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Abstract of the doctoral dissertation entitled: **Salt aerosols in the atmosphere of the underground Bochnia Salt Mine; origin, composition, causes of distribution and potential therapeutic applications**

Underground salt aerosols are commonly used in spa treatment for respiratory disorders as part of subterranotherapy or speleotherapy. In many Central and Eastern European countries, these treatments have been traditionally recognized in medicine for many decades. Despite this, the mineral and chemical composition of airborne particles, which is the absolute basis for the development of this type of treatment in underground salt mines, has so far been poorly recognized. Unrelenting anthropopression on the surrounding atmospheric environment and a significant increase in mass tourism make it an increasing contemporary challenge for such facilities to maintain air purity while preserving the presence of natural aerosols on which this type of activity is based.

The main objectives of this study were: i) To characterize the mineral and chemical diversity of underground aerosols and their spatial distribution in a salt mine; ii) To determine the effect of external air pollutants drawn in by the ventilation system on the natural mineral and chemical composition of particles suspended in the mine atmosphere; iii) To determine the role of tourist traffic and regular mine maintenance. Samples for the study were collected in different thermal seasons (summer and winter) along the main air current at stations located successively at increasing distances from the intake shaft. Analytical methodology combining both classical methods of mineralogical and chemical analyses (SEM/EDS, XRD) as well as methods commonly used to determine the quality of outdoor ambient air (including measurement of suspended particle concentration, analysis of organic and elemental carbon, water-soluble ions, and metals) was used to characterize the underground aerosols. In addition, complete qualitative and quantitative mineral composition analysis, microscopic characterization of particle morphology and composition, and elemental composition analysis were performed for dust fallout samples.

The results of this study provide, for the first time, such a detailed insight into the diversity of components of underground aerosols in a facility used for tourism and health resort purposes. An appropriately selected analytical strategy enabled to determine the composition and distribution of individual groups of components present in the subsurface, including both natural (geogenic) and anthropogenic particles. The results enabled to identify desirable (beneficial) components for underground respiratory therapy and undesirable components whose presence should be limited. Specific actions to increase desirable constituents and reduce undesirable constituents were also proposed. Most of these are universal and can be implemented in other such facilities around the world. Based on the results of this research, specific locations were suggested for the underground healing chambers in the Bochnia Salt Mine. The presented results support the need to regulate the legal requirements for air quality standards in facilities used for speleotherapy/subterranotherapy in Poland and in all countries where these treatments are traditionally recognized in medicine. Based on these results, new prospective research directions on bioaerosol in underground salt mines are presented.