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ScienceDirect

Russian Geology and Geophysics 57 (2016) 303–315

RUSSIAN GEOLOGY AND GEOPHYSICS

www.elsevier.com/locate/rgg

# The Paleogene/Neogene boundary in continental deposits of the West Siberian Plain

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Received 3 March 2014; received in revised form 6 August 2014; accepted 28 May 2015

**Abstract**

This paper presents palynological and paleomagnetic characteristics of three West Siberian horizons: Zhuravka (Upper Oligocene, Chattian), Abrosimovka, and Beshcheul (Lower–Middle Miocene, Aquitanian, Burdigalian, Langhian, and Serravallian). We consider the distribution of dinocysts of the genus *Pseudokomewuia* in the stratotype section of the Zhuravka Horizon (Zashchitino Village) and in the section of borehole 13 (Chelyuskintsev Village), which exposes the Turtas, Abrosimovka, and Beshcheul Formations. Similar compositions and structures of dinocyst assemblages and similar palynofloras in the Turtas and Abrosimovka Horizons, as well as the sedimentation environment and cyclic structure of lacustrine deposits, suggest that the Paleogene/Neogene boundary should be localized at the base of the Beshcheul Horizon. We propose to include the Abrosimovka Horizon into the Upper Oligocene (upper Chattian). The data are correlated with the regional paleomagnetic scale. These views should be reflected in a new regional stratigraphic chart for the Paleogene–Neogene deposits of the West Siberian Plain.


*Keywords:* continental lacustrine deposits; Turtas, Zhuravka, and Abrosimovka Formations; palynology; magnetostratigraphy; upper boundary of the Oligocene; West Siberia

## Introduction

In connection with the preparation of the GK-200/2 and GK-1000/3 series of geological maps for publication, new material has recently been obtained allowing us to return to the problem of the volume of the Upper Oligocene (Chattian) and the position of the Paleogene/Neogene boundary in the continental deposits of the West Siberian Plain. In the current regional chart (Unified..., 2001), the Zhuravka Horizon is assigned to the Upper Oligocene, and the boundary between the Paleogene and Neogene is drawn along the bottom of the Abrosimovka Horizon, which is conventionally referred to the Lower Miocene (Aquitanian and Lower Burdigalian Stages). The problem of locating this boundary has been discussed for a long time, and in early stratigraphic constructions, the Abrosimovka Horizon was fully placed in the Upper Oligocene (Merkulova, 1971; Panova, 1971; Zal'tsman, 1968). Later it has been found that the horizon contains floristic levels conventionally assigned to the Aquitanian–Burdigalian (Nikitin, 2006). Unfortunately, these floristic levels were defined from different sections. There is still no Abrosimovka Horizon that meets all the requirements for the definition of stratotypes (Zhamoida, 2006). A section in which all floristic levels and palynological and paleomagnetic data would be consistently correlated has not been found so far. Therefore, the question of the age of these deposits is still controversial. In connection with the problem posed, the papers considers new data on palynology (spores, pollen, dinocysts) and magnetostratigraphy obtained by studying a number of new natural outcrops and borehole sections.

## Summary of stratigraphy

Below we give a summary of the stratigraphy of the Upper Oligocene desposits (Zhuravka Horizon) and their adjacent Lower Middle Miocene deposits (Abrosimovka and Beshcheul Horizons).

The Zhuravka Horizon of the plain is dated to the Upper Oligocene. It includes a number of formations and strata, of which the most widespread and well-studied are the Turtas and Zhuravka Formations. The deposits are silt, clay, sand,

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1068-7971/$ - see front matter 
http://dx.doi.org/10.1016/j.rgg.2016.02.007

and brown coal 0 to 100 m thick (Unified..., 2001). The Turtas Formation is located in the northern and central regions of the plain, and the Zhuravka Formation is confined to the southern regions, mainly to the Omsk depression (Shatskii, 1978). The deposits lie conformably or with a slight break at the Novomikhailovka Horizon (Lower Oligocene, Rupelian Stage) and are overlain, more often intermittently, by the Abrosimovka Horizon (Lower Miocene, Aquitanian, and Burdigalian Stages) (Unified..., 2001). The age of the deposits is estimated from floristic data. The sediments contain prints of leaves, seeds, and fruits (Nikitin, 2006). According to spore and pollen data, the deposits correspond to the Fagus grandifoliiformis, Pterocarya stenopteroides SPZ-14 regional palynozone. The spore–pollen spectra of the Zhuravka Horizon are generally characterized by pollen of *Pterocarya stenopteroides* Pan., *Fagus grandifoliiformis* Pan., *Fagus tenella* Pan., *Carya glabraeformis* Boitz., *Quercus sibirica* Pan., *Ilex obscuricostata* Trav., and *Picea tobolica* Pan. Spectra with this pollen composition correlate with the spectra of the Lower Baigubek Horizon (layers with *Cardium abundans)* North Ustyurt (Boitsova and Panova, 1973; Panova, 1971).

