Mining-induced seismicity at the Korobkovskoe iron ore deposit of the Kursk magnetic anomaly

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This paper considers the scale relationships for weak seismic events induced by mass explosions during the development of the Korobkovskoe iron ore deposit of the Kursk magnetic anomaly. The features of the surveyed area are the presence of a large fault zone and a significant excess of horizontal stresses over vertical ones, despite the small working depth of about 300 m from the free surface.

The measuring system consisted of 4 measuring points equipped by Bruel&Kjaer 8306 and Dytran 3191 accelerometers with an operating frequency band of 0.08 Hz – 1 kHz and a sampling rate of 10 kHz. One measurement point was upgraded to a three-component one, which made it possible to use polarization analysis for location of seismic events. It was found that the sources of recorded seismic events are densely grouped in space in the vicinity of the nearest explosion chamber. Most of them are located inside the area with the level of dynamic deformations from explosions of more than $10^{\smile 6}$.

Determination of source parameters was carried out according to the model of J. Brune and the model of the circular fault of R. Madariaga. The obtained values of magnitudes from -2.6 to -1.7 and corner frequencies from 320 to 715 Hz correspond to the source radii from a few meters to a few tens of meters. The radiated seismic energy varies from 0.001 to 10 J, the scaled seismic energy varies from $3{\cdot}10^{-8}$ to $4{\cdot}10^{-6}$ N·m.

To cluster seismic events, the approach used to analyze acoustic emission signals during the deformation of geomaterials was applied. The technique made it possible to distinguish two clusters of weak seismic events, which are characterized by different scale ratios - the behavior of the scaled seismic energy with an increase of the moment magnitude of the event.

The work was carried out within the framework of state task No. 122032900172-5.