Soils contaminated with heavy metals (mining and metallurgical waste heaps) are inhabited only by certain species of plants. Not all of them are able to survive toxic for most organisms' concentrations of zinc, lead, cadmium, chromium, iron or copper. What does make some plants special in this matter? Our project aims to understand the mechanisms of plant tolerance to heavy metals in such species. In cooperation with two Polish units, the Jagiellonian University in Krakow and the Polish Academy of Sciences, and a foreign partner – the Uppsala University, we plan to identify genes and describe chemical compounds responsible for heavy metal tolerance, as well as identify plant organs/tissues that play a particularly important role in this mechanism. For the study, we chose a species with remarkable tolerance to heavy metals, growing naturally on post-mining waste heaps (zinc-lead), *Viola tricolor* (heartsease). This is a well-known plant in pharmaceutical industry exhibiting a medicinal property such as body detoxification, strengthen of blood vessels, metabolism stimulation and cough inhibiting. This plant, when occurs naturally in soils contaminated with heavy metals, excludes them, which means that it retains very large amounts of heavy metals in the roots, blocking their transport to leaves, flowers and fruits. While heavy metal-accumulating plants and their oversupply of heavy metals are extensively studied, the mechanisms of heavy metal tolerance in metal-excluding plants are unknown. Interestingly, heartsease isn't exception in its group it belongs to, the whole genus *Viola* (violets) is rich in species that have evolved tolerance to heavy metals. In the current project we would like to determine whether in the presence of metals, the activity of genes related to the uptake (the so-called membrane transporters), mainly in roots, change. A very important question is whether genes responsible for the production of various chemical compounds binding and immobilizing metals are more potent. We suspect that among these compounds are cyclotides with such potential metal binding sites however their role in heavy metal stress has not been confirmed so far. Summing up, the project allows to discover new mechanisms that ensure ornamental and medicinal violets the ability to colonize areas degraded by the metallurgical and mining industries. Using advanced analytical techniques based on molecular weight measurements and peeking at the building blocks of life (nitrogenous bases) from which they are made of we will achieve the main aim of the project. Knowledge of the mechanisms of tolerance in violets will allow in the future to use these plants for various types of manipulations and breeding treatment, further increasing their ability to eliminate metals from the environment. So, in the future, they could be used to clean up polluted areas while maintaining their beautiful, decorative, and medicinal character.