DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

This project deals with some solid particles that undergo accumulation on roads of the city of Kielce and in river sediments and soils. These particulates, referred to as “road dust” or “street dust”, comprise both natural constituents (minerals from soil erosion and rock weathering, plant matter etc.) and anthropogenic components (materials from road surface abrasion, tire and brake wear etc.). The most interesting component of the latter group is glass microspheres that may be regarded as a potential new indicator of the road dust distribution in the environment. The glass microspheres meet the criteria of a good marker that is they are resistant to weathering and may be widespread in different terrestrial and near-shore marine environments. This has partly been evidenced by the preliminary results of the studies conducted by Gałuszka and Migaszewski (2018) and Suhas et al. (2019). However, this issue needs more detailed investigation in the context of fluvial and windborne transport of glass microspheres.

This project covers three main aspects of the study of road dust, river sediments and top soils:

i) search for a new technogenic indicator in the study of the road dust fate in the environment;
ii) development of new test methods (sampling, sample preparation and analysis) for glass microspheres in the environmental compartments mentioned above;
iii) assessment of the extent of these technogenic particulates in fluvial and soil environments.

The principal objective of this study is to characterize the quality and quantity of glass microspheres and additionally Zr, Sb, Ba, Sn, Y and Cu in road dust, and their occurrence in river sediments and top soils, their local diversity, and to assess the usefulness of glass microspheres as a potential marker of the road transport impact on the environment.

In order to complete the study objectives, the following representative composite samples will be collected: road dust from three streets in the city of Kielce, road dust from beltway S7/E77 and neighboring top soils, and sediments from four rivers (Silnica, Bobrza, Czarna Nida and Nida) in the southeastern part of the Świętokrzyskie province. In order to assess sediment and soil sampling uncertainty, duplicates will be taken at a distance of 1–2 m. Sampling will be carried out three times during implementation of this project. The samples will be examined for the occurrence of glass microspheres released from road paints and additionally Zr, Sb, Ba, Sn, Y and Cu derived from vehicle brake pads in road dust, river sediments and soils. Different methods will be employed: microanalytical (optical and scanning electron microscopy with dispersive energy, electron microprobe analysis) and geochemical (fluorescence X-ray spectrometry and inductively coupled plasma-mass spectrometry) to better identify and characterize mineralogy and geochemistry of the media examined. Statistical analysis of the results will allow us to evaluate sampling uncertainty. This study will use a wide range of analytical methods, which are routinely applied in geochemical and mineralogical laboratories, but in this case will contribute to the development of new procedures for glass microsphere analyses in road dust, sediment and soil samples. One of these advancements would include working out a new separation method of glass microspheres from the samples examined. The reasons for undertaking this project are gaps in the knowledge and understanding of fluvial and airborne transport mechanism of glass microspheres. An expected outcome of this study will be an assessment of the extent and content of this dust component in river sediments and top soils. This knowledge will be used for a proposal of new indicators of the road dust sources. It should be emphasized that results of this study would be of interest to scientists representing a broad range of disciplines including: environmental geochemists, urban geochemists, mineralogists, environmental scientists, and geologists involved in the Anthropocene study.