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Late Devonian climatic deterioration on the East European Platform and marine biota reaction on it

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Remarkable changes are apparent in climate during Late Devonian-Carboniferous times. Mostly the climate was rather different from the present. The faunas offer much evidence for understanding the climate but, in turn, understanding the paleogeography of the faunas is dependent on understanding the climate and the changes in climate. The Devonian period as a whole was a time of very warm climate on the Earth (SIMON *et al*. 2007). The Late Devonian at first had a warm climate (Frasnian), and in Famennian time there was a gradual decrease in temperature, with the development of the first glaciation in the end-Famennian (Hangenberg event) (JOACHIMSKI *et al*. 2009). Late Devonian glaciation is well-documented in three Brazilian basins, and the glaciation has shown a wider extent for this event, reaching Bolivia, Peru, Central African Republic, Niger, and the USA (ISAACSON *et al*. 2008). Physical evidence for this event includes glacial pavements and polymict striated, and faceted clasts as dropstones and within marine resedimented deposits. These climatic changes have been accompanied by the sharp glacioeustatical fluctuations in sea level that led to the cyclic structure of the deposits of this age on a global scale (KAISER 2005, KAISER *et al.* 2008, SANDBERG *et al*. 2002, PERRI & SPALLETTA 2000, ALEKSEEV *et al*. 1996, JOHNSON *et al*. 1985). Late Devonian climatic deterioration is clearly recorded in the sections of the East European platform. At present, very little is known about the beginning of the first Late Devonian glaciation, as well as a reaction to it of the marine biota. Paleoclimatic models on the basis of actual contemporary have never been implemented. It is very important to specify the start time of glaciation and to identify the sequence of biotic and abiotic events that took place during the transition from "warm" to "cold" the biosphere at the end of the Devonian. The research aims to address the fundamental problems in Earth sciences related to identification of the nature of the relationship of climate change and major events in the development of marine biota, such as mass extinctions, changes in the diversity of individual groups, the change of major evolutionary trends.

So far in the world the epicontinental basins have attracted attention in terms of their comprehensive detailed analysis. Publications available on the sedimentary basins of the North American platform, especially the Appalachian, devoted only to individual sections and individual groups, they do not give a general idea. The basins of folded regions (Kuzbass, Western Australia, Cordillera, etc.) are known better, where there were significant reef building and the gradient of depth. The combination of detailed biostratigraphic, sedimentological, paleontological and paleoclimatic studies, of course, will reflect the most current trends in the geosciences. Comparative analysis of sequences of shallow-water carbonate sedimentation basins, formed in different states of the biosphere by anyone is not satisfied. So far, the Late Devonian climate deterioration and the marine biota reaction on it have not been studied in the shallow-water epicontinental basins.

The problem of the relationship of climate deterioration and major events in the development of marine biota, such as mass extinctions, changes in the diversity of individual groups, the change of major evolutionary trends in response to transgressions and regressions, the mass migration of fauna, etc. debated for a long time. The global Devonian eustatic curve proposed by D. Johnson and others (JOHNSON *et al*. 1985), does not rely on the synthesis of regional curves of relative sea-level fluctuations, which until now existed only as separate not linked to each other pieces of the low temporal resolution. None analysis of sea level fluctuations and changes in the structure and composition of marine biota, especially benthic communities, for large regions with a relatively quiet tectonic setting, which is the East European Platform. Relationships in the development of half-closed marine basins in response to climate deterioration, as well as to fluctuations in their messages to the open ocean and changes in local levels of the seas remain undetected. Shallow-water basin that existed in the central part of the East European Platform during the Late Devonian is a good model to identify the main patterns of development of large epicontinental basins paleoequatorial area during the period of "warm" the biosphere. In this area, starting from the Lower Carboniferous to Late

Carboniferous, there was generally similar basin, but during the "cold" of the biosphere. The nature of the "cold" Carboniferous basin and its biota inhabiting is known (MAKHLINA *et al*. 1993). At the same time the Late Devonian deposits of the East European Platform analyzed only in terms of stratigraphy and cyclicity (RODIONOVA *et al*. 1995, TIKHOMIROV 1967).

Concerning the conditions of sedimentation and, especially, on the biota of the epicontinental basin, we know very little. Therefore, synthesis of existing data and new studies using the most modern techniques are essential. Paleoclimatic reconstruction on the basis of the actual current is never executed. Meanwhile, of course, that the deposits of "warm" Late Devonian and "cold" Carboniferous basins have different character and different sets of cyclic lithofacies under identical environments of sedimentation, although both were very shallow and located in the equatorial region. Identifying these differences is extremely important for understanding the basic laws of development of the biosphere in the broadest sense of the word. This study provides for special researches to analyze the Late Devonian basin of the East European Platform, which will identify specific characteristics of this basin at various state of the global biosphere. The solution of the problem stated above base on the most advanced methods and approaches that exist in this area.

A comprehensive analysis of the section of the Late Devonian of East European Platform on the basis of stratigraphic, sedimentological, paleoecological and paleoclimatic studies have performed. Only the combination of such studies can to give the main features of the Late Devonian basin and the organic world and can to reveal its evolutionary patterns. The territory which covered by research, include the Moscow syneclise, Voronezh anteclise and Timan, i.e. the main part of the basin at which we can follow the main facies transitions, and to restore the community of benthic organisms. For this kind of research is extremely important to have detailed and reliable tools near and distant stratigraphic correlation of shallow-water strata of the Late Devonian of East European Platform. Such tools have appeared only in recent years. It is above all detailed scale of the Late Devonian of East European Platform on conodonts. It is currently linked to reliably polygnatid conodonts with standard scale (ARISTOV, 1988). Application of zonal scale in the aggregate allow a reliable correlation between a different part of the basin and correlate a regional scale to the standard scale of the Late Devonian. According to the results of the study, this detailed zonal sequence supplemented by event-frame. Sedimentological studies are central to the establishment of environments of sedimentation, paleodepths, salinity and other characteristics of the ocean basins also implemented. The section covering each area paleobasin a significant part of the sedimentary sequence studied on sedimentological data. Particular attention was paid to surf and shoaling of sharp breaks and marking them paleosols (in the Famennian). Recent widespread in the Middle and Upper Carboniferous of Central Russia, but has not yet been identified in the Late Devonian (Famennian). The combined analysis paleotectonic, sedimentological, paleoecological and paleoclimatic data on the basis of detailed stratigraphic allowed the construction of curves of relative sea-level fluctuations for different parts of the basins. Dating of events calculated on a scale DCP-2003 (MENINNG *et al*. 2006). In the comprehensive study of the biota of the Late Devonian focus on groups such as the benthic brachiopods and corals. The nekton is studied in detail by conodonts. The fish is subjected to special study.

Our studies are concentrated on the identification of the reaction of the marine biota on climate deterioration and on the eustatic sea level fluctuations which occurred on the East European Platform in the Late Devonian. The investigations are based on biostratigraphic on eight Devonian/Carboniferous sections and boreholes.

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