

ABSTRACT

As a result of activities related to the mining of coal in the GZW longwall system, significant stresses with values exceeding their mechanical strength arise. Violation of this balance leads to a dynamic release of the accumulated energy, including an increase in the deformation of the rock mass before the shock and a decrease after the shock. Attempts to understand and define the mechanism and search for precursors of phenomena causing earthquakes and anthropogenic rock mass tremors are the subject of intense research in scientific institutions around the world.

The aim of the dissertation was to identify the nature of displacements in the epicentral zone before and after the occurrence of strong shocks induced by mining exploitation and an attempt was made to define and determine the precursors of seismic hazard based on the monitoring of surface displacements over the coal seam exploitation and the parameters of the seismic source determined from seismological recordings in the conditions of KWK ROW Rydułtowy. The observations covered the area designated in the mining area of the Coal Mine ROW Ruch Rydułtowy. The mine area E-E1 was designated as the research object and the impact of mining operations carried out in this area in seam 703 /1-2 with the longwall VIII-E-E1 on the relations between vertical deformations measurable on the surface and seismicity recorded in the area.

The work uses data obtained from seismological measurements with the use of an underground mine seismological network, while the nature of displacements was tested on a test site based on periodic and continuous geodetic measurements using the Global Navigation Satellite Systems (GNSS) technique and the precise geodetic leveling method. As a result of the conducted research, the occurrence of significant vertical displacements and changes in terrain deformation in appropriately selected time windows with strong mining tremors was documented, which was confirmed by additional periodic measurements performed using the method of precise leveling in the area of the test site. On the other hand, the continuous monitoring of displacements (30-second timing) conducted at four GNSS stations located above the exploited coal seam of the VIII-E-E1 longwall, showed ground uplift in a short time (minutes-hours) before the strongest seismic tremors in their epicentral zone, and then slow recovery after the occurrence of a shock to the situation before the appearance of the uplift symptom. Seismological monitoring in the area of the test site made it possible to determine the location of tremors and their seismic energy, as well as the parameters of the seismic source, which allowed for the determination of average

displacements in the tremor's focus and the change in time of criteria parameters such as the index of seismic energy and seismic moment as well as the reduction of stresses in the focal point shock.

A relationship between the average displacements in the source of seismic tremors and the seismic energy index in the short time windows shifting with a step of one day, with strong mining seismic tremors was documented.

The results of the tests carried out at the KWK ROW test site, Ruch Rydułtowy, showed that the development of the seismicity process may be different due to mining and stress-deformation conditions. For this reason, in some seismicity periods, the energy index (energy-stress parameter) performs better as a criterion parameter, while in another seismicity development scenario, the average displacement parameter in the shock focus (parameter related to discontinuous deformations) is better.