

The new data on the Aptian zonation in the Ulyanovsk (Simbirsk) region, Russian Platform

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With 3 plates, 2 figures and 1 table in the text

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Abstract: Recent reinvestigation of sections provided the opportunity to propose a new biostratigraphic zonation for the Aptian deposits of the region. The Barremian/Aptian boundary is defined by the disappearance of the belemnite *Oxyteuthis (Validoteuthis) lahuseni*. The basal Aptian does not contain any index macrofauna and could correspond to the *Prodeshayesites* zone. The succeeding *Deshayesites forbesi* zone was recognized by CASEY (1964), but its stratigraphical range in the River Volga Basin was determined for the first time. It is overlain by the *Deshayesites deshayesi* zone with oil-shales. Above it, the *Deshayesites grandis* zone was recognized. It contains large *Deshayesites* in assemblages with numerous *Australiceras*. The *Tropaeum (T.) bowerbanki* zone ends the Lower Aptian succession. It was possible to recognize only one ammonite zone, the *Aconeceras nesus* zone, in the Middle Aptian. The Upper Aptian cannot be characterized by means of ammonites because of the near-shore origin. It is overlain disconformably by the Upper Albian with a sharp basal contact. The succession is very similar to that in England.

Zusammenfassung: Jüngste Studien der Profile geben die Möglichkeit, eine neue biostratigraphische Zonenaufteilung der Apt-Ablagerungen in diesem Gebiet vorzuschlagen. Die Grenze Barreme/Apt ist durch das Verschwinden des Belemniten *Oxyteuthis (Validoteuthis) lahuseni* bestimmt. Das Basis-Apt enthält keine Index-Makrofauna und könnte der *Prodeshayesites*-Zone entsprechen. Die folgende *Deshayesites forbesi*-Zone wurde von CASEY (1964) festgestellt, aber ihre stratigraphische Reihe im Wolga-Gebiet wurde zum ersten Male definiert. Darüber befindet sich die *Deshayesites deshayesi*-Zone mit Öl-Schalen. Über dieser Zone wurde die *Deshayesites grandis*-Zone festgestellt. Sie enthält große *Deshayesites* zusammen mit zahlreichen *Australiceras*. Die *Tropaeum (T.) bowerbanki*-Zone beendet die Nieder-Apt-Reihenfolge. Es konnte nur eine Ammoniten-Zone (die *Aconeceras nesus*-Zone) im Mittel-Apt festgestellt werden. Das Ober-Apt kann

mit Hilfe der Ammoniten nicht gekennzeichnet werden, weil es sich ursprünglich in der Nähe der Küste befand. Darüber befindet sich das Ober-Apt mit scharfem Basis-Kontakt. Die Reihenfolge ist der von England sehr ähnlich.

1. Introduction

The best Aptian sections of the Russian Platform are situated in the middle of the Volga River valley, between Ulyanovsk (Simbirsk) and Saratov in the Simbirsk (or Ulyanovsk-Saratov) Syncline (MILANOVSKY 1987). Investigations of the stratigraphy of the Aptian have a long history, starting from the works of TRAUTSCHOLD, SINZOW (1870-1905), LAHUSEN, etc. The most important works, which provided the basis of current understanding of the Aptian stratigraphy of this region, are by SAZONOVA (1958-1967) and GLAZUNOVA (1959-1973). The subsequent regional stratigraphic 'Unified' scheme (1993) does not contain many changes to the Aptian zonation. The main problem for Aptian investigations in the Simbirsk Syncline is the absence of continuous sections, because of the numerous landslides and stratigraphic gaps. In 1995-1996, the author had a unique opportunity for the investigation of the Aptian in the northern part of Ulyanovsk, where a very complete succession was exposed in artificial excavation during the building of the bridge across the Volga. In 1995, the section was visited in the context of the Peri-Tethys Programme, together with colleagues from the Institute of the Lithosphere and the Geological Institute of the Russian Academy of Sciences, Moscow. In 1996, the author worked on the section with colleagues from the Geological Institute of the Russian Academy of Sciences, Moscow, and from the Palaeomagnetic Laboratory, Saratov State University. Some preliminary results have already been published by the author (BARABOSHKIN 1996 a-d). In addition to the main section, sections near Novoulyanovsk (Kremenki Village and Tornov Ravine) were investigated. Those sections are of great interest, because the Barremian/Aptian boundary is exposed there.

