ABSTRACT

This habilitation thesis is a synthesis of the author's scientific research activity, carried out after the public presentation of the doctoral thesis entitled "*Surface Stability Analysis as Effect of Underground Mining of the Coal Seams with Gentle and Medium Dip from the Jiu Valley Coal Basin*", thesis elaborated under the scientific coordination of Mr Prof.PhD.Eng. COZMA Eugen and publicly presented on 01.07.2011.

Chapter 1 of this habilitation thesis, presents "*The synthesis of postdoctoral scientific and professional results, for the period 2011-2021*", being presented in synthesis the main results obtained by the author in the didactical and scientific activity after the public presentation of the PhD thesis. The professional activity of the author focused on the following areas of competence: Monitoring the behaviour of surface and buildings, Prognosis of surface deformation due to the underground mining, Numerical modelling of the stability of surface and buildings, Topography, Geodesy, Cadastre.

The information presented in this paper is the result of research conducted by the author, individually or in collaboration with other researchers, research conducted based on research contracts and not only and disseminated in various scientific publications in the country and abroad.

In **Chapter 2** entitled "*Monitoring, analysis and prognosis of continuous subsidence of the land from the surface of the coal mines in the Jiu Valley*", is presented in summary the phenomenon of continuous deformation of the surface due to underground mining, with its particularization for the underground mining of coal deposits from the Jiu Valley. Also, in addition to these generalities, were presented the results of research obtained by the author on various case studies in the Jiu Valley basin, on monitoring the phenomenon of subsidence and monitoring over time the deformation of buildings; statistical analysis of the measurements using profile functions; as well as the prognosis of surface displacement under the influence of the extracted space with the help of the influence functions, for the case of the underground mining of the horizontal or gentle dip coal seams.

Chapter 3 entitled "*Monitoring and analysis of discontinuous subsidence phenomena of the land from the surface of the Lupeni mine generated by the underground mining of the coal seams by top coal caving*", presents the results of research conducted by the author on an atypical phenomenon for coal mining conditions in the Jiu Valley, the appearance of discontinuous subsidence phenomena.

Therefore, in this chapter, we try to decipher the geo-mechanical phenomenon that led to the emergence of some sinkholes and highlighting the main factors that contributed to the development of this phenomenon. For this purpose, measurements were made on the terrain deformations using photogrammetric methods and aerial laser scanning, the modelling with 3D finite elements, in elasto-plasticity and with the help of the Knothe-Budrik influence function. The factors that contributed to the occurrence of discontinuous subsidence phenomena are: the shallow mining depth, LTCC mining method and the presence of faults in the vicinity of the mining panels. Also, the geo-mechanical phenomena of subsidence terraces development and sinkholes in the mining subsidence troughs at the Lupeni mine were described.

The title of **Chapter 4** is "*Modelling using the finite element method of the stability of buildings under the influence of the underground mining of thick coal seams from the Jiu Valley*." The chapter presents the results of research conducted by numerical modelling with finite elements, using the CESAR-LCPC software (in 2D and 3D), on the stability of different types of constructions subjected to the influence of extracted space.

Thus, several buildings with one, two and three levels and buildings with two levels and different lengths were generated, built of reinforced concrete panels or brick masonry. These

buildings were subjected to the mining influence of a mining panel specific to the mines in the Jiu Valley basin, sequentially extracted with a longwall coal face, on different operating heights, with the use of roof control by rocks caving and with top coal caving mining. Following the analysis of the major principal (tensile) stresses and minor principal (compressive) stresses, a series of conclusions regarding the behaviour of these buildings which are under the influence of underground mining has been revealed.

In addition to these numerical models, the behaviour of a well was also analyzed at the approach of the longwall face, in the geological-mining conditions specific to the mines in the Jiu Valley basin.

Also, by 2D numerical modelling, research was carried out on the surface stability and implicitly of the objectives located in the area of influence of the underground mining of coal seams in the case of Paroseni and Vulcan mines, in the area where a gas pipeline was initially designed BRUA and, based on the obtained results, the location of the gas pipeline was optimized so that it would not be affected by the deformations transmitted by the underground mining.

"*Monitoring and prediction/prognosis of land deformation from the surface of the Slănic salt mine under the influence of underground mining gaps*" is the title of **Chapter 5**. The contributions made by the author are presented, regarding the surface stability analysis affected by the underground mining of the rock salt by dry operations at Slănic Prahova salt mine. In this chapter were analyzed the measurements made in the surface monitoring stations, their mathematical interpretation was made and the main factors that contributed to the deformation of the surface were analyzed, namely: dimensions of the gaps, mining depth, geomechanical characteristics, tectonics and microtectonics of the deposit, hydrogeology and the effect of detonating explosives.

Chapter 6 entitled "*Modelling the stability of the surface and underground structures (pillars and ceilings) from the Slănic salt mine using the finite element method*" presents an analysis with finite elements in 2D and 3D, respectively, in elasto-plasticity, of the state of stresses and deformations developed around the underground mining excavations at the Slănic Prahova salt mine (Ocna din Deal, Ocna din Vale, Carol, Mihai, Unirea and Cantacuzino Mines) and highlighting the factors that led to the loss of stability of some of this mines. Also, a stability analysis of the future levels + 145m and + 129m was performed, from the Slănic Mine (New Mine, below the levelling ceiling).

In **Chapter 7** - "*Topographic monitoring and prognosis of the stability of underground structures at the Cantacuzino Mine - Slănic Prahova salt mine*" were analyzed the topographic measurements performed during 2004-2019, on the ceilings from the Cantacuzino mine - Slănic Prahova salt mine.

The main factors that led to the deformation and cracking of the ceilings were analyzed, the stability over time of the ceilings between levels was assessed, and solutions were offered to consolidate the mining excavations marked by instability (by using anchor cables or by filling certain rooms with backfill paste).

Chapter 8 is entitled "*Career Development Plan. Future directions regarding the academic and scientific evolution*" and briefly presents the main directions and objectives of career development from a didactic and scientific point of view.