EGU General Assembly 2022

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Extensive characterization of waterborne mineral fibres and study of their possible migration to air in naturally occurring asbestos (NOA) rich settings.

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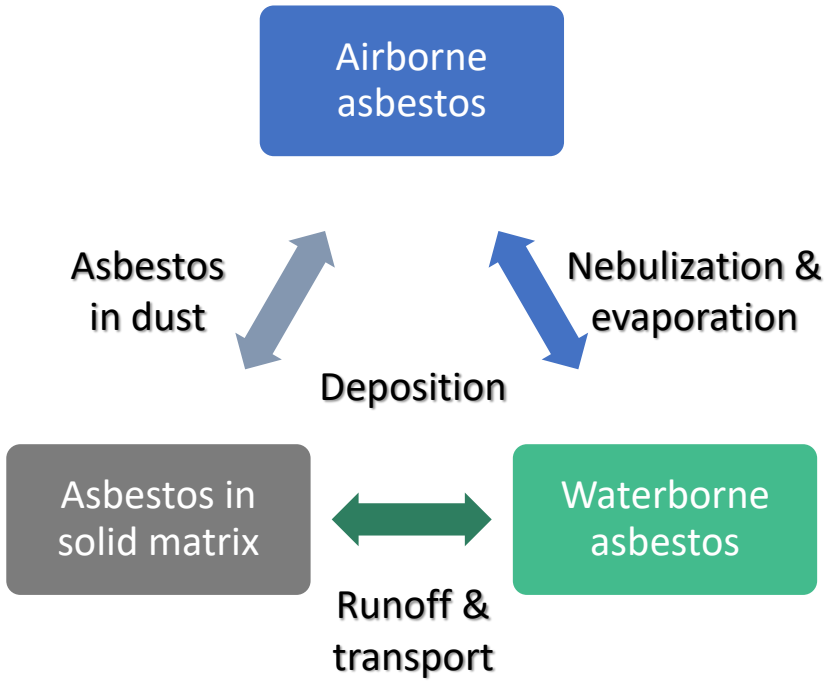
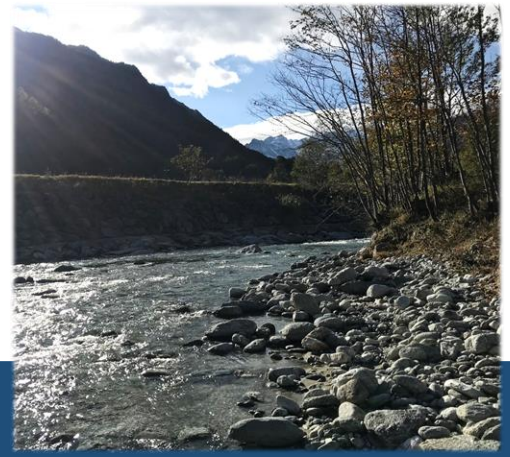
Asbestos circulation in the environment

Weathering and erosion of asbestos rich-rocks and sediments / mine tailing deposits





Waterborne asbestos transport (surface waters and groundwater)

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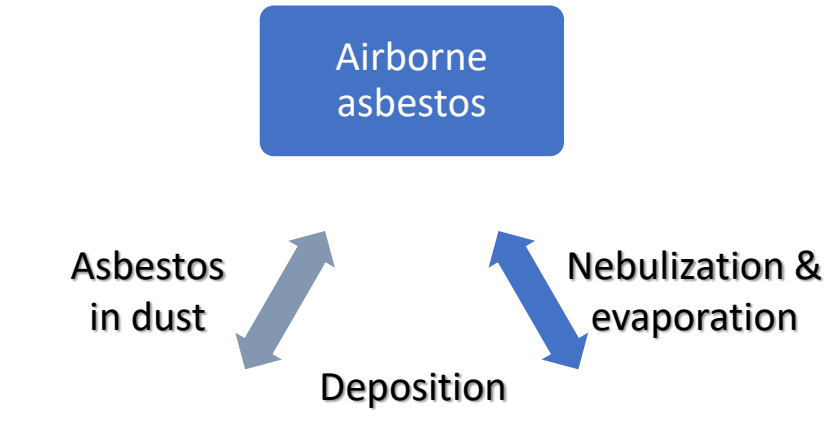
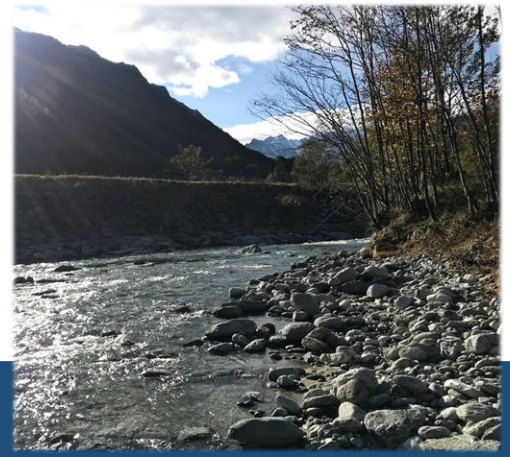




