Sequential extraction based environmental risk assessment of potentially toxic elements in the topsoil of two sloping vineyards (Tokaj-Hegyalja, Hungary)

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Introduction

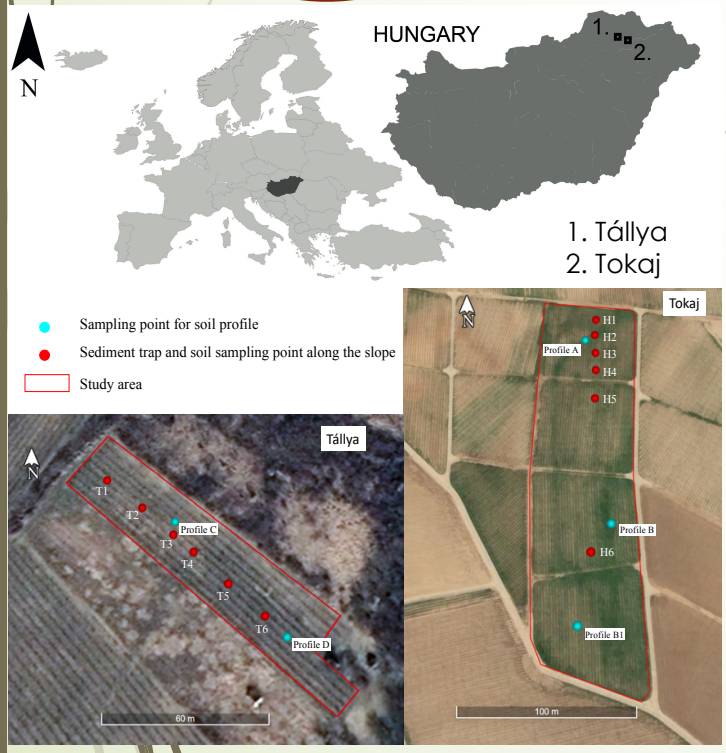
- Potentially toxic elements (PTEs) are exhibited in different geochemical fractions, which significantly affect their behaviour in the soils and eroded sediments.
- Soil erosion and redeposition of PTE-rich sediment particles in sloping vineyards increase the risk of contamination of non-target environments.

Determining geochemical distribution of PTEs

ascertains different ways of soil- and sediment-bound PTEs

is appropriate to assess PTE available, potential mobility, and toxicity to crops

is useful for an adequate environmental risk assessment



The study area in the Tokaj Wine Region (NE Hungary); Location of the soil profiles (0-200 cm); and the position of sediment traps and soil sampling along the main slope

Methods

The improved version of the BCR (Community Bureau of Reference) ***three-step sequential extraction*** procedure:

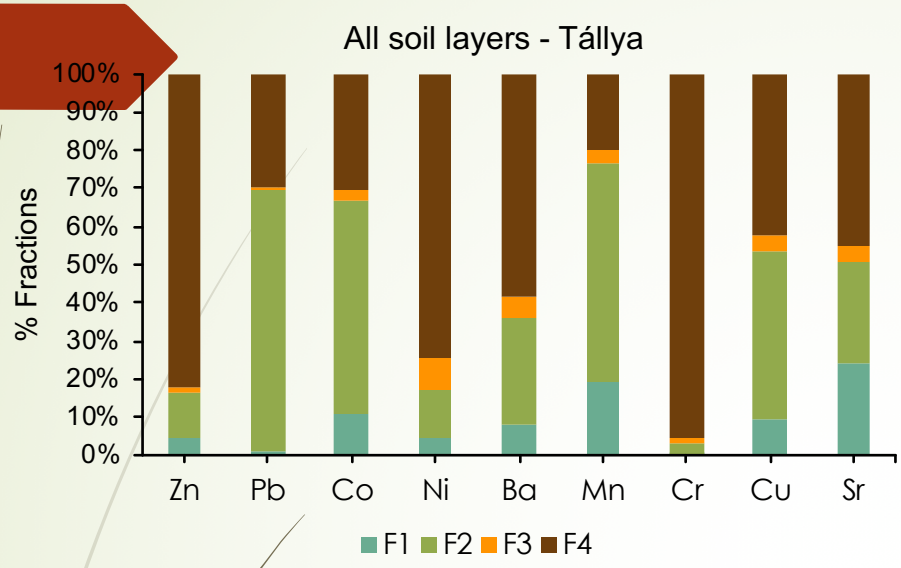
Step 1 - *Acid-soluble fraction* (F1)*:* 40 ml of acetic acid (0.11 mol/l)

