Geophysical Research Abstracts,
Vol. 11, EGU2009-4858, 2009
EGU General Assembly 2009

Palaeogeographical features of the Permian sedimentary basins by variations of stable isotopes ratios ^{87}Sr^{86}Sr, δ^{13}C and δ^{18}O in carbonate rocks in the eastern part of the Russian plate

N.G. Nurgalieva (1), V.A. Ponomarchuk (2), D.K. Nurgaliev (1), and S. Spassov (3)

(1) Kazan State University, Kazan, Russia, (2) Siberian Branch of the Russian Academy of Sciences, Novosibirsk, Russia, (3) Centre de Physique du Globe de l'Institut Royal Météorologique de Belgique, Dourbes (Viroinval), Belgium

Variations of stable isotopes ratios ^{87}Sr/^{86}Sr, δ^{13}C and δ^{18}O, received from Permian carbonate rocks within Volga and Kama river region, have been used to study the evolution of Permian sedimentary basins in the eastern Russian plate as well as their connection to the open sea. The use of isotope data allowed specifying the nature of some lithological cycles.

The ^{87}Sr/^{86}Sr and also δ^{13}C and δ^{18}O ratios change regularly over geological times and therefore allow age estimation and correlation of different sedimentary sequences.

In the Pechischi and accompanied sedimentary deposits (Volga river) variations of the ^{87}Sr/^{86}Sr, δ^{13}C and δ^{18}O ratios correspond in general to global trends. The ^{87}Sr/^{86}Sr ratios change from high values during the Lower Permian to the lower values during the Upper Permian. In the Artinskian, the ^{87}Sr/^{86}Sr ratio is 0.70774. In the Kazanian, the strontium ratio is much lower: 0.70769 in the Early Kazanian and 0.70725 to 0.70766 in the Late Kazanian. The Perekhodnaya member is characterised by a ratio of 0.70738 corresponding to the boundary between the Kazanian and Urzhumian. Changes of δ^{13}C range within -7 to - 4‰ PDB, and the changes of δ^{18}O are within -7 to -4‰ PDB throughout the Permian. These changes correspond to sedimentologic and stratigraphic plots of the Permian studied area.

Within the Kazanian, these variations clearly feature three Noinsky's cycles being associated with evaporite formation cycles in the Kazanian palaeosea. These cycles are characterised by alternation of dolomites, evaporites and argillaceous rocks and are similar to the Zechstein marine cycles identified in Germany and England. The origin of the evaporitic component is related to the widely accepted concept that salt basins have to be partially isolated from the open sea by a sill or by a bar, supposedly accounting for an increase in water salinity. Otherwise, concentrated brines would flow towards the ocean with return currents. Some researchers assume that this isolation could be caused by a physical barrier such as for instance an organic reef, a sand bar or an uplift of sea bedrocks.

The ^{87}Sr/^{86}Sr ratio during the Tatarian in Monastyrskoe section (Volga river) is considerably higher (mean value is 0.70846) than in the Kazanian, which points to a dominant role of continental environments during the formation of these deposits. In general, variations of ^{87}Sr/^{86}Sr, δ^{13}C and δ^{18}O reflect a strengthening or a weakening of the connection between sedimentary basin and the open sea.

In the Sheremetevka section (Kama river), which represents the continental analog of the Upper Kazanian, higher ^{87}Sr/^{86}Sr ratios are observed, confirming the continental origin of these sediments. One can see trends of δ^{13}C decrease and of δ^{18}O increase, indicating a strengthening of the evaporate factor towards the end of the Permian.

In Tanaika section (Kama river), the isotopic profiles of the Lower Kazanian have been used to investigate the origin of the red pigment in Permian deposits. The red layers are characterised by lower carbon isotope ratios, while dark layers show increased values. This indicates that the sediments were probably formed during seasons which correspond to high and low biological productivity periods of the sedimentary basins.