2. Stratigraphy

The Barremian/Aptian boundary remains poorly investigated in the Russian Platform (RP). In the old literature the "belemnite Formation" is referred to the Barremian (MILANOVSKY 1940, GERASIMOV et al. 1962, etc.). Recently, the formation has been called the Urensk Formation by PISANNIKOVA (Unified ... 1993) for the Ulyanovsk region. The succession comprises silty clays and sands with siderite concretions. It contains the belemnites *Praeoxyteuthis jasykowi*, *P. pugio*, *Oxyteuthis* (*O.*) *brunsvicensis*, *O. (Validoteuthis) lahuseni*, various *Aulacoteuthis* (GLAZUNOVA 1969) and bivalves. As is known from English and German sections, most of the above-mentioned belemnites belong to different substages and even stages of the Lower Cretaceous (MUTTERLOSE 1983, KEMPER 1976, DOYLE & BENNETT 1995, etc.). Unfortunately, the belemnite finds were made in the beach of the River Volga and their actual position in the succession is not known. We collected belemnite samples both from sections and from the beach.

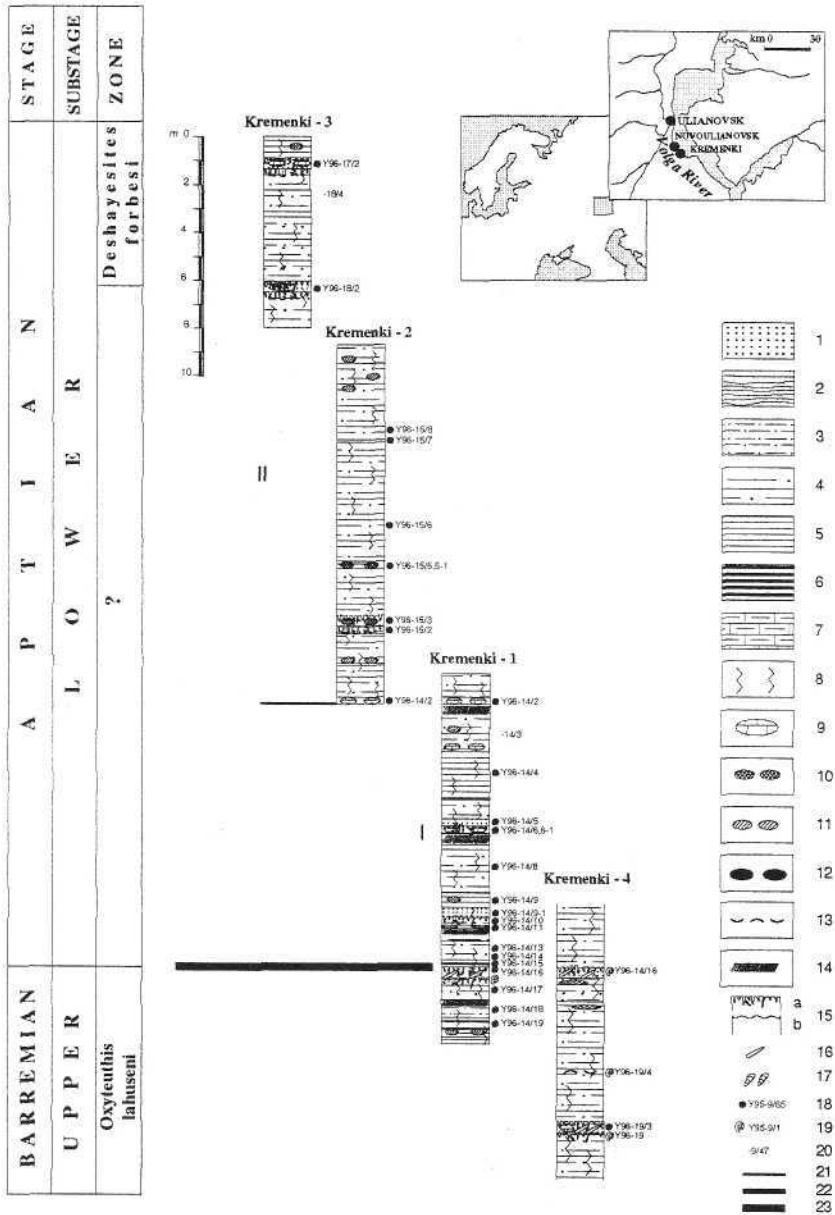


Fig. 1. Scheme of localities and the Kremenki section. Legend (Figs. 1 and 2): 1 - sands; 2 - laminated sandy clays; 3 - silts; 4 - clayey silts; 5 - clays; 6 - oil shales; 7 - clayey limestones; 8 - bioturbation; 9 - carbonate concretions; 10 - siderite concretions; 11 - sulphide concretions; 12 - phosphorites; 13 - shell detritus; 14 - Fe-coloured rocks; 15 - contacts: a - soft/hardgrounds, b - erosional surfaces; 16 - belemnite levels; 17 - remains of *Pinna* in situ; 18-20 - numbers of: 18 - samples, 19 - ammonite finds, 20 - beds; 21-23 - stratigraphic lines between: 21 - members, 22 - zones, 23 - substages.

The section is represented by a series of landslides on the right bank of the River Volga near the village of Kremenki (Novoulyanovsk region, 30 km S of Ulyanovsk; Fig. 1). Sections in landslides were correlated by means of horizons of siderite and carbonate concretions.