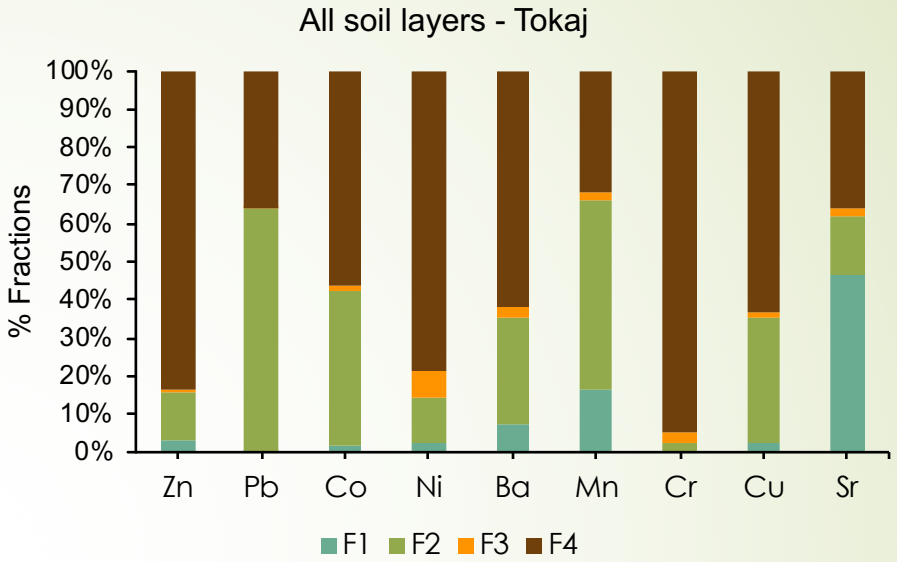
Step 2 - *Reducible fraction* (F2*)*: 40 ml of fresh hydroxylamine hydrochloride (0.5 mol/l)

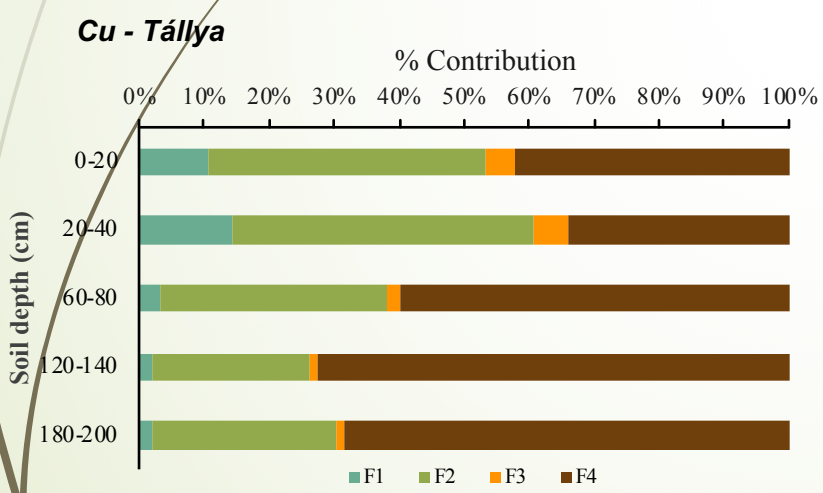
Step 3 - *Oxidisable fraction* (F3): 10 ml of 8.8 mol/l hydrogen peroxide (stage 1) and 50 ml of 1 mol/l ammonium acetate (stage 2)

