Features of the stressed state of the subsurface and the development of seismicity in the epicenter of the technogenic Bachata earthquake

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The earthquake in the area of the Bachatsky coal mine on June 18, 2013 (Mb = 5.5, Neic) is the world's largest man-made earthquake associated with the extraction of solid minerals. This created a powerful aftershock process. More than 3,000 aftershocks were recorded, and the focal mechanisms of 76 aftershocks of this earthquake were determined. The Bachata earthquake and all induced seismicity near it are spatially linked to the coal mine, the orientation of the mechanism of the focus of this earthquake corresponds to the orientation of the long axis of the section, it occurred in the sediments of the depression, has a shallow depth of the focus, the recurrence schedule has a slope different from natural seismicity. The noted facts point to the technogenic nature of the Bachata earthquake and the seismic activation in the spatio-temporal framework of which it occurred.

The source mechanism of the Bachata earthquake is an upsurge with nodal planes having, according to the Global CMT WSW-ENE, a strike. One of these planes is steeply immersed on the SSW, and the other is hollow on the NNE. It is most likely to associate the Bachata earthquake with the Afonino-Kisilevskaya system of upwells having a close strike in the depth range up to 3 km. These faults at depths of more than 3 km are flattened out, forming a lyrical system of upwelling. In this regard, it is most likely that the stress state in which this earthquake occurred corresponds to the NNE-SSW orientation of the axis of greatest compression with a slow dip on the SSW. Accordingly, the minimum compression is oriented subvertically with immersion on the NNE. This stress state is a horizontal compression, and we consider it as a basic - foreshock state that operated before the Bachata earthquake.

Tectonophysical analysis shows that mining operations to deepen a coal mine lead to a decrease in vertical compressive stresses should be accompanied by an increase in maximum shear stresses and a decrease in isotropic pressure.

The tectonophysical reconstruction of the natural stress state, performed according to the data on the focal mechanisms of the aftershocks of the Bachata earthquake, made it possible to establish its inconsistency with the foreshock stress state of the Bachata section area. The greatest restructuring of the stress field occurred in the northwestern sector of the section. Here, in the aftershock sequence, the horizontal shift mode is mainly observed . Moreover, the stresses of the greatest compression, while retaining the subhorizontal orientation, changed the stretch to the NW-SE direction. In this sector, the axes of minimal compression operate in the NE-SW direction. Thus, the greatest changes in the stress state occurred in this sector. In the south-eastern sector of the section, the horizontal compression mode has been preserved, but the orientation of the axis of greatest compression has changed here by almost 90 degrees.

The report will focus on the tectonophysical aspects of technogenic activation of seismicity.