A laboratory study to define tools for monitoring asbestos mobility in aquifers

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Keywords: column test, groundwater, asbestos.

Given the urgent necessity of groundwater resources protection resulted after years of uncontrolled human exploitation and climate change, which affected both their quality and quantity, the assessment of possible groundwater contamination by well-known contaminants and Emerging Pollutants (EP) is of paramount importance. Airborne asbestos is widely recognized as a contaminant of concern for human health and the environment. Since its carcinogenicity when inhaled is well established, previous studies have mainly monitored its presence in air, neglecting to consider water as an exposure pathway. Asbestos in water could be ingested – especially if it reaches the tap water system – or become a secondary source of airborne fibres, in case of water-to-air migration.

An accurate risk assessment of waterborne asbestos is particularly required in mine areas or in Naturally Occurring Asbestos (NOA)-rich areas. In the first case, non-monitored mine tailings deposits can be present and contain non-exploitable fibrous minerals which may be dispersed in surface and groundwater. In the second case, NOA-rich rocks and soils weathering and erosion could result in waterborne mineral fibres diffusion. In both situations, there is a risk of mineral fibre migration through groundwater from the pollution sources, which was traditionally considered negligible. Conversely, a recent column-based laboratory study (Mohanty et al., 2021) highlighted possible chrysotile mobility through porous media. Moreover, possible mineral fibre diffusion in water was recently considered in the Lanzo Valleys and Balangero Plain (NOA-rich area in the North West Alps, Italy) as a consequence of interactions between water and ophiolitic rocks or related sediments (Avataneo et al., 2021).

In this context, a laboratory study based on column transport tests was set to investigate the fibre transport in saturated aquifers. The experimental results make it possible to better understand possible groundwater contamination by mineral fibres and their movement through porous media, providing hints to clarify the relation between fibre presence and movement in the water system and reservoir peculiarities (geology, hydrogeology). This work will provide tools to monitor asbestos transport due to groundwater flowing in NOA-rich settings or in areas where non-monitored mine tailings deposits are present.

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