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Thermomagnetic analysis of native iron from the upper sedimentary horizons of Lake Baikal, section GC-99 (*Posolskaya Bank*)

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Abstract

We present results of a thermomagnetic analysis of Late Pleistocene–Holocene bottom sediments from the gravity core GC-99 of the borehole BDP-99 drilled at Posolskaya Bank of Lake Baikal in the framework of the Baikal Drilling Project. The results are compared with the earlier analytical data on the samples from the lower (Miocene) section of the BDP-98 drilled on the Akademichesky Ridge. Native-iron particles were found in only 14 of 61 samples. Their content varies from ~10^{-5} to 10^{-4}%, and their distribution is near-bimodal, with a distinct "zero" mode. The results of the thermomagnetic analysis are confirmed by a probe microanalysis: Only occasional native-iron particles were found. Nickel was detected in only one sample. The samples have a large number of magnetite and titanomagnetite grains. It is shown that the distribution of native-iron particles in the Baikal sediments depends on the rate of sedimentation: The rate increase is accompanied by the increase in the number of the "zero" group samples (free of iron particles). The conclusion is drawn that the native-iron particles in the studied sediments are predominantly of cosmic origin.

Keywords: native iron; magnetic minerals; thermomagnetic analysis; probe microanalysis; Late Pleistocene–Holocene sediments; Lake Baikal

Introduction

In recent years, we have collected voluminous data on native iron present in epicontinental sediments of different ages (from Cenozoic to Cambrian) in different regions of Eurasia, in the Northwest Atlantic sediments, and in the lacustrine sediments of Baikal (East Siberia) and the Darhad Basin (Mongolia). The content and composition of native-iron particles in the sediments were studied by thermomagnetic analysis (TMA) (up to 800 ºC) and probe microanalysis (PMA) (Grachev et al., 2009; Pechersky et al., 2008, 2011, 2013a,b,c). The main results of the previous studies are as follows. In epicontinental and oceanic sediments, native-iron microparticles are present in low contents (seldom exceeding 0.001%). Usually, these contents show no correlation with the sediment lithology and with the content of terrestrial Fe-minerals (magnetite, iron hydroxides, etc.). This argues for the predominantly cosmic origin of native-iron particles, and their ubiquitous occurrence testifies to their relationship with cosmic dust. The results of TMA (Pechersky et al., 2013a) and PMA of the Upper Miocene Baikal sediments revealed the main regularity: a bimodal distribution of native-iron particles and a predominance of the "zero" group samples, i.e., lacking iron particles. The "zero" group samples amount to 30–40% in the earlier studied epicontinental and oceanic sediments (Pechersky et al., 2011, 2012, 2013c) and 93% in the lower section of the Baikal sediments (Pechersky et al., 2013a). This can be explained by the high rate of sedimentation and, correspondingly, the inverse dependence of accumulation of metallic iron on it, which testifies to the cosmic origin of the native-iron particles in the studied Baikal sediments (Pechersky and Sharonova, 2013). The above regularity is due to the limited amount of cosmic dust settling on the Earth's surface. According to PMA, the Baikal sediments of the Akademichesky Ridge contain both pure native-iron particles and ones with Si and Cr impurities but free of Ni impurity.

In this work we study native-iron particles in the Quaternary sediments at Posolskaya Bank of Lake Baikal. They accumulated in a deep-water basin, in contrast to the earlier

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