ASSESSMENT OF THE MODERN GEODYNAMIC SITUATION AT TASHTAGOL IRON ORE DEPOSIT

Boris T. Mazurov
Siberian State University of Geosystems and Technologies, 10, Plakhotnogo St., Novosibirsk, 630108, Russia, D. Sc., Professor, Department of Space and Physical Geodesy, phone: (383)343-29-11, e-mail: btmazurov@mail.ru

Tatiana V. Lobanova
Siberian State Industrial University, 42, Kirova St., Novokuznetsk, 654007, Russia, D. Sc., e-mail: lobanova_tv@sibsiu.ru

Tatiana E. Elshina
Siberian State University of Geosystems and Technologies, 10, Plakhotnogo St., Novosibirsk, 630108, Russia, Ph. D., Associate Professor, Department of Cartography and Geoinformatics, phone: (383)343-29-11, e-mail: dony2005@mail.ru

Dinara A. Abzhaparova
Osh State University, 331, Lenina St., Osh, 714000, Kyrgyzstan, Ph. D., Associate Professor, phone: (996-03-222)5-46-65, e-mail: ada23121970@yandex.ru

The results of GNSS observations in the area of protected objects in the mining influence zone are presented. For research, the Northwest section of the Tashtagol iron ore deposit was selected. This is the largest field in the Mountain Shoria. Directly in the area of the mine there is a sinkhole. This makes monitoring difficult. An analysis of the displacements of the earth's surface under anthropogenic impact is carried out. The finite element method and the model of locally uniform deformation of a triangular finite element were used. Surfer and Elcut software packages were used to determine the parameters of the deformation fields and their visualization. The article shows the change in shape and boundary, displacement and dilatation fields, deformation field along the x axis and deformation field along the y axis. The research results will help to substantiate an expert assessment of the geodynamic situation of the Tashtagol iron ore deposit at present and to make a reasonable forecast of the deformation situation of the deposit territory. This justifies the relevance of regularly conducted geodetic observations, which are also of environmental importance and industrial safety.

Keywords: iron ore deposit, GNSS observations, finite elements, visualization, deformation fields, dilatation, shear, rotation

REFERENCES

1. Esikov, N. P. (1979). *Tektonofizicheskie aspekty analiza sovremennykh dvizheniy zemnoy poverkhnosti [Tectonophysical aspects of the analysis of modern movements of the earth's surface]*. Novosibirsk: Nauka Publ., 182 p. [in Russian].
2. Kaftan, V. I., Serebryakova, L. I. (1990). *Sovremennye dvizheniya zemnoy kory: T. 28, Geodeziya i aeros"emka. Itogi nauki i tekhniki [Modern movements of the earth's crust: T. 28, Geodesy and aerial photography. Results of science and technology. VINITI AN USSR]*. Moscow, 149 p. [in Russian].
3. Tatevyan, S. K., Kuzin, S. P., & Oraevskaya, S. P. (2004). Using satellite positioning systems for geodynamic research. *Geodeziya i kartografiya [Geodesy and Cartography]*, 6, 33–44 [in Russian].
4. Krige, D. G. (1951). A statistical approach to some mine valuations and allied problems at the Witwatersrand. *Master's thesis*. University of Witwaterstand, South Africa, 1951.
5. Terada, T., & Miyabe, N. (1929). Deformation of the earth crust in Kwansai districts and its relation to the orographic feature. *Bulletin of the Earthquake Research Institute*, 7, 223–239.

6. Moser, D. V., Levin, E. L., Gey, N. I., Karaneyeva, A. D., & Nagibin, A. A. (2015). Monitoring of deformations of the earth's surface on the territory of the Karaganda coal basin. *Geodeziya i kartografiya [Geodesy and Cartography]*, 3, 21–26 [in Russian].

7. Kalenitskiy, A. I., & Solovitskiy, A. N. (2019). On the development of multilevel structures on the geodynamic test site during the development of the Kuzbass subsoil. *Vestnik SGUGiT [Vestnik SSUGT]*, *24*(2), 45–55 [in Russian].

8. Lobanova, T. V., & Trofimova, O. L. (2018). Modern geodynamic movements in the area of the Sibiryak shaft of the Tashtagol mine. *Problemy nedropol'zovaniya [Problems of Subsurface Use]*, 3, 70–80 [in Russian].

9. Gordeev, V. F., Malyshkov, S. Yu., & Polivach, V. I. (2019). Geophysical monitoring of dangerous technogenic manifestations in undermined areas. *Vestnik SGUGiT [Vestnik SSUGT]*, *24*(2), 35–44 [in Russian].

10. Kuzmin, Yu. O. (2018). Identification of the results of repeated geodetic observations when assessing the geodynamic hazard of subsoil use objects. *Vestnik SGUGiT [Vestnik SSUGT]*, *23*(4), 46–64 [in Russian].

11. Berlyant, A. M. (2005).Visualization properties as a method for modeling geoimages. *Geodeziya i kartografiya [Geodesy and Cartography]*, 12, 43–52 [in Russian].

12. Elshina, T.E., Utrobina, E. S., & Sysoev, A. V. (2020).Visualization of the mountain relief model for WEB-maps. *Vestnik SGUGiT [Vestnik SSUGT]*, *25*(1), 145–155 [in Russian].

13. Abzhaparova, D. A., & Mazurov, B. T. (2017). Cartographic support of engineering and geodetic works in mountainous areas, taking into account the secant plane. *Vestnik SGUGiT [Vestnik SSUGT]*, *22*(3), 5–13 [in Russian].

14. Auden, J. (1976). *Konechnye elementy v nelineynoy mekhanike sploshnykh sred [Finite elements in nonlinear mechanics of continuous media]*. Moscow: Mir Publ., 464 p. [in Russian].

15. Akivis, M. A., Goldberg, V. V. *Tenzornoe ischislenie [Tensor calculus]*. Moscow: "Science" Publ., Main Editorial Office of Physical and Mathematical Literature, 352 p. [in Russian].

Получено 19.04.2021