Waterborne asbestos transport (surface waters and groundwater)

Non-conventional exposure ways related to the use of contaminated water:

- **in agriculture/industry** secondary source of airborne asbestos
- **as supply for tap water** ingestion

Study area and sampling campaigns

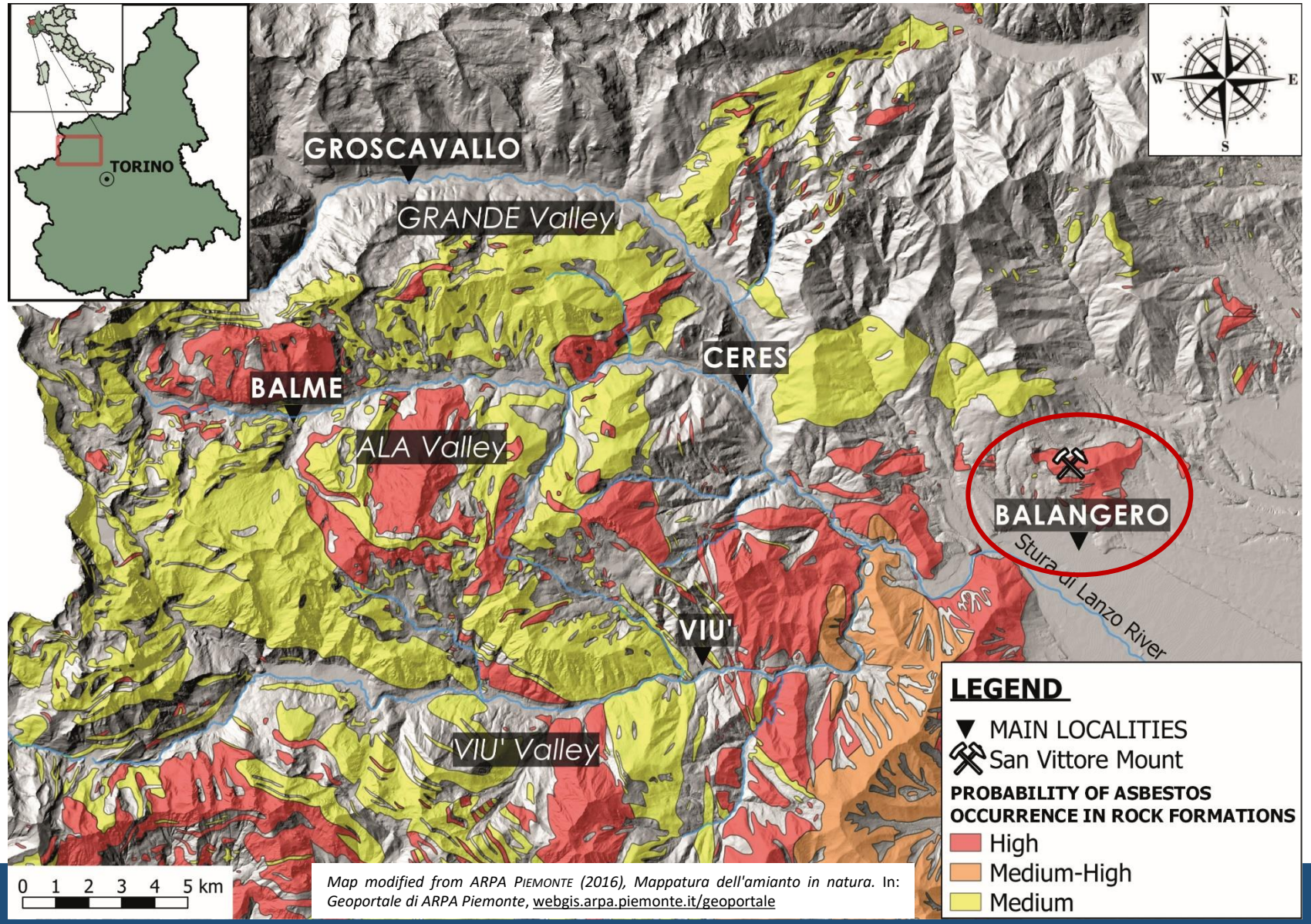
Water sampled in Lanzo Valleys and Balangero Plain (NW Alps, Italy).

