TETHYAN/BOREAL CRETACEOUS CORRELATION

Mediterranean and Boreal Cretaceous paleobiogeographic areas in Central and Eastern Europe

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3. EARLY CRETACEOUS SEAWAYS OF THE RUSSIAN PLATFORM AND THE PROBLEM OF BOREAL/TETHYAN CORRELATION

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Abstract: The Russian Platform is one of the candidate regions, where Boreal and Tethyan stratigraphic divisions could be correlated. Ammonite distribution in the Boreal Realm, Russian Platform and adjacent area indicates close connections between opening and closure of sea-ways, sea-level changes, and climatic variations resulting in changeable reliability of correlation between these areas. Two stages in the Russian Basin development were recognized. Boreal conditions prevailed during the Berriasian-Barremian interval here being interrupted only by several Tethyan invasions. Strong Tethyan influence in this region was recorded during the Aptian and Albian. Ten Boreal and four Tethyan invasion events were recognized in the whole Lower Cretaceous sedimentary record. The majority of faunal invasions were connected with sea-level rise connected with climatic changes and some of them could be explained by the cool/warm water current influence. During the Barremian-Aptian and the latest Albian, existence of consistent dry land barriers between Eurasia and North America is supposed.

Key words: Lower Cretaceous, Russian Basin, Tethyan Realm, Boreal Realm, climate, sea ways, sea-level fluctuation, biostratigraphic correlation, ammonite zoogeography.

3.1 Introduction

The stratigraphic divisions of Lower Cretaceous Boreal and Tethyan marine sequences could be correlated after detailed knowledge of biostratigraphy in the regions of the sea-connections of both regions. During the Early Cretaceous, both the Boreal and Tethyan Realms were connected by several main seaways: the West European seaways (South British, Mid-French, Danish-Polish), the East European seaways (Russian and Mid-Uralian), North American seaways (North Canadian and Alaskan) and Chukotka seaway in Asia. The existence of a more-or-less permanent North Atlantic seaway, frequently discussed in the literature, seems to be rather problematic (Baraboshkin 1999). The West European and North American seaway development is well-studied and the data were already applied in Boreal/Tethyan (B/T) correlation. The history of the other seaways is less known, but the data can also be involved. Lower Cretaceous sediments, although strongly eroded during Quaternary glaciation and after neotectonic uplift, are widely distributed in the Russian Platform (Fig. 3.1). The possibility of long distance south-north correlations makes this region a serious candidate for B/T correlations (Baraboshkin 1999). Ammonites were used as the tool in this correlation, which included (1) biostratigraphical analysis based on the newly obtained detailed data; (2) paleogeographical analysis and seaway reconstructions; (3) paleozoogeographical analysis with a

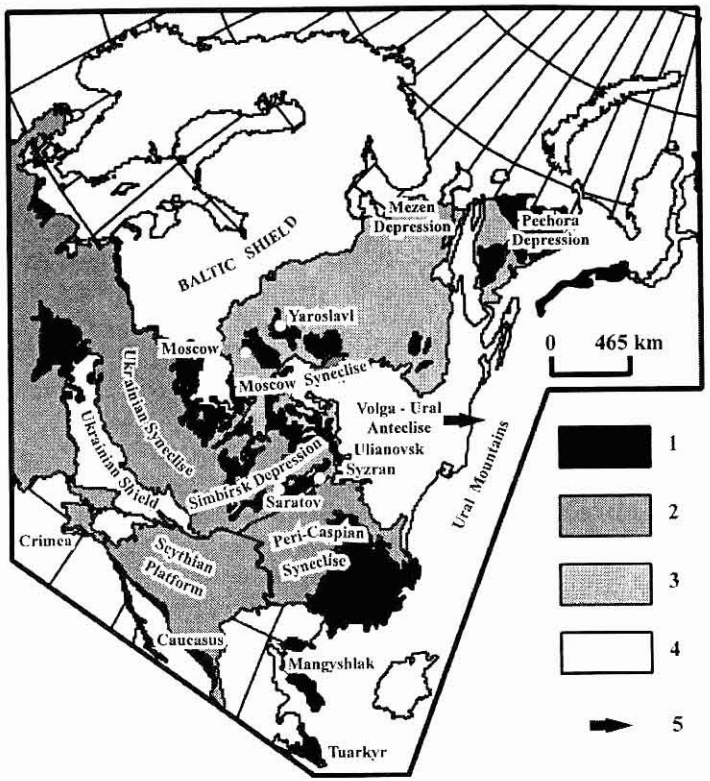

Fig. 3.1. Scheme of the main structures and the distribution of Lower Cretaceous on the Russian Platform (the Lower Berriasian is omitted). 1 — Lower Cretaceous and Cretaceous (without subdivisions) exposures; 2 — Depressed structures with the Lower Cretaceous, covered by younger sediments; 3 — Marginal parts of the depressed structures, where Lower Cretaceous was eroded; 4 — Uplifts; 5 — The place of possible Trans-Urals seaway.