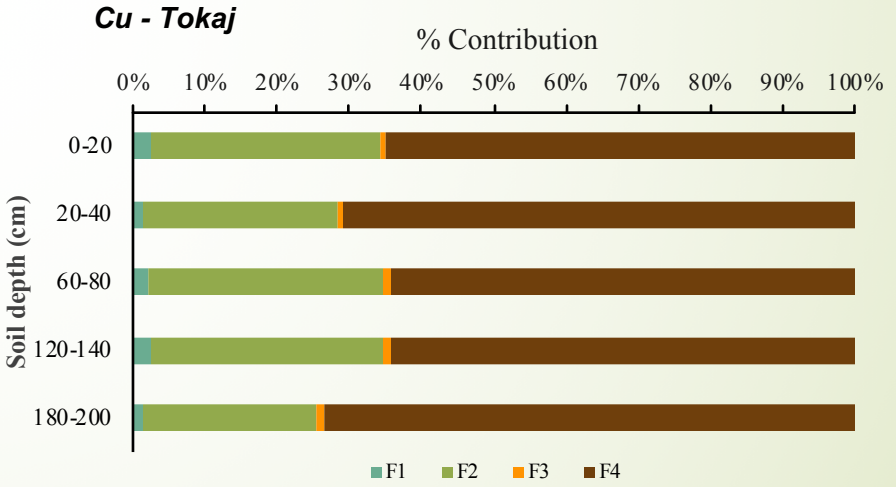
Residual (F4): 7 ml aqua regia (HNO_3/HCl=1:3)