I sampling campaign in 2020 (dry period) → **22 samples in total.**

II sampling campaign in 2021 (rainy period) → **32 samples in total** (greater sampling density in the Balangero plain).

Sampling points:

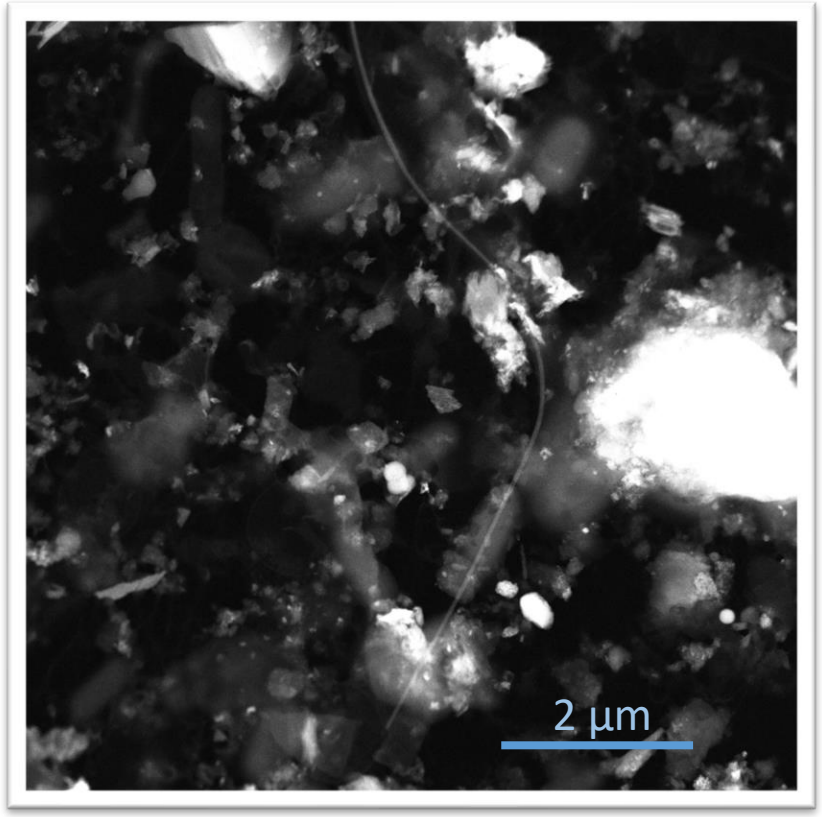
- **surface waters** from Stura river or its tributaries;
- **groundwater** from springs, wells and piezometers (sampled in static mode).



Map modified from ARPA Piemonte (2016), Mappatura dell'amianto in natura. In: *Geoportale di ARPA Piemonte*, webgis.arpa.piemonte.it/geoportale

Avataneo C. et al. (2021). **Groundwater Asbestos pollution from Naturally Occurring Asbestos (NOA): a preliminary study on the Lanzo Valleys and Balangero Plain area, NW Italy.** Italian Journal of Engineering Geology and Environment, 1.

TEM-EDS-SAED characterization



STEM image of a **chrysotile fibre**

TEM-EDS-SAED analyses in collaboration with the Analytical Mineralogy group – Friedrich-Schiller University of Jena, Germany

Authors thanks Prof. Langenhorst and Dott. Pollok for TEM support.

GROUNDWATER

ALL FIBRES SIZE*	Length [µm]	Width [µm]
Max	13.23	0.4
Min	0.35	0.01
Average	2.74	0.08

FIBRES CONCENTRATION*	Concentration [f/L]
All mineral particles	$27.2 \cdot 10^6$
Chrysotile + fibrous tremolite/actinolite	$6.7 \cdot 10^6$

*All fibres are considered, despite their length.