special attention to the co-distribution of zonal indexes; (4) comparison with the other scales. Ammonites represent the principal index group in the detailed Lower Cretaceous biostratigraphy. Similarly to Recent cephalopods (Nesis 1985), the most important primary limiting factors of ammonite distribution (and the ammonite zones) are: (1) temperature, (2) basin bathymetry and configuration, (3) mode of life, (4) trophic resources and (5) postmortal transport. In this context, any ammonite zone represents a three-dimensional body with maximum thickness in the basinal part where the factors 1-4 are in optimum. As it wedges outwards from the optimum factor 5 becomes important. The problem of the seaway's existence is a cardinal problem in both cases.

The paper is focused on determination of seaway opening/closing chronology in the Russian Basin (RB) and its reflection in the B/T correlation. It continues the investigations already started (Baraboshkin 1996, 1997c, 1998, 1999; Baraboshkin, Kopaevich & Olferiev 1998; Baraboshkin, Guzhikov, Leereveld & Dundin 1999).

3.2 Early Cretaceous Russian Basin seaways and B/T correlation

3.2.1 Early Berriasian (Figs. 3.2, 3.3, 3.4A, 3.5). Many stratigraphers agreed on the correlation of the Upper Volgian with the Lower Berriasian (Casey 1973; Sasonova & Sasonov 1979; Jeletzky 1984; Hoedemaeker 1987; Sei & Kalacheva 1997, etc.). I also accept this idea, but I am supporting Sakharov (1984, 1993, etc.) that it is reasonable to subdivide the Berriasian into two Substages (Baraboshkin 1999).

The Russian Basin had free connection with the Boreal Realm during the Early Berriasian through the Mezen and Pechora Basins (Sasonova 1971, 1977; Sasonova & Sasonov 1967; Saks et al. 1971, 1972). In 1977, Sasonova proposed an additional reconstruction for the Occitanica Chron (p. 30) with a northward spreading of *Malbosiceras malbosi* and *Tirnovella* sp. into the central part of the Russian Basin. The existence of this connection was not confirmed (Baraboshkin 1999). The absolute domination of a Boreal ammonite fauna in the Lower Berriasian (= Upper Volgian) of the RB excludes connections with the Polish Furrow Basin where late Early Berriasian neocomitids are known, and with the Tethys Ocean as well. It is very possible that the east sea connection did exist with the West Siberian Basin (Bazhenov Sea). The temperature conditions of the RB sea or the shallowness of the seaways made faunal exchange difficult and some endemic genera developed in this basin (*Kachpurites, Garniericeras*) and endemic species of *Craspedites* (Gerasimov 1969). Only at the end of the Fulgens Chron (Craspedites nekrassovi Subchron) the rate of endemism falls due to the Boreal water mass expansion, when *Craspedites okensis,* the typically Boreal ammonite penetrated into the Russian Basin. This form is older in North Siberia and its area expanded eastsouthwards into West Siberia (Braduchan et al. 1986), Pechora Basin (Mesezhnikov et al. 1979a), Spitzbergen (Ershova 1983) up to the Peri-Caspian (Sokolova 1939; Vakhrameev 1952). This event marks the ***first Boreal expansion event***, which is very convenient for Boreal — Boreal correlation. This water mass movement started even earlier in the North Pacific (Chukotka), which is confirmed by the distribution of *Praechetaites* in the Perisphinctid-Polyptychitid Province (Baraboshkin 1999). Unfortunately, the Russian Basin was separated from the Tethyan Realm in the south and this Boreal expansion does not help Boreal/Tethyan correlation.

3.2.2 Late Berriasian (Figs. 3.2, 3.3, 3.4B, 3.5). It is one of the most important intervals for B/T correlation in the Russian Platform region, because it is characterized by the ***first Tethyan expansion event*** towards the north.

Sasonova (1971, 1977 and Sasonova & Sasonov 1967) supposed that there was no direct connection between both the Russian and the Polish Basins, because of the difference of faunas (in contrast to the ideas of Marek 1967-1969). Previously (Baraboshkin 1999) I considered the existence of this straight as probable, but now I withdraw this point. There are too many differences between Polish "*Riasanites*" and the real ones and the bulk of the Polish "Ryazanian" fauna differs from the original Ryazanian of the Russian Platform.

The other seaway passed through Mangyshlak, where the neocomitid diversity is rather high: *Neocosmoceras, Euthymiceras, Riasanites*, other berriasellids and Boreal *Surites*. It should be noted that first *Riasanites* (*R.* cf. *swistowianus, R.* ex gr. *subrjasanensis*) were found together with *Neocosmoceras* and *Transcaspiites* in this area ("Zone of Neocosmoceras