Geochemical fractions of PTEs in the vineyard soil







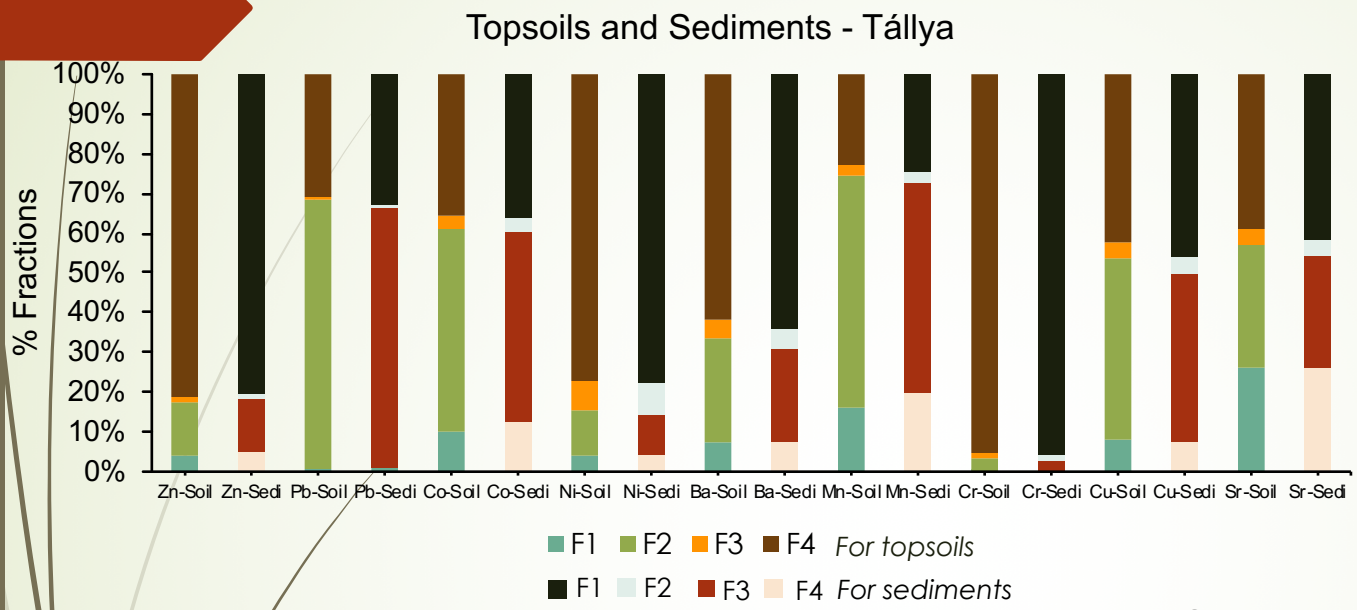


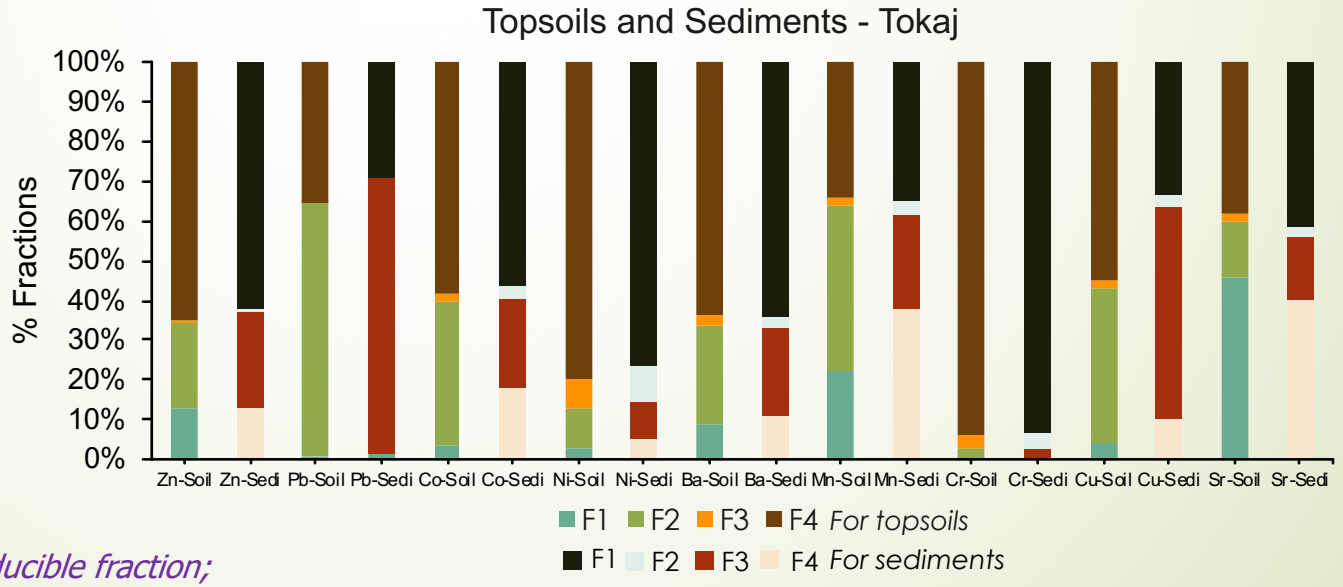
- Most of the PTEs are associated with the ***residual soil fractions***.

(F1: Acid-soluble fraction; F2: Reducible fraction; F3: Oxidisable fraction; F4: Residual fraction.)

- The ***soil pH, $CaCO_3$, and silt content*** played a major role in the stability of PTEs in the soil.