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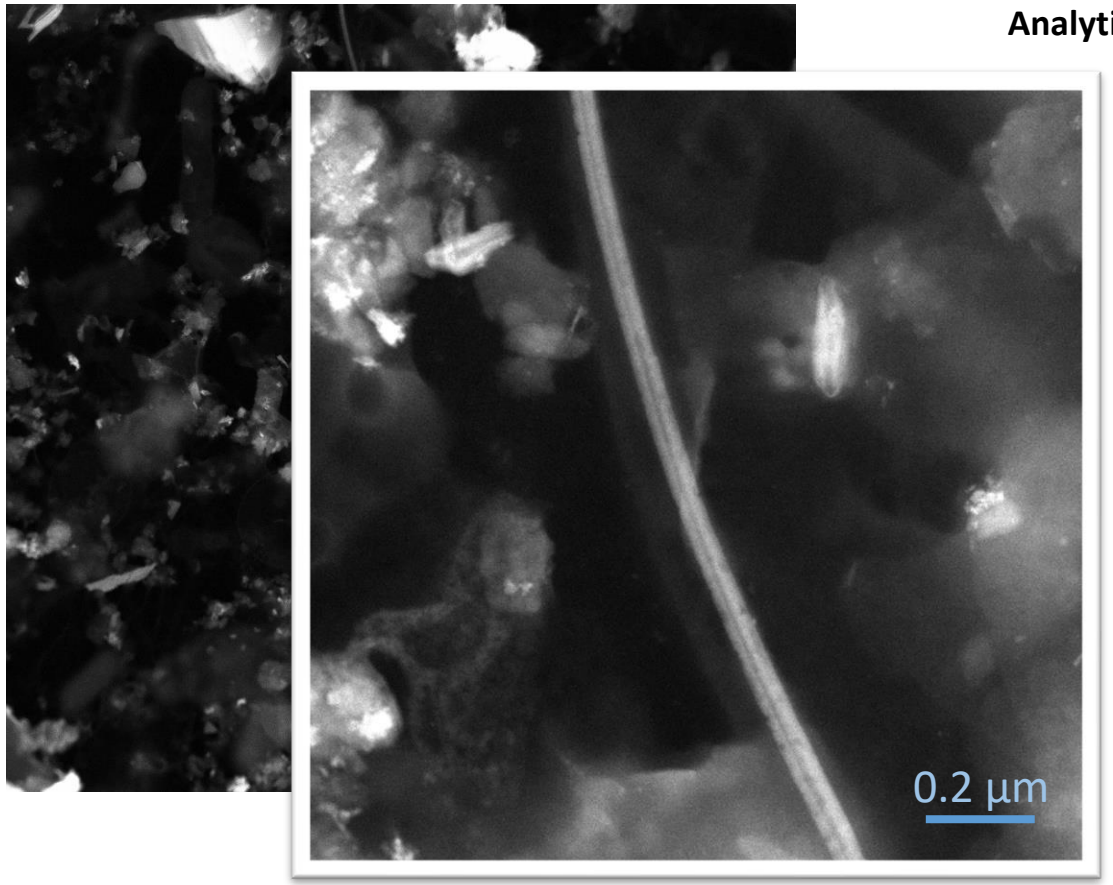

