Postseismic Effects of Mass Explosions Recorded During the Mining of KMA Iron Ore Deposits

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The study of the effect of mass explosions on the filtration properties of a water-saturated reservoir is of particular importance for assessing the geodynamic and geoecological safety of deposit mining.

The transition to a new level of scientific and methodological support of mining with use of high-precision sensors installed in observation wells and operating in a wide frequency range provides monitoring of the technogenically disturbed groundwater regime. The observations of the reaction of the "resevoir-well"system have been made within the iron ore deposits of the Kursk Magnetic Anomaly (KMA), located in the south-east of the city of Gubkin, Belgorod region and developed using explosive technologies since July 2019. Along with co-seismic responses to the passage of seismic waves from mass explosions carried out in a mine and a quarry two types of post-seismic effects are traced.

The first type is represented by an increase in pressure in the "reservoir-well"system by 0.1–0.5 kPa, which probably indicates a local change in the filtration properties of a water-saturated reservoir and may be associated with the arise of the skin effect due to the clogging of fractures in the near-wellbore space. The second type includes a decrease in the level of the over-ore aquifer from 15 mm to 86 mm during the first days after the explosions carried out near the observation point. A relatively high gradient of decrease in the groundwater level compared to the background variations filtered from the influence of atmospheric pressure was noted in the near field of mass explosions and is probably associated with the filling of zones of technogenic (induced) fracturing.

The results of repeated pumping and geophysical studies in wells located within the developed iron ore deposits indicate an ambiguous change in the filtration properties of water-saturated reservoirs under the influence of mass explosions carried out over 2.3 years of measurements. According to the diagrams of water-level recovery after pumping transmissivity of shales in the over-ore flooded strata decreased from 7.7 to 5.5 m^2/day, and for quartzites it increased from 1.4 to 1.7 m^2/day. A general trend of a decrease in level and a decrease in pressure head by 0.8-1.6 m was noted. According to resistivity measurements in the over-ore aquifer, a shift in water inflow intervals and a change in their intensity were traced, which are confirmed by other types of geophysical studies in wells – caliper logging and telemetry.

Postseismic effects were traced at a ground velocity of more than 8.4 mm/s at reduced distances of less than 69 m/kg$^(1/3)$. The experimental data obtained can be used to develop a methodology for predictive assessment of the response of the "resevoir-well"system to seismic impact, which will minimize the risks of possible accidents during the exploitation of solid mineral deposits.

The work was carried out within the framework of State Assignment No. 122032900172-5.