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Tytuł wystąpienia: **" Environmental monitoring of coal mining area: insights from stable isotope measurements of methane excess"**

Streszczenie:

Coal mining activities represent one of the largest contributors of methane (CH4) emissions into the atmosphere in Poland and worldwide. The Upper Silesian Coal Basin (USCB) in southern Poland is known for persistent enhancement of methane visible from space. It is important to mention that the venting of methane from coal mining will imply European Commission regulations in the near future. Therefore, creating a reliable CH4 inventory for USCB's underground coal mines requires accurate in-situ measurements of associated emissions, with particular attention to stable isotope signatures of the source.

This study aimed to determine the influence of physical processes, site-specific conditions, and parameters of coal mine operations on variations in composition and distribution of coalbed gases during migration pathways from coal seam (up to about 600 – 700 m deep), along walkways of mine workings, and across mine ventilation shaft into the atmosphere. The research was based on the stable isotope (δ13C, δ2H) tracing the coalbed methane released from underground longwall coal face and surrounding rock strata to the mining atmosphere.

The above-described techniques were applied to analyse gas samples collected in one of the operating hard coal mines in the USCB. The reported geochemical data on coalbed gases of the examined coal seam indicated that CH4 released to the mining atmosphere is dominantly of thermogenic origin. Free gas samples taken from the borehole in the coal seam (about 670 m deep) contain mostly methane (~ 64.8 – 92.1 % v/v), with depleted δ13C signatures of −50.9 ± 0.7 ‰ and δ2H of −197.3 ± 6.2 ‰. Gas samples collected along 145 m length of longwall coal face confirmed the relationship between migration of desorbed gases from the coal seam and enrichment in 13C and 2H signatures of methane (δ13C: −48.9 to −46.6 ‰, δ2H: −192.4 to −178.1 ‰).

An increase in distance from the longwall coalface towards the exhaust shaft and higher velocity of the ventilation air stream showed a pronounced

dilution effect on gas content variability. In general, the results revealed lower variations in isotopic signatures of methane in the ventilation shaft than reported in previous studies. Indeed, isotopic tracing links the mining observations and atmospheric monitoring perspectives to follow up on methane emissions from mining activities in the USCB.