❑ *Geochemical fractions of PTEs in the topsoil and eroded sediment*





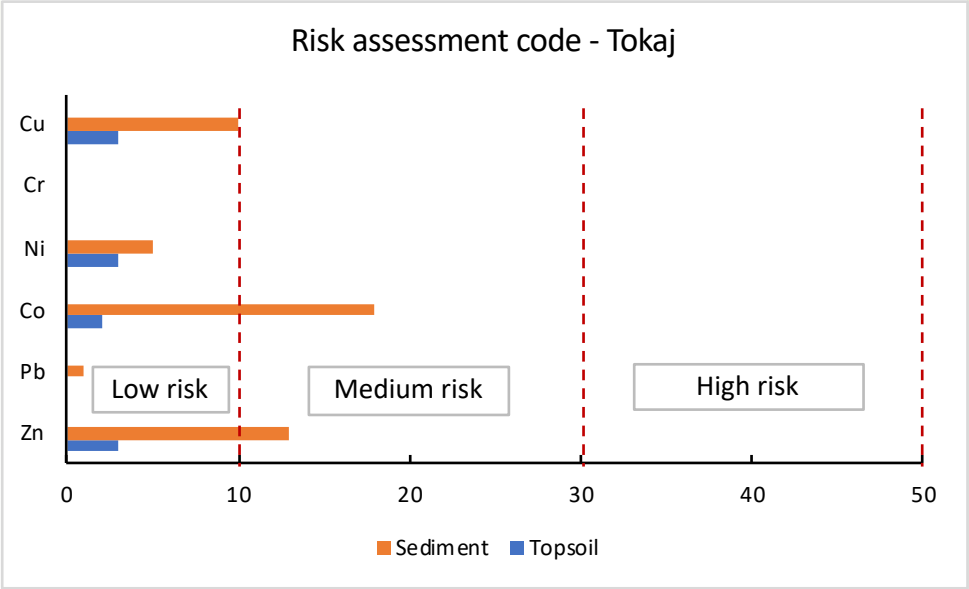
- ***Minerals composition of soils and sediments***
- ***illite/muscovite*** *(the sorption of PTEs)*

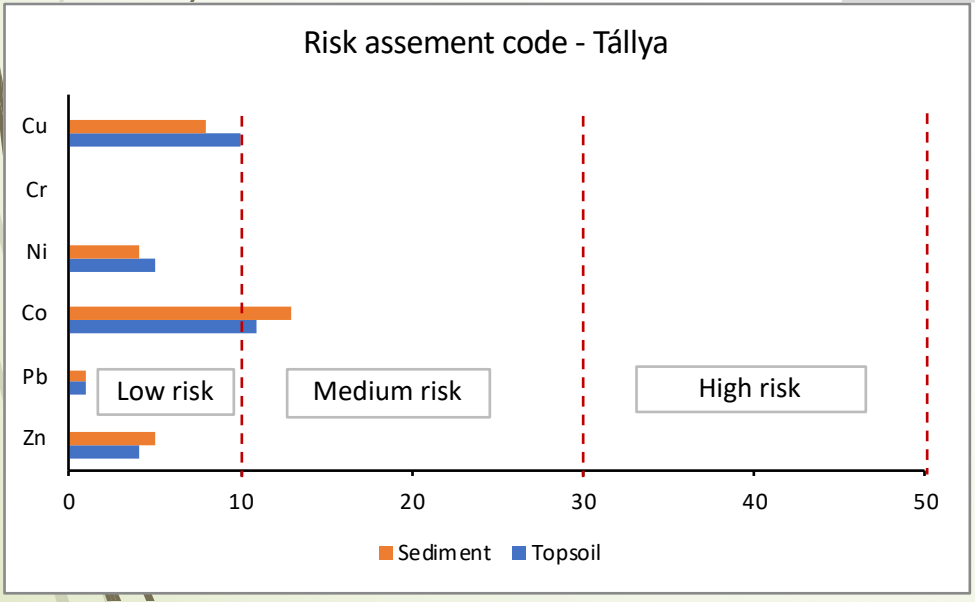
(F1: Acid-soluble fraction; F2: Reducible fraction; F3: Oxidisable fraction; F4: Residual fraction.)

Environmental risk assessment

Risk assessment code (RAC) = percentage of acid-soluble fraction PTE (F1) in total PTE concentration (F1+F2+F3+F4)

- *Elevated environmental risk can be indicated for PTEs in the eroded sediment.*





Thank you!

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