

Relative paleointensity of geomagnetic field obtained from the sediments of Lake Shira (Khakassia)

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Investigation of the geomagnetic field behavior in the geological past requires a diverse approach that includes constant monitoring of the world database on paleointensity (H_{anc}) and its continuous filling with new reliable determinations.

The paper presents the results of petromagnetic studies and determination of relative paleointensity in sediments of Lake Shira (Khakassia). The importance of obtaining data lies, in particular, in the fact that in the large area around Lake Shira, located at a distance of at least 900 km from the mentioned sampling sites, the Geomagia 50 [1] geomagnetic database currently has no data at all by paleointensity, both relative and absolute.

To determine the carriers of magnetization, measurements of hysteresis parameters, thermomagnetic and X-ray phase analyzes were carried out. According to radiocarbon dating, the age of the studied sediments spans about 9,100 years. Relative paleointensity was determined by the pseudo-Thellier method [7]. The selection of qualitative definitions of H_{anc} was based on the following criteria: at least 5 number of points for slope calculation; quality criterion $q \geq 1$; fraction of NRM demagnetized in the paleointensity determination interval $f \geq 25\%$; relative paleointensity determination error - $\sigma \leq 20$. The obtained data were compared with paleointensity values calculated for Shira coordinates using different models (CALS10K.1b [4], PFM9k.1 [6], HFM.OL1.AL1, CALS10k. 2 ARCH10k.1 [3]). A comparison of new data was also made with a data from the neighboring region obtained from archaeomagnetic objects in Siberia and Mongolia in 1970 – 2015. [2; 5 and references within].

A comparison of the relative paleointensity data from the sediments of Lake Shira and various models of the behavior of the geomagnetic field intensity showed their agreement, if take into account the general trend of changes in intensity, and not the correspondence of individual definitions. This gives possibility for applying this technique to the determination of paleointensity using the pseudo-Thellier method as applied to sedimentary rocks. Specific features in the behavior of the measured relative paleointensity also appear, for example, the anomaly of the maximum intensity in the interval from 7100 to 7300 years ago may be a result of non-dipole variation, which is not taken into account in modern models, or a result of a sharp change in rock magnetic parameters in this interval.

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References

- [1] M.C. Brown, F. Donadini, M. Korte, A. Nilsson, K. Korhonen, A. Lodge, S.N. Lengyel, C.G. Constable, *Earth Planets Space*. 67 (2015) 83.
- [2] S.P. Burlatskaya, I.E. Nachasova, K.S. Burakov, *Geomagnetism and Aeronomy*. 16 (1977) 447.
- [3] C. Constable, M. Korte, S. Panovska, *Earth Planet. Sci. Lett.* 453 (2016) 78.
- [4] M. Korte, C. Constable, F. Donadini, R. Holme, *Earth Planet. Sci. Lett.* 312 (2011) 497.
- [5] I.E. Nachasova, K.S. Burakov, O.V. Pilipenko, *Izvestiya, Physics of the Solid Earth*. 51 (2015) 44.
- [6] A. Nilsson, R. Holme, M. Korte, N. Suttie, M. Hill, *Geophys. J. Int.* 198 (2014) 229.

[7] L. Tauxe, T. Pick, Y.S. Kok, *Geophysical Research Letters*. 22 (1995) 2885.