

Patterns of occurrence and development of induced seismicity in mining areas in the Altai-Sayan region

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Based on the results of seismicity monitoring in Western Siberia, seismic activations near coal enterprises and iron ore mines are being studied. It has been established that the strongest activations of the subsurface in the mining area occur as short-term activations lasting 1-2 months and repeated several times after one or two years. The following similar activations are already taking place at other facilities. The existence of different types of induced seismicity on the territory of Kuzbass has been experimentally proved. Induced seismicity near the mines is formed as a cloud of earthquake epicenters in the face area under the mine to a depth of up to one and a half km and shifts in space after the face. The shutdown of the mining equipment instantly affects the seismic activity, as well as the resumption of production. Wandering induced seismicity is seismic events in areas where mining has been completed underground, but the rocks are in a non-equilibrium state. Induced seismicity under open sections and under dumps near sections. For this type of seismicity, the depth of events from the cut bed is up to 4-5 km. It is to this type of induced seismicity that earthquakes with magnitudes from 4 to 6 belong, and it is these earthquakes that pose the greatest man-made danger to the population and buildings on the surface. Special attention is paid to the development of seismicity in places of joint impact on the subsoil of open and underground mine workings. An example is the interaction in the area of the Kaltansky mine and the Alardinskaya mine, when the underground mine is surrounded by sections and is subjected to constant seismic effects from industrial explosions. We observe two types of induced seismicity when one develops inside the other. Induced seismicity with magnitudes from 0 to 2 flows under the workings of the Alardinskaya mine, and activation with larger events with magnitudes up to four and at greater depths has formed around it. Another variant of the interaction of different workings is induced seismicity under the Yerunakovskaya-8 mine. Microseismicity under the mine was detected long before the occurrence of events with magnitudes greater than three. The reason for the activation is the conduct of underground mining operations under the dump near the section. There is a regular shift of microseismicity in the space under the workings.

In the Mountain Shoria, the effect of partial synchronization of the development of seismicity at the Kazsky, Sheregeshsky, Tashtagolsky mines, separated from each other at distances of hundreds of km, was found. In this case, the fact of initiation of seismicity near the mines due to changes in the stress state of the Earth's crust as a whole has been established. It is in this natural-man-made seismicity.