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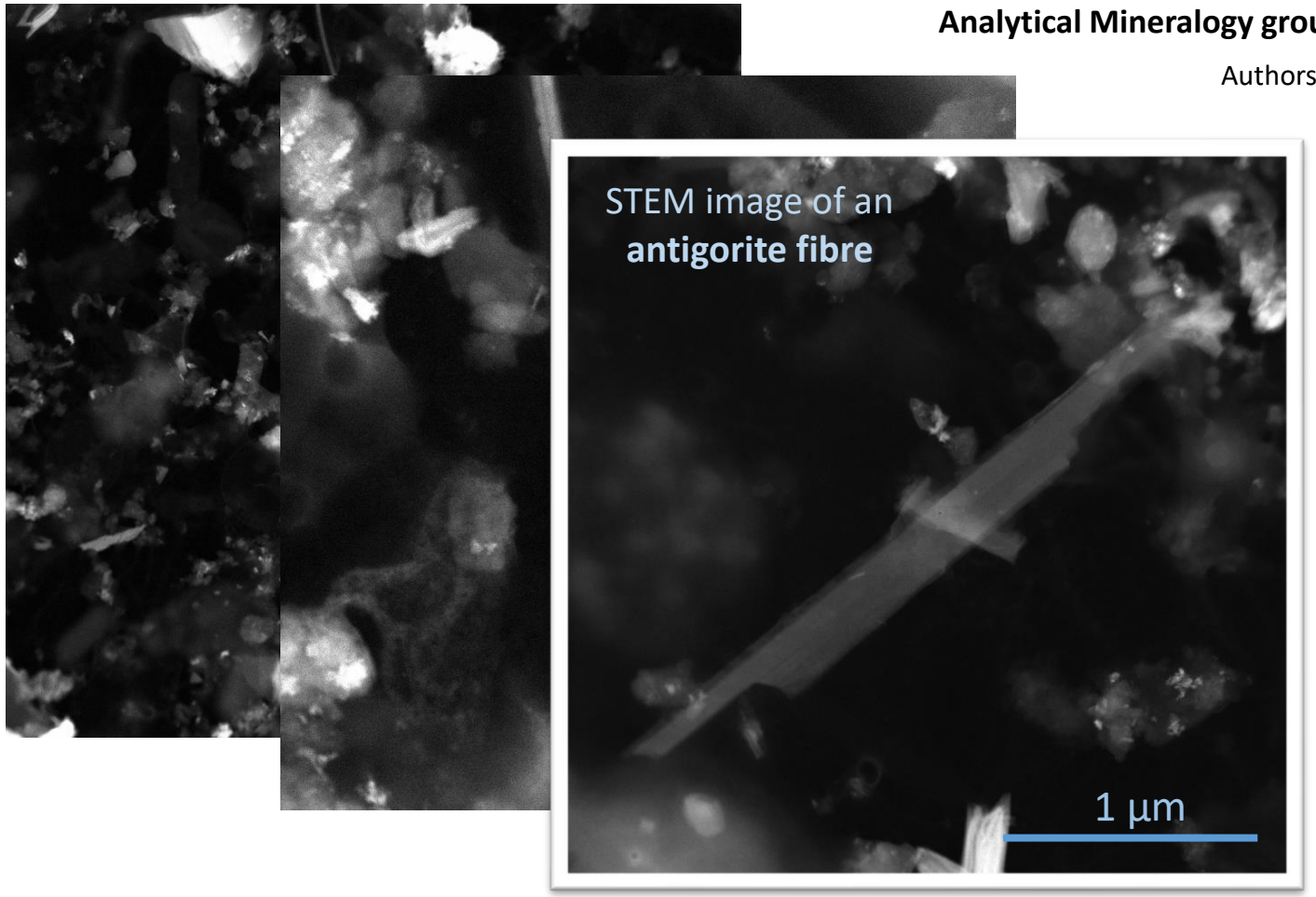

