

## GEOCHEMISTRY

# The First Detailed $\delta^{13}\text{C}_{\text{org}}$ Record in Permo-Triassic Boundary Deposits in the Kolyma–Omolon Region (Northeast Asia)

A. S. Biakov<sup>a,b,c\*</sup>, M. Horacek<sup>d,e</sup>, Corresponding Member of the RAS N. A. Goryachev<sup>a</sup>,  
I. L. Vedernikov<sup>a</sup>, and Yu. D. Zakharov<sup>f</sup>

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**Abstract**—We have obtained the first detailed  $\delta^{13}\text{C}_{\text{org}}$  record in Permian-Triassic boundary sediments in deep-water facies in Northeast Asia (Kolyma–Omolon region, Balygychan Basin). Our data show good convergence both with the Setorym River section (South Verkoyansk region), where the Permian-Triassic boundary has been determined approximately, and with a number of other sections of Permian-Triassic boundary sediments in the Boreal and Tethyan Superrealms, in particular, in the Buchanan Lake section in Arctic Canada, the Festningen section on Spitsbergen, the Wadi Shahha section on the Arabian Peninsula, and published sections in the Dolomites.

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Continuous marine sequences of transitional Permian-Triassic deposits contain unique information on the catastrophic events of this time. In Russia, such sequences are well known only in the Northeast, in the South Verkhoyansk region and in the Kolyma–Omolon region. In the South Verkhoyansk region, Permian-Triassic boundary deposits are represented by relatively shallow-water deltaic and shelf facies [1]. In the Kolyma–Omolon region, continuous Permian-Triassic sections have been revealed in predominantly deepwater back-arc basins of the Okhotsk–Taigonos Volcanic Arc: the Ayan-Yuryakh and Balygychan basins [2].

It is well known that Upper Permian deposits in Northeast Russia contain almost no conodont

remains (representatives of two species were found only in Permian and Triassic boundary layers in the Setorym River Basin [3]), which makes their correlation with the stages of the International Stratigraphic Chart (ISC) rather conditional. One of the most promising ways to solve this problem is chemostratigraphic methods, in particular,  $\delta^{13}\text{C}_{\text{org}}$  isotopy, which has been widely used recently for interregional correlations.

We have studied for the first time the carbon isotopic composition of organic matter in boundary clay deposits of the Upper Permian and Lower Triassic in the Balygychan Basin, which we distinguished within the large tectonic block of the same name. The Permian-Triassic boundary deposits are represented in the block's west, in the upper reaches of the Pautovaya River, by the Pautovaya Formation and the lower part of the Gherba Formation (figure) [2]. The organic matter content in rocks is 0.91–0.95% on average, increasing in some samples up to 4.92%.

The Pautovaya Formation is around 170 m in thickness and is predominantly represented by schisted, practically unstratified aleuritic mudstones dark gray to black in color; in the lower part, by interlayers (up to 10 cm) of gray and light gray horizontal, lenticular, and cross-bedded fine-grained feldspathic-lithic sandstones and siltstones.

Remains of fauna are represented in the lower part of the Pautovaya Formation by bivalves *Intomodesma costatum* Popov, *Intomodesma* sp. indet., as well as by the gastropods *Straparolus* sp. At the top of the forma-

<sup>a</sup>North-East Interdisciplinary Scientific Research Institute n.a. N.A. Shilo, Far East Branch of the Russian Academy of Sciences, ul. Portovaya 16, Magadan, 685000 Russia

<sup>b</sup>Northeast State University, ul. Portovaya 13, Magadan, 685000 Russia

<sup>c</sup>Kazan (Volga) Federal University, ul. Kremlevskaya 18, Kazan, 420008 Russia

<sup>d</sup>BLT Wieselburg Research Center Francisco-Josephinum, Rottenhauser str. 1, Wieselburg, A-3250 Austria

<sup>e</sup>Institute of Lithospheric Research, Vienna University, Althan str. 14, Vienna, 1090 Austria

<sup>f</sup>Far East Geological Institute, Far East Branch of the Russian Academy of Sciences, pr. Stoletiya Vladivostoka 159, Vladivostok, 690022 Russia

\*e-mail: [abiakov@mail.ru](mailto:abiakov@mail.ru)