

Title: **VARIABILITY OF PHYSIOCHEMICAL PARAMETERS OF PRECIPITATION AND SHALLOW GROUNDWATERS IN BIELSKO-BIAŁA AREA**

The thesis studies the variability of physiochemical parameters of precipitation and shallow groundwaters in Bielsko-Biała area.

The shallow groundwaters were examined in samples taken in approx. 2-week intervals (2011-2012) from the following springs: JA – “Józef”, NP. – “Nad potokiem”, ST – “Walczok”, ZO – “Żołędziowa”, WK – Wołek „Kosary”, WP – Wołek „Panienska” located in Bielsko- Biała area.

The precipitation were studied in two meteorological stations in Bielsko-Biała and Kobiernice (Bielsko district) and compared to the data from external sources: American CDO (Climate Data Online) base and Bielsko-Biała Aleksandrowice airport. Simultaneously, the average daily air temperatures were analyzed. Between May 2011 and November 2012 the scope of the studies (pH, precipitation rate) was extended and samples were taken and analyzed. The samples of spring waters and rain waters were examined in the laboratory of the Department of Hydrogeology and Engineering Geology of the AGH University of Science and Technology in Krakow, by means of atomic emission spectrometry (ICP-OES). The following elements were traced: Ca, Mg, Na, K, HCO₃, Cl, SO₄, Al, Ag, As, B, Ba, Be, Cr, Cs, Fe, Ga, Li, Mo, Se, Sb. At the site from where the samples were obtained the following parameters were measured: pH, temperature, electrolytic conductivity, Eh (redox potential).

The main objective of the study was the analysis of the variability of the selected parameters of spring waters compared to the changing environmental components, primarily precipitation waters.

The measured parameters were analyzed with the descriptive statistics tools and compared with the requirements regarding water intended for human consumption according to the Regulation of the Minister of Health from 2015. An additional objective was to determine whether consumption of water from the examined springs by the local residents is safe for human health.

The main threat to the quality of shallow underground waters in the region of Beskid Śląski and Mały is the polluted and acid precipitation. Flysh rocks contain little CaCO₃ what translates into their limited capacity to buffer pollution e.g. in the snow cover. Cracks in the flysh rocks allow fast infiltration of the rain waters into the aquifer.

The studies revealed that most precipitation are acid rains. However, as a result of buffering, the pH of the spring waters meets the acceptable limits. The tested spring waters contain the decreased amount of magnesium compared to the acceptable level set in the Regulation of the Minister of Health from 2015. In the spring waters the amounts of arsenic, stibium and selenium exceeded the values permissible for water intended for consumption. The average selenium content in all springs exceeded the maximum acceptable value several times, and in some cases even over a dozen times. The precipitation waters were likely the source of selenium. In the studied period it was observed that the amount of selenium in precipitation

waters was $0.052 \text{ [mg/dm}^3\text{]}$, which means it has exceeded the acceptable value over five times. The selenium content may be of anthropogenic origin — a result of burning of fossil fuels. Periodically exceeded acceptable values occurred also for stibium amounts in all the springs. The exceedances occurred mainly between February and April what may be associated with the periods of spring thaws. During this period, an increased amount of arsenic was also noticed in most of the springs.

Rainfall samples sporadically contained excessive amounts of both, stibium and arsenic.

In the NP spring there was also a twofold simultaneous abrupt increase in the amount of potassium and chlorides, what can be associated with anthropogenic pollution of agricultural origin (synthetic fertilizers).

The parameters of waters in the examined precipitation and spring samples show high variability measured by means of the coefficients of variation (classic and positional). The increased variability of the amounts of studied components occurred during early spring and spring.

The studies led to the conclusion that the water in the examined springs continuously fails to meet the requirements for water intended for human consumption.

This refers also to the exceeded acceptable amount of selenium and, during spring thaws, also arsenic and stibium.