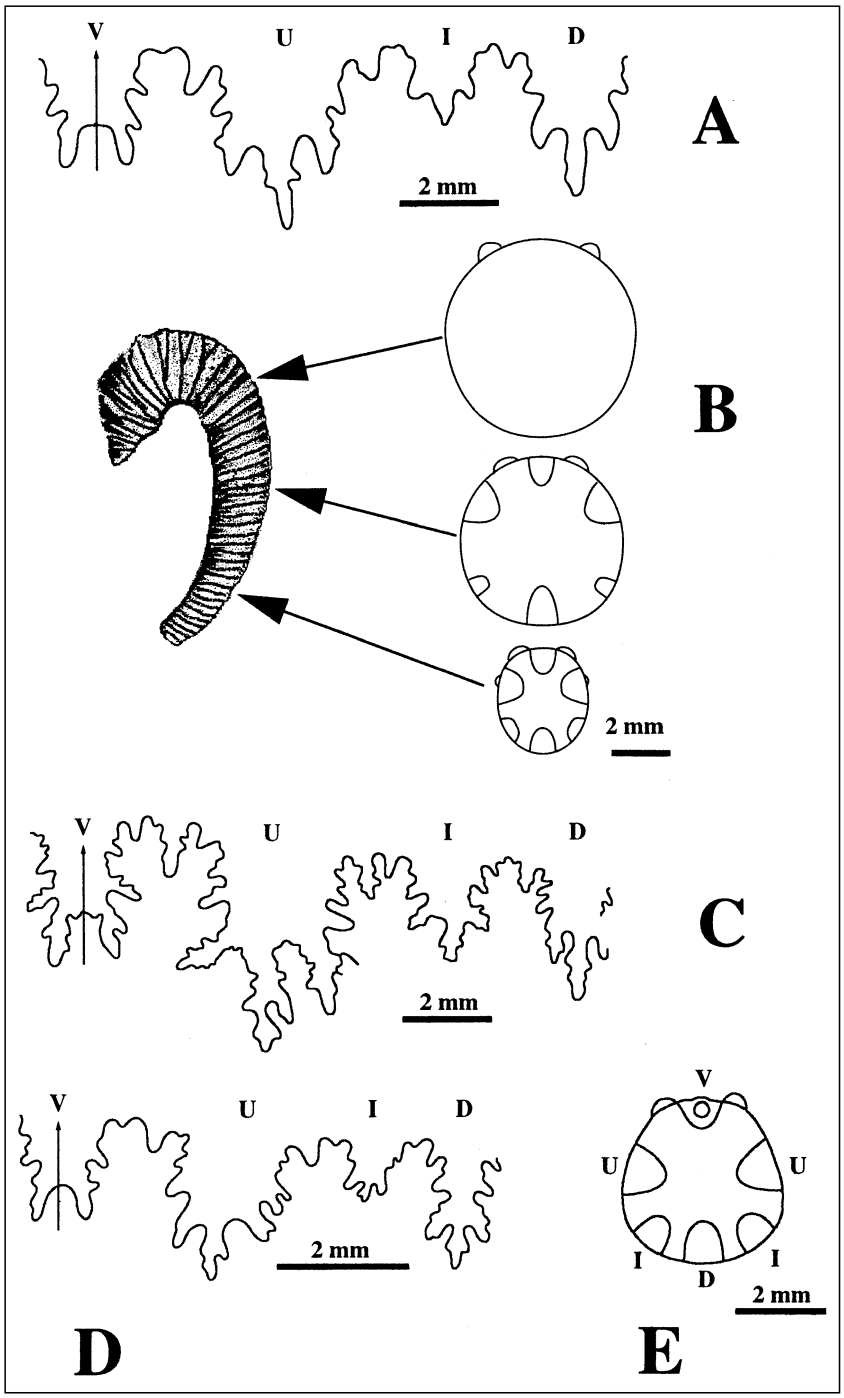
The presence of *Volgoceratoides* in Germany allows us to connect its origin with the development of Late Barremian European endemic heteromorphs (like *Parancyloceras*).

Distribution: Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zones of the Russian platform (Povolzhie), *Deshayesites weissi* Zone of North Germany.

Volgoceratoides schilovkensis I. MICHAILOVA & BARABOSHKIN gen. et sp. nov.

(Pl. 1, Figs. 4–6,9)

Holotype: PIM No. 2478/3390, Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zone, right bank of the Volga River, Ulijanovsk region, near Shilovka Village.