The upper part of the section is supposed to be Barremian. It comprises dark grey, silty, bioturbated clays with a soft clayey sandstone bed (0.4 m, Y96-14/16) at the top. Rare *Cymbula* aff. *nuda* and *Nucula* occur in the clays. The top and the bottom of the bed are represented by soft-grounds. *Oxyteuthis* (*Validoteuthis*) *lahuseni*, *O.* (*V.*) *barremicus*, *O.* (*V.*) sp., *Oxyteuthis* (*O.*) sp. and fragments of *Cucullaea golowkinskii* are found in the basal part of the sandstones. The same assemblage, and guards similar to *Oxyteuthis* (*O.*) aff. *germanica* (Pl. 1, Fig. 1) were collected from the beach. Specimens of *O. germanica* in the collection of Prof. J. MUTTERLOSE, stored in the Institute of Geology and Palaeontology of Hannover, are of two types: more and less cylindrical. Our finds belong to the cylindrical morphotype. It could indicate the possible presence of the *germanica* zone (MUTTERLOSE 1983, KEMPER 1995, etc.) in a part of the section that is covered by landslides. In the assemblage, depressed guards of *Oxyteuthis* intermediate between *O.* (*O.*) *depressa* and *O.* (*V.*) *lahuseni* were also found (Pl. 1, Fig. 2). Those belemnites are shorter and thicker than the typical *O. depressa*, and probably reflect the same tendencies that took place in the case of the relationship between *O.* (*O.*) *germanica* and *O.* (*O.*) *depressa* (MUTTERLOSE 1983).

The presence of *Oxyteuthis* characterizes Upper Barremian to basal Aptian successions in NW Europe (MUTTERLOSE 1983, DOYLE & BENNETT 1995). The species *lahuseni* has been considered as Hauterivian-Barremian and referred either to *Acroteuthis* (SAKS & NALNYAEVA 1966) or to *Oxyteuthis* (GLAZUNOVA 1969). *Oxyteuthis* (*Validoteuthis*) *barremicus* is supposed to be Barremian (GLAZUNOVA 1969). It is more or less