The Abrosimovka Horizon is assigned in the regional scheme to the Lower Miocene Aquitanian–Lower Burdigalian Stages of the International Stratigraphic Chart (Unified..., 2001). It comprises lacustrine- and lacustrine-boggy deposits 5–10 to 80 m thick. It includes the Abrosimovka Formation defined by Nikolaev in 1956 from natural outcrops on the Abrosimovka River (Unified..., 2001). The stratotype for the formation is suggested to be the section of borehole 67 located in the Irtysh River valley near the village of Ekaterininskoe (Merkulova, 1971). The most detailed subdivision of the formation is provided by carpological data. In the single flora of the Abrosimovka Horizon, four floristic levels have been recognized: Lyamin, Ekaterininskoe, Vasyuganoyar, and Kireevsk (Nikitin, 2006). It has been established that the formation stratotype does not contain the full set of fossil floras, and it is therefore composed of partial sections (Unified..., 2001). On the basis of floristic data, the formation correlates with the Baigubek and Aral deposits of the Ustyurt and the Northern Aral Region, which belong to the Aquitanian Stage (Boitsova, 1964; Boitsova and Panova, 1973). According to spore and pollen data, the Abrosimovka Horizon and the eponymous formation are defined by the Pinaceae, Taxodiaceae, Quercus sibirica, Ulmus crassa SPZ-15 palynozone (Unified..., 2001). The correlation with the stages of the International Chart is conventional and is still a matter of controversy among researchers. Many of them believe that the Abrosimovka Horizon should be fully assigned to the top of the Upper Oligocene (Upper Chattian Stage) (Merkulova, 1971; Panova, 1971; Zykin, 2012).

The Beshcheul Horizon (Lower–Middle Miocene) includes the eponymous formation represented by consertal sands and silts up to 50 m thick. Unlike the Abrosimovka Formation, it is not coal-bearing. The formation is easily recognized in sections due to the characteristic banded stratification caused by the staining of rock by iron oxides, and rests erosively on the Abrosimovka Horizon deposits. At this stratigraphic level, there is a significant change in the structure of pollen-spectra, manifested in a sharp increase in the proportion of pollen of small-leaved woody plant and Polypodiaceae spores. The formation is defined by floristic assemblages (Tagan, Kas'-kovka, Isakovka) and the Alnus, Polypodiaceae SPZ-16 palynozone (Unified..., 2001).

Of great importance in the study of Oligocene and Miocene deposits is paleomagnetic research, which has been performed in the Turtas, Zhuravka, and Abrosimovka Formations in numerous boreholes in southern West Siberia and along the Trans-Siberian Railway. A geomagnetic polarity scale has been developed based on the synthesis and analysis of paleomagnetic data for all formations and Cenozoic sedimentary basins of the West Siberian Plate (Gnibidenko, 2006). The boundaries of the Cenozoic, including Eocene and Oligocene in the Cenozoic magnetic polarity scale for West Siberia have been established (in absolute chronology) from the sequence of magnetic polarity orthozones and a correlation with the global time scale (Berggren et al., 1995). The use of this scale for the analysis of Cenozoic sections has made it possible to evaluate the completeness of the fossil record and establish the time scale of erosions and sedimentation breaks from the loss of polar orthozones from sections. Gaps in the absolute chronology have been determined using the scale as a reference in studies of new sections (Gnibidenko et al., 2011). Polar magnetic zones, which are magnetic references of global nature, allow stratigraphic correlations to be brought to a global level, regardless of the genesis of desposits and climatic setting.

In the Cenozoic polarity scale of the West Siberian Plate, the Zhuravka Horizon is represented by four orthozones of different polarity: $R_5E_3h$, $N_4E_3h$, $R_6E_3h$, and $N_5E_3h$. They correspond to layers with seed assemblages characteristic of the Turgai floristic stage (Nikitin, 2006) and the Fagus grandifoliiformis, Pterocarya stenopteroides palynozone; the deposits are dated as Late Oligocene (Unified..., 2001).

In the Cenozoic magnetic polarity scale, the Abrosimovka Horizon is represented by three orthozones: $R_1N_1aq$, $N_1N_1aq$, and $R_2N_1aq$ (Gnibidenko, 2006). The lower reversed-polarity orthozone, $R_1N_1aq$ contains the flora of the Lyamin level, the overlying normal-polarity $N_1N_1aq$ orthozone is characterized by the Ekaterininskoe level flora, and the $N_1N_1aq$ orthozone by the Vasyuganoyar flora. Seed assemblages of the Abrosimovka Horizon are indicative of the progressive impoverishment of thermophilic Turgai flora. Three orthozones of the horizon are defined by the Quercus sibirica, Ulmus crassa palynozone. Based on pollen and paleocarpological data, these deposits and the orthozones recognized in them can be conventionally assigned to the Lower Miocene (Aquitanian–Burdigalian) (Volkova et al., 2002). However, new material may change the understanding of the location of the Paleogene/Neogene boundary in West Siberia.

## Summary of paleogeography

The West Siberian Plain before the Oligocene was characterized by marine sedimentation (Akhmet'ev et al., 2001;