

Dynamics of rock mass seismicity during mining near the Saamsky fault in the Kirovsky mine, Apatit JSC

Kozyrev A.A., Zhuravleva O.G., Zhukova S.A.

Mining Institute - Subdivision of the Federal Research Centre «Kola Science Centre of the Russian Academy of Sciences», Apatity, Russia

e-mail: svetlana.zhukowa@yandex.ru

At present the problem of dynamic damage of rock mass in the underground mining of mineral deposits becomes more urgent. The development of the Khibiny apatite-nepheline deposits has been under working since 1929 by the open mining method, since 1933 - by the underground mining method. Large-scale mining has a significant impact on the geodynamic regime of the geological environment of the developed deposits, which is proved by the increasing seismicity. Deepening of mining significantly worsens the mining operating conditions due to increase in rock pressure and changes of the physico-mechanical properties and structural features of the rock mass.

This study presents the results of a retrospective analysis of microseismic monitoring data in the area of the Saamsky Fault, which is one of the largest radial subvertical faults of the Khibiny massif. The Saamsky Fault is a section between the Kukisvumchorr and Yukspor deposits developed by underground mining. This fault passes through the Saamsky Valley and the water-filled Saamsky open pit. To the date mining operations there have been completed.

Nowadays, the study of seismic activity in the area of the Saamsky fault is particularly important, because it is these large faults that have a dominant impact on stress-strain state of the rock mass and, in the first place, are activated under the impact of mining operations. Modern mining operations and existing tectonic processes lead to the redistribution of stresses and the accumulation of potential energy, which is converted into kinetic energy as geodynamic events, such as shifts along previously weakened tectonic disturbances and rock mass fissuring.

As the mining operations approach the Saamsky fault, there are changes in the stress-strain state of the rock mass and the seismic regime, which is revealed in an increase in the number of seismic events and their energy. Each strong seismic event is accompanied by a number of smaller events - foreshocks and aftershocks. In the last decade, strong seismic events (energy more than 10 MJ) have occurred in the area, which indicates the activation of this fault.