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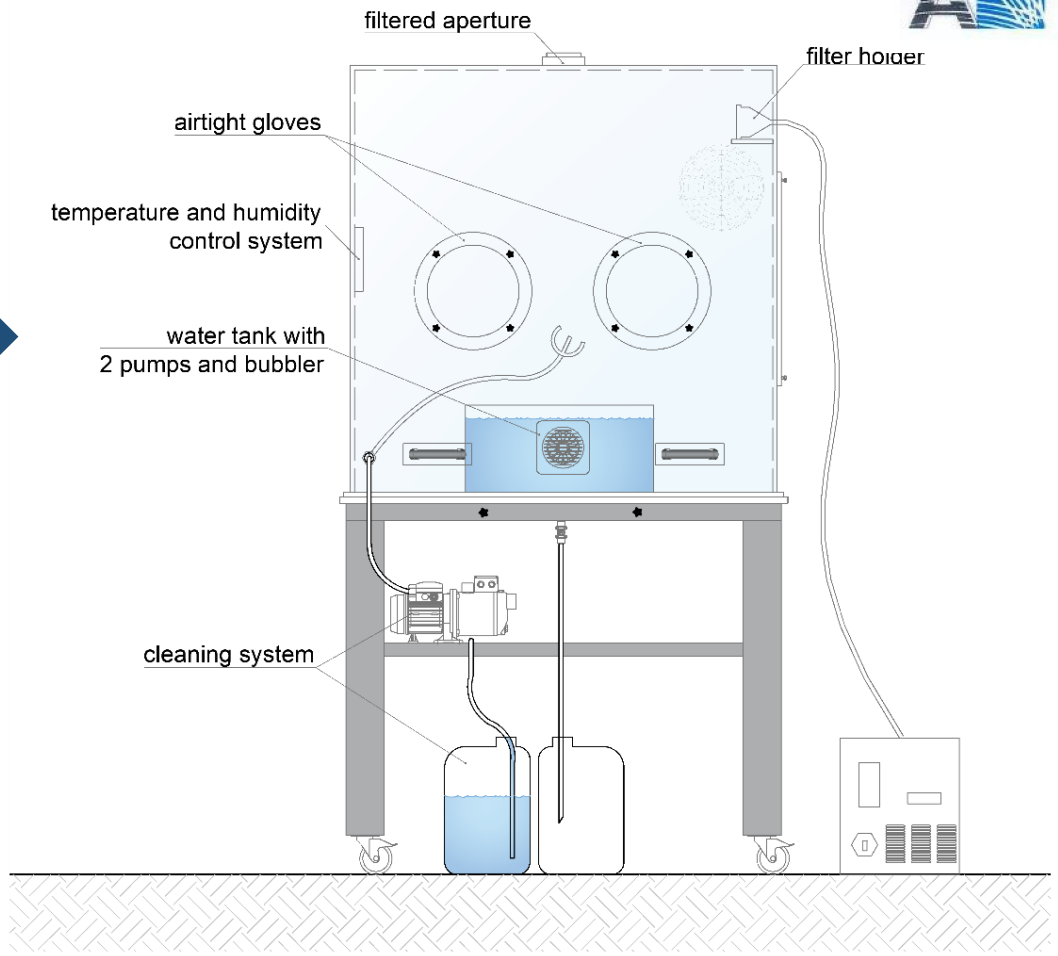
Experimental simulation to evaluate water-to-air migration

SURFACE WATERS

Average asbestos concentration in stream water: **10^6 f/L**, with peaks of **$20 \cdot 10^6$ f/L** (period 2018-2019).

Sample prepared for experimental simulation	Waterborne chrysotile added in prepared suspension [µg/L]
W_0	Drinking water, no chrysotile added
W_1	13.74
W_2	27.48
W_3	137.40

The Cube device



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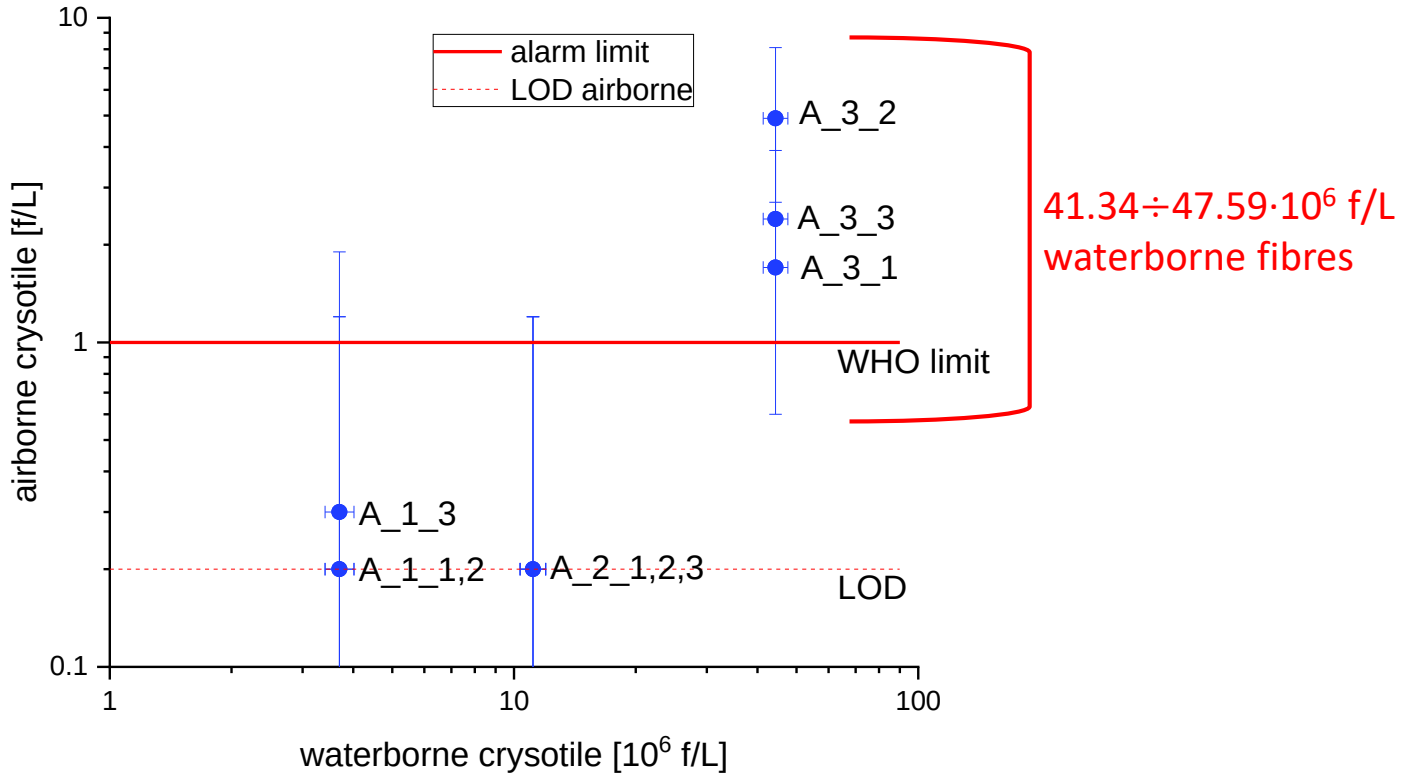
Experimental simulation to evaluate water-to-air migration – Main results