Text-Fig. 3.
Suture lines and cross-sections of *Volgoceratoides schilovkensis* I. MICHAILOVA & BARABOSHKIN, gen. et sp. nov. (A, B) and *Koeneniceras tenuiplicatum* (v. KOENEN, 1902) (C–E).
Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zone. Ulijanovsk region, Shilovka Village.
A) No. MSU 2/96. Suture line under H = 4.7 mm and W = 4.4 mm.
B) No. MSU 2/96. Changes in the cross-section under H = 3.1, H = 4.9 and H = 5.7 mm respectively.
C) No. PIM 2474/3390. Suture line under H = 7.5 mm.
D) No. MSU 6/96. Suture line under H = 3.9 mm and W = 3.6 mm.
E) No. MSU 6/96. Cross-section under H = 3.8, W = 3.3.

Table 2.
Sizes and angles of *Volgoceratoides schilovkensis* I. MICHAILOVA & BARABOSHKIN, gen. et sp. nov.
*: with respect to the shaft; **: only on the bend of the hook.

No.	Hsh	hsb	hse	wse	hb	wb	hhe	whe	α_1*	α_3**	δ
1/96	28	2	4,5		5,5		6		15	12	70
2/96			5,2	5,1	6	7	6,5	6,6	15	13	70
2478/3390 holotype	<23	2	4,3		5		5,5		15	12	65
2480/3390			4,5	4	5,3		6		13	12	70
3/96			4,3		5				15	12	70
4/96					5	6			15	13	

Material: 7 nearly complete specimens, 1 shaft, 1 imprint and several fragments.

Description: Small (H = 30 mm), symmetrical with 3 postembryonal morphogenetic stages: early stage (H = 10–15 mm) – broadly unrolled spiral; average stage – relatively short shaft and the late stage – a hook. The living chamber occupies half of the shaft and a hook. Whorl section rounded – hexagonal with flattened venter. An embryonal shell-protoconch and a first whorl has not been observed.
The sculpture is represented by rare smooth simple ribs in the unrolled spiral part. It is distinctly revealed only at the beginning of the shaft under H >2 mm. Single ribs become frequent with two rows of small tubercles (ventral and lateral) in the shaft. Ventral ribs between tubercles are weakened and interrupted in the beginning of the shaft. Ribs divide into two branches exclusively in the hook bend, in the middle of the whorls or rarely on the dorsal/lateral bend.

Sizes [mm] and angles [°]: See Table 2.

Suture line and remarks: Refer to diagnosis of the genus.

Distribution: Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zones of Russian platform (Povolzhie) in the vicinity of Ulijanovsk City and Shilovka Village.

Genus: *Koeneniceras* I. MICHAILOVA & BARABOSHKIN, gen. nov.

Ancyloceras (pars) – VON KOENEN, 1902, S. 331.

Name: In honour of A. VON KOENEN.

Type-species: *Ancyloceras tenuiplicatum*: v. KOENEN, 1902. Lower Aptian, *Deshayesites weissi* Zone, North Germany, Kastendamm.

Diagnosis: Small planospiral criocones with partially coiled whorls (microconchs) or completely uncoiled (macroconchs). Whorl-section hexagonal, rounded up to round. The protoconch and the first whorl unknown, but in accordance with small parts of the spiral (H <0.5 mm), it was formed directly after the first whorl. The living chamber occupies half of a whorl.

The sculpture is represented by simple and rare bipartite ribs and by very rare constrictions. Bituberculate ribs have well-developed ventral tubercles and smaller ventrolateral tubercles, which are present on the early whorls only. Bifurcate ribs branch near the umbilical bend. All ribs cross the ventral side without interruption.

Suture line: (Text-Fig. 3). All lobes, except ventral, tripartite. Ventral lobe (V) shallow, subsymmetrical; the deepest umbilical lobe (U) asymmetrical, with lateral tees variable in size. Internal lobe (I) is small and dorsal lobe (D) is prolonged and narrow. Saddles are bipartite, external saddle (V/U) with unequal branches.

Composition: *Koeneniceras tenuiplicatum* (v. KOENEN, 1902).

Remarks: To our knowledge the species *Ancyloceras tenuiplicatum* v. KOENEN, 1902 has not been cited nor revised later. As judged by fragments, figured by v. KOENEN, and consideration of much better preserved samples from the Ulijanovsk region, we can conclude that the proposed new genus differs from others previously described.

The closest genus is the Upper Barremian *Parancyloceras* SPATH, 1924, which might be an ancestor of the new genus and which differs by its semicoiled shell and by rare spaced ribs.

The Hauterivian *Aegocrioceras* SPATH, 1924, endemic in Northern Europe, is distinguished by larger sizes, slower increasing of height of whorls and rare spaced ribs with only ventrolateral tubercles, which disappear early.

Hemihoplites SPATH, 1924 also recalls the new genus, but differs by more rapid coiling of whorls.

Besides the type, probably one more rare costate new species is present in our collection, but it requires further study.

Distribution: Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zones of the Russian platform (Povolzhie), *Paradeshayesites weissi* Zone of North Germany.