Plate 1

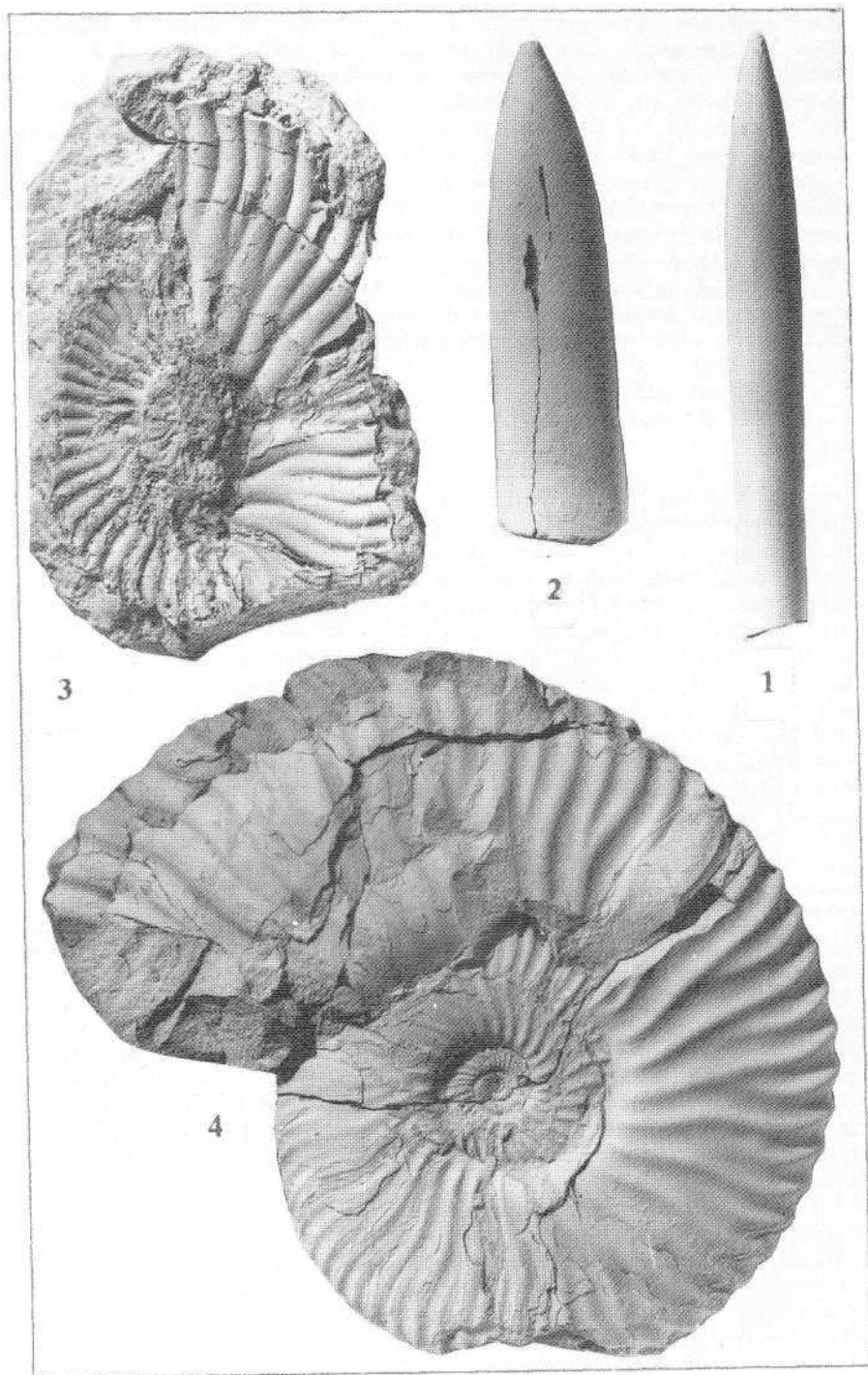
Fig. 1: *Oxyteuthis* (*Oxyteuthis*) aff. *germanica* STOLLEY. - No. Y96-19/14, ventral side. Upper Barremian, *Oxyteuthis germanica* zone. Right bank of the River Volga, near Kremenki Village, on the beach. Author's collection.

Fig. 2: *Oxyteuthis* (*Validoteuthis*) *lahuseni* (PAVLOW). - No. Y96-19/16, ventral side of the depressed morph. Upper Barremian, *Oxyteuthis lahuseni* zone. Right bank of the River Volga, near Kremenki Village, on the beach. Author's collection.

