

## ABSTRACT

Serpentine soils derived from ultrabasic rocks in southwestern Poland are characterized by relatively high content of Ni, Cr, and Co. The main objective of the study is the analysis of the mobility of Ni, Cr, and Co in serpentine soils derived from various types of ultrabasic parent rocks. Furthermore, the Ni isotopes analyses are helpful in understanding the biogeochemical cycle of Ni and the influence of serpentine soils on human health is studied.

Parent rocks are represented by (a) proper serpentinites (Jordanów, Żmijowiec) and (b) ultrabasic rocks with primary minerals and/or pseudomorphic textures (the Szklary Massif, Przemiłów, Radunia, the Popiel Hill). The main Ni-bearing minerals in proper serpentinites are spinels and serpentines, while in the second group of parent rocks Ni is bound in spinels and olivines. Chromium is mostly bound in spinels (magnetites, Cr-magnetites, spinel-chromite) regardless the type of ultrabasic parent rock. Spinels are also Co-bearing phases. Furthermore, elevated contents of Ni and Cr are observed in clinocllore, pyroxenes, and amphiboles.

Chemical extractions show that Ni is the most mobile in Polish serpentine soils followed by Co and Cr among studied metallic elements. The mobility of Ni is higher in soils derived from ultrabasic rocks with primary minerals and/or pseudomorphic textures compared to soils derived from proper serpentinites. Ultrabasic rocks with primary minerals contain olivines that are characterized by relatively high susceptibility to weathering. Hence, higher mobility of Ni is noted in soils derived from ultrabasic rocks with primary minerals and/or pseudomorphic textures. Serpentines as volumetrically predominant minerals in serpentinites are relatively stable during weathering. The behavior of Co in soils is similar to that observed for Ni. Chromium is the least mobile among all studied metallic elements because of high resistance of spinels to weathering. Furthermore, mobility of Cr does not depend on the type of parent rock.

Results of chemical extractions and chemical composition of plants indicate that chemical extractions reflect only to some extent bioavailability of Ni, Cr, and Co in soils. Plants from Jordanów are characterized by higher content of Ni (aboveground parts), Co (underground parts) and Cr (above- and underground parts) compared to plants from the Szklary Massif although higher mobility of Ni and Co is observed in the Szklary Massif. The uptake of metallic elements is probably controlled by presence of tremolite (Ca-amphibole) in serpentinized peridotite from the Szklary Massif, which does not occur in serpentinite from Jordanów. Calcium leached from tremolite is responsible for competing with metallic elements in plants during uptake and/or translocation. Therefore, lower contents of metallic elements are observed in plants from the Szklary Massif compared to Jordanów. Furthermore, other factors such as pH of soils, presence of allogenic minerals and age of soils affect the uptake of metallic elements.

Isotope analysis show that isotopic signature ( $\delta^{60}\text{Ni}$ ) for parent rocks (serpentinized peridotite in the Szklary Massif and serpentinite in Jordanów) is in the range of unweathered peridotite xenoliths. Hence, it suggests that serpentinization probably does not affect the  $\delta^{60}\text{Ni}$  in ultrabasic parent rocks. Furthermore, weathering of these rocks leads to the removal isotopically heavy pool of Ni (at least in the Szklary Massif) confirming previous results in other ultramafic areas. The comparison  $\delta^{60}\text{Ni}$  of soils with rate of weathering shows that the more advanced weathering, the heavier isotopic composition of soils. It suggests that light pool of Ni could be leached out during pedogenesis in Polish soils.

Chemical extraction with glycine shows that Ni and Co in soils from the surface horizons derived from ultrabasic rocks with primary minerals and/or pseudomorphic textures

may be realitevely easily absorbed in human stomach after soil digestion.This is probably due to the relatively high susceptibility of olivines to dissolution.