Koeneniceras tenuiplicatum (v. KOENEN, 1902)

(Pl. 1, Fig. 1–3,10)

Ancyloceras ? cf. *brevispina*: v. KOENEN, 1902, S. 365, Taf. XL, Fig. 4.
Ancyloceras tenuiplicatum: v. KOENEN, 1902, S. 377, Taf. XLV, Fig. 11; Taf. LIII, Fig. 5 (only).

Lectotype: A specimen figured in v. KOENEN (1902) Taf. LIII, Fig. 5, Lower Aptian, *Paradeshayesites weissi* Zone, North Germany, Kastendamm. The type material was not found by E. BARABOSHKIN in v. KOENEN's collection (Geologisch-Paläontologisches Institut der Universität Göttingen) and probably is lost.

Material: 8 nearly complete well-preserved specimens and one large imprint.

Description: Small subsymmetrical criocones (D up to 40–50 mm). Whorl-section hexagonal, rounded, weakly stretched in height and weakly flattened in venter. Ribs frequent, simple or rare (1–5 per whorl) bipartite, crossing venter with some decreasing. All ribs are bituberculate in the early whorls. Ventrolateral tubercles disappear with growth, while the ventral tubercles remain. Constrictions are rare.

Two groups are distinguished by the coiling rate and peculiarities of costulation. They are interpreted as micro- and macroconchs.

Macroconchs have the largest size and noticeably dominate in quantity. They are completely uncoiled, the sculpture appears relatively late. It is more dense and the tubercles are less developed than in microconchs. In one specimen (MSU No.10/96) the tubercles practically disappear in the late stage.

Microconchs have touching whorls up to D = 20 mm and then become uncoiled. The stage with under-developed sculpture is shortened; ribs and tubercles are more coarse than in macroconchs.

Sizes [mm] and angles [°]: See Table 3.

Table 3.
Sizes and angles of *Koeneniceras tenuiplicatum* (v. KOENEN, 1902)
macr = macroconchs; micr = microconchs; **: impression.

No.	D	Du	H	dbw	W	α_1	α_3
2474/3390 macr*	29	12,7	11,4	1	12	-10	5
2297/3390 macr (imp**)	35	14	12	1,5		-5	
5/96 macr	31	13	11,5	1	8	-10	5
6/96 micr	[19]	9	6		[6]	-15	
7/96 macr	13	8	4,4		4	-5	
8/96	20	9	9		8,5	-10	5
9/96 micr	20,5	8	7		8	-15	
11/96 ?macr	24,5	11,5	9		7	-5	5
10/96 macr	27,7	11	10,5	2	8	-10	5
37/96 macr	32	13	13,5	1	4,6	-2	4

Suture line: Refer to diagnosis of genus.

Remarks: Between two samples of "*Ancyloceras tenuiplicatum*", figured by v. KOENEN (S. 377, Taf. XLV, Fig. 11; Taf. LIII, Fig. 5) and "*Ancyloceras* cf. *tenuiplicatum*" (S. 379, Taf. LIII, Fig. 4) we prefer the specimen on Taf. LIII, Fig. 5 to be selected as lectotype, because the sample on Taf. XLV, Fig. 11 is probably damaged (it has unusual shape), and the specimen on Taf. LIII, Fig. 4 was determined in the open nomenclature. The latter, judged by the rarity of ribs, is probably a new type. All of them represent macroconch shells with dense sculpture and relatively large whorls.

Ancyloceras? cf. *brevispina* from *Weissi* Zone figured by v. KOENEN (S. 365, Taf. XL, Fig. 4), could be interpreted as a coiled microconch with coarser sculpture.

Distribution: As for the genus.

4. Discussion

Although the systematics for the whole heteromorph ammonite assemblage need further work, some features of the ammonite distribution already can be recognised.

First, two different zonations are proposed for the Lower Aptian of the Povolzhie region. The deshayesitid zonation is useful for near-shore to shallow-marine facies and an ancyloceratid zonation can be applied to the shallow-marine facies and to the relatively deeper facies of the inner epicontinental sea, which conditions were characterised in the works of SASONOVA (1958), RONOV, SASONOVA & KHAIN (1964), SASONOVA & SASONOV (1967).

Second, analysing both deshayesitid and ancyloceratid assemblages, one can see that the assemblage of the *Deshayesites tenuicostatus* Zone and the *Deshayesites volgensis*/ *Volgoceratoides schilovkensis* Zone are more similar to those of Germany and England than to the Caucasus and Turkmenia. It probably means that the Early Aptian transgression moved in a southward direction and not northwards as it was supposed in all previous works (SASONOVA, 1958; RONOV, SASONOVA & KHAIN, 1964; SASONOVA & SASONOV, 1967; BARABOSHKIN, 1996, 1997, 1998; BARABOSHKIN et al., 1999). It is partially confirmed by the absence of basal Aptian (up to the *Paradeshayesites weissi* Zone) in the Mangyshlak sections (MOSKVIN, 1986–1987). This unusual conclusion may have resulted from the other possible scenario if we suppose the existence of a powerful surface current, which moved along the Viking pass between Greenland and the Baltic Shield and then turned to the Russian sea. Planctonik ammonite larvae (or juvenile ammonites?) were distributed by this current. This would explain also the distribution pattern of the new genera *Volgoceratoides* and *Koeneniceras*.

