

Release of geogenic arsenic and other trace elements from tunnel excavation material and related risks to water resources

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In Switzerland and other densely populated regions around the world, extracted rock from tunnel construction represents a major waste stream. Because space in disposal sites is limited, Swiss law requires that uncontaminated excavation material must be used as much as possible for construction, recultivation of material extraction sites, landscaping or littoral zone restoration in surface waters. Excavated material with naturally elevated contents of arsenic (As) and other trace elements like nickel (Ni) and chromium (Cr) are legally uncontaminated and should also be reused if risks to surface and groundwater resources can be excluded. However, ensuring reuse of geogenically-enriched material is risk-free involves many interacting controls. Trace element release from deposited material depends on its mineralogy and physicochemical properties, its grain size distribution as determined by excavation method (boring versus drilling/blasting), and the biogeochemical and hydrological conditions at the deposition site. In a recently started project, we aim to strengthen the scientific basis for the assessment of the release of As and other trace elements from tunnel excavated material in dedicated field and laboratory studies. First results will be presented from a field study investigating how deposition of several megatons of tunnel excavation material for delta restoration affects trace element concentrations and general water chemistry in a Swiss peri-alpine lake. Field results are complimented by a laboratory study comparing the leaching of As from materials with different mineralogies, textures and As speciation, in both standardized regulatory leaching tests and biogeochemically motivated extractions. These results will support the sustainable management of extracted material reuse and the protection of water resources.