Chrysotile airborne concentration vs. waterborne concentration



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MAIN RESULTS

- The **occurrence of different types of mineral fibres** (both asbestos and non-asbestos classified) in the water system of the area is verified.
- Fibres found in **groundwater** are mainly characterized by **length < 5 µm** and show **different composition**.
- **Analyses** of asbestos **in groundwater** are difficult and possibly requires **TEM-EDS-SAED investigations.**
- Asbestos is found in large amount in **surface waters**, it constitutes an environmental problem due to **water-to-air migration.**
- **About $40 \cdot 10^6$ f/L waterborne fibres** could release **more than 1 f/L in air** (WHO alarm limit).

FUTURE PERSPECTIVES

Groundwater

- **TEM-EDS-SAED characterization** of all sampling points.
- Definition of a **protocol** to prepare and analyse **groundwater** samples.
- Study on **possible fibres movement in saturated porous aquifers** [*Session HS8.2.1-Friday 27.05, h 16.03*].

Surface waters

- Deepen the **experimental test** using different asbestos concentrations and types (e.g. amphiboles).
- Share **good practices** to prepare and analyse **surface waters** samples.
- Define an **alarm limit level for waterborne fibres.**

FUTURE PERSPECTIVES

This presentation participates in OSPP

EGU

Outstanding Student & PhD candidate Presentation contest

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Dott. Manuela Lasagna
Dott. Francesco Turci
Dott. Jasmine Rita Petriglieri
Dott. Maura Tomatis
The RSA s.r.l. staff