Fig. 3: *Deshayesites forbesi* CASEY. - No. Y95-9/1-1. Imprint of the shell. Lower Aptian, *Deshayesites forbesi* zone. Right bank of the Volga River, Ulyanovsk, excavation for the new bridge. Author's collection.

Fig. 4: *Deshayesites collevarus* GLAZUNOVA. - No. Y95-9/16-2. Complete specimen with deformed living chamber. Lower Aptian, *Deshayesites grandis* zone. Right bank of the River Volga, Ulyanovsk City, excavation for the new bridge. Author's collection.

All specimens are stored in the Department of Historical Geology, Geological Faculty, Moscow State University. All figures are in natural size.



clear that the development of *Oxyteuthis* on the Russian Platform took place at the same time in W Europe. The author thinks that the above-mentioned finds indicate Upper Barremian in the Kremenki section. We propose *Oxyteuthis (Validoteuthis) lahusei* as zonal index species for that interval (top of the Barremian?) and we place the Barremian/Aptian boundary between beds Y96-14/16 and Y96-14/15. The *lahusei* zone should probably be correlated with the *depressa* zone in W Europe. Unfortunately, the whole belemnite succession of the Volga remains poorly investigated, and there is a possibility that the boundary should be placed a little bit lower (ERBA et al. 1996).

The basal part of the Aptian succession was studied to the south of the Kremenki section, near the Tornov Ravine (Fig. 1, Kremenki-3). This part begins with the Tornov Formation described by PISANNIKOVA (Unified ... 1993).

The lower part of the succession consists of two members, intermediate in lithology between Barremian and Aptian. These are in ascending order:

I (Y96-14/15 - 14/3). Rhythmical alternation of grey-brown soft sandstones (0.03-0.1 m), dark grey clayey siltstones (0.8-2.0 m) and black clays. All the sediments are bioturbated; the clays contain weathered marcasite concretions and carbonate concretions occur in the sandstone beds. Softgrounds are developed at the base of each sandstone bed. The top of each rhythm is brown-coloured due to iron oxides. Three rhythms are included in the member, their total thickness is 10.2 m.

II (Y96-14/2 - 18/4). Rhythmical alternation of dark grey silty clays (2-5 m), bioturbated, and soft glauconite-quartz sandstones, brown-coloured (0.5-0.2 m). The silty clays contain weathered marcasite concretions and the sandstones contain carbonate to siderite concretions. Softgrounds are commonly developed at the base and the top of the sandstone beds. Four rhythms are included in the member, their total thickness is about 22-23 m. Bed Y96-17/2 is very distinctive and was recognized near the base of the Ulyanovsk section. *Deshayesites cf. forbesi* (Fig. 2, Y95-9/1) was found below this level in the Ulyanovsk section in an assemblage with *Arctica? sp.* and *Cymbula nuda*.

The succession continues in the northern part of Ulyanovsk (right bank of the Volga), in the Youth Park. The following succession is exposed there, in ascending order:

III (Y95-9/3 - 9/5). Rhythmical alternation of green-brown glauconite sands (0.2-0.5 m), dark grey silty clays (0.2-3.0 m) and grey striped bioturbated clays (1.5-2.0 m) and silty clays with siderite concretions. Softgrounds occur at the base of each sandy bed. Three rhythms comprise their member, their total thickness is 7.8 m. The top of the upper rhythm is eroded. Fragments of *Deshayesites forbesi* (Y95-9/4A, Pl. 1, Fig. 3), *Cymbula nuda* and *Inoceramus volgensis* (Y95-9/5) have been found in the member.

IV (Y95-9/6 - 9/14). The member is composed of the black oil-shales, referred to the Ulyanovsk Formation by KRAVTZOV, STURMAN and ZHUKOVA (Unified ... 1993). The black shales contain huge carbonate concretions (usually called "Aptian Plate"), with the largest ones in the lower part of the member and smaller ones in the top. The structure of the member consists of finely-laminated light and black beds (1-5 mm). The basal part of the member contains wood pieces, shell detritus and