Later on, both northern and southern water masses affected the Russian sea and this is why Turkmenian and English/German ammonite assemblages are found in the succession.

Acknowledgements

It is a pleasure to acknowledge V.M. EFIMOV, I.A. SHUMILKIN, G.N. USPENSKY, V.A. KRIVOSHEEV (Ulijanovsk), G.K. KABANOV and M.O. AGAFONOV (Moscow) for demonstration of their collections and transferring of some samples for investigation. We thank T.N. BOGDANOVA (VSEGEI) for productive work and discussions on Aptian ammonites. Our special thanks we address to Dr. R. CASEY, who carefully corrected the English style of the paper. We are grateful to the RFBR foundation (grants Nos. 01-05-64641, 01-05-64642 and 00-05-64738) for financial support of our work. Due to DAAD support (ref. 325) and a very kind help of Dr. H. JAHNKE (Göttingen) E. BARABOSHKIN had a possibility to visit the v. KOENEN collection in the Geologisch-Paläontologisches Institut der Universität Göttingen.

Plate 1

Figs. 1–3,10: ***Koeneniceras tenuiplicatum* (V. KOENEN, 1902).**
Ulijanovsk region, Shilovka Village.
Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zone.
Fig. 1: PIM 2474/3390.
Lateral side.
Collected by K.A. KABANOV.
Fig. 2: MSU 6/96.
Lateral side.
I.A. MIKHAILOVA collection, collected by V.M. EFIMOV.
Fig. 3: MSU 5/96.
Lateral side.
I.A. MIKHAILOVA collection, collected by G.K. KABANOV.
Fig. 10: MSU 37/96.
Lateral side.
I.A. MIKHAILOVA collection, collected by I.A. SHUMILKIN & G.N. USPENSKY.

Figs. 4–6, 9: ***Volgoceratoides schilovkensis* gen. et sp. nov.**
Ulijanovsk region, Shilovka Village.
Lower Aptian, *Deshayesites volgensis*/*Volgoceratoides schilovkensis* Zone.
Fig. 4: PIM 2481/3390.
Lateral side.
Collected by G.K. KABANOV.
Fig. 5: MSU 2/96.
Lateral side.
I.A. MIKHAILOVA collection, collected by K.A. KABANOV.
Fig. 6: Holotype PIM 2478/3390.
Lateral side.
Collected by K.A. KABANOV.
Fig. 9: MSU 1/96.
Lateral side.
I.A. MIKHAILOVA collection, collected by I.A. SHUMILKIN & G.N. USPENSKY.

Fig. 7: ***Ancyloceras matheronianum* D'ORBIGNY, 1842.**
MSU 12/96.
Lateral side.
I.A. MIKHAILOVA collection, collected by V.A. KRIVOSHEEV.
Ulijanovsk region, Novoulijanovsk Town.
Lower Aptian, *Deshayesites volgensis*/*Ancyloceras matheronianum* Zone.

Fig. 8: ***Tropaeum (Tropaeum) bowerbanki* J. DE C. SOWERBY, 1837.**
MSU 13/96.
Lateral side.
E.J. BARABOSHKIN collection.
Ulijanovsk region, Ulijanovsk City.
Lower Aptian, *Tropaeum bowerbanki* Zone (× 0.39).

All figures are in natural size unless noted otherwise.

Plate 2

Figs. 1,2: ***Proaustraliceras tuberculatum* (SINZOW, 1872).**
Collected by K.A. KABANOV.
Ulijanovsk region, Ulijanovsk City, Soloviev Ravine.
Lower Aptian, *Deshayesites deshayesi*/*Proaustraliceras tuberculatum* Zone.
Fig. 1: PIM 2518/3390.
a: Lateral side.
b: Venter.
Fig. 2: PIM 2503/3390. Lateral side.

Fig. 3: ***Audouliceras renauxianum* (D'ORBIGNY, 1841).**
MSU 34/96 (the specimen has been stolen).
a: Lateral side.
b: Venter.
Collected by M.O. AGAFONOV. Ulijanovsk region, Sengiley Town.
Lower Aptian, *Deshayesites deshayesi*/*Audouliceras renauxianum* Zone (× 0.92).

All figures are in natural size unless noted otherwise.

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Manuskript bei der Schriftleitung eingelangt am 6. April 2001