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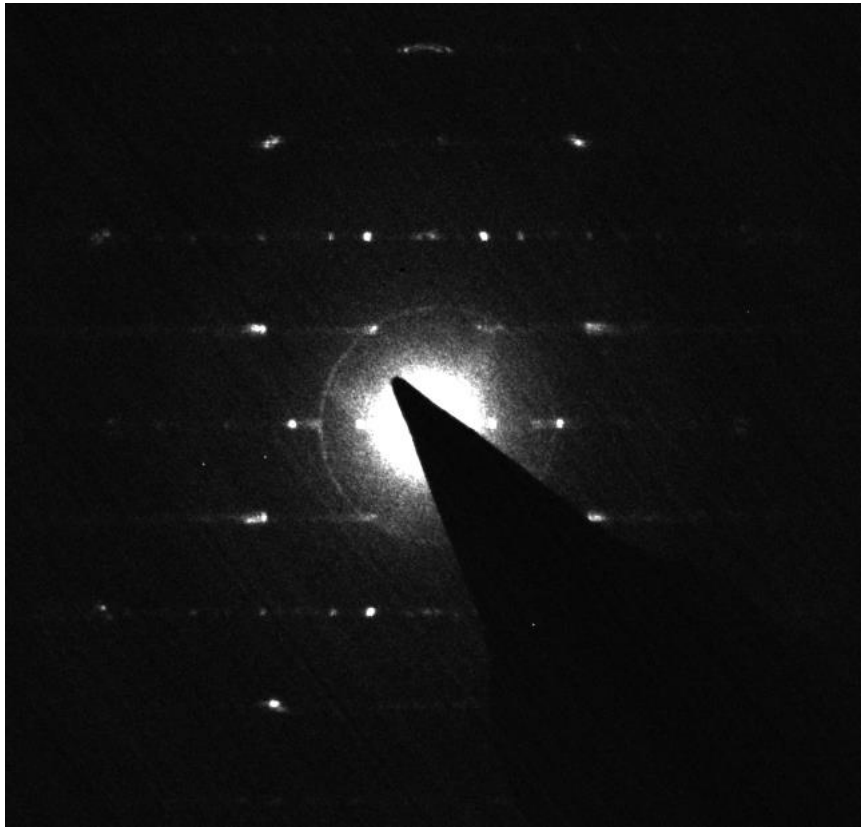
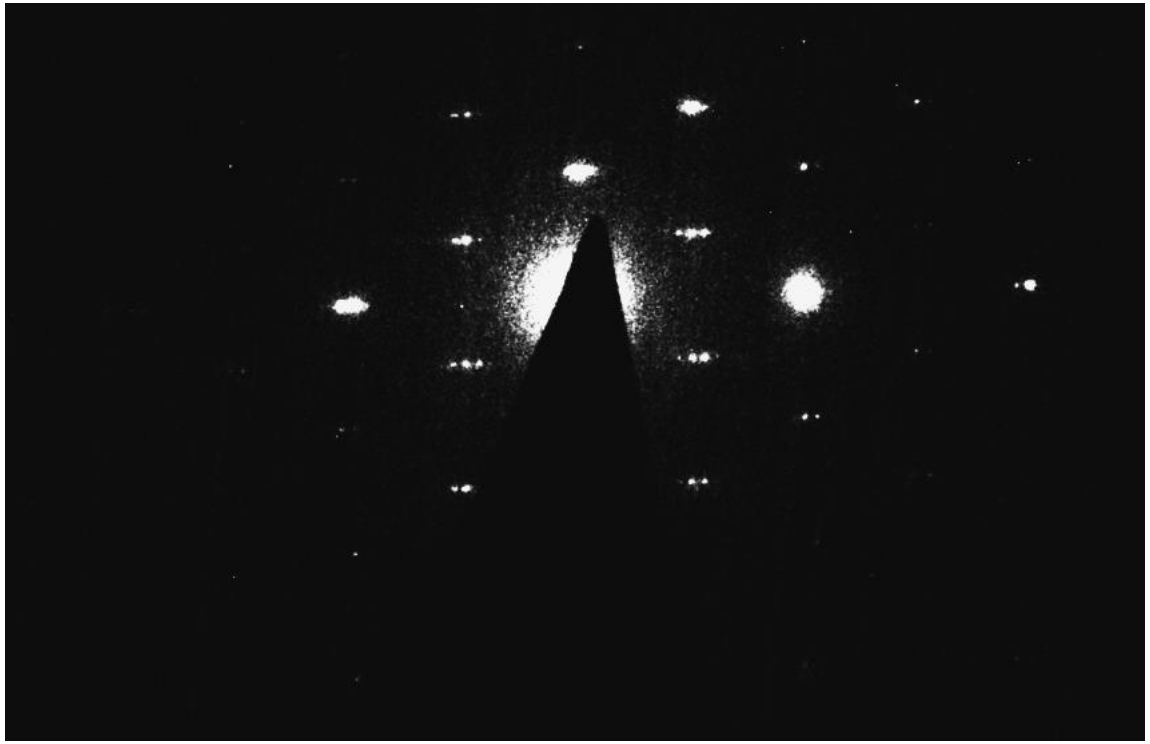
TEM-EDS-SAED characterization

GROUNDWATER

TEM-EDS-SAED analyses in collaboration with the Analytical Mineralogy group – Friedrich-Schiller University of Jena, Germany



DP of a **chrysotile fibre**



DP of an **antigorite fibre**