# Analysis of water soluble metals in sulfide open-cast mines

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## 1. Abstract

- > Abandoned sulfide mines in Cyprus are known to produce acid mine drainage (AMD), which is directly linked to potential environmental harm.
- > New analytical techniques must be created and put into use immediately to find potential pollutants.
- > In this work, a sampling campaign was performed to collect liquid samples from various mines in the Nicosia region.
- > The samples came from various sites that were close to the mine crater, as well as from nearby pollution hotspots where liquid extracts could be obtained.
- > An in house-built extraction electrospray ionization (EESI) source connected to a field-deployable highresolution time-of-flight mass spectrometer (ToF-MS) was used to analyze the collected water soluble samples.
- > A deeper knowledge of the fundamental mechanisms governing the release of water-soluble metals and their evolution in the environment, industry, or general public health will be possible thanks to the development of the EESI-ToF-MS.

 $\succ$  According to the findings, copper is the element with the highest concentration across all sites.

- > The maximum values recorded across all locations exhibit a narrow range of 50-115 mg/m<sup>3</sup>.
- > When compared to samples retrieved from craters, those taken directly from AMD showed higher amounts



**Figure 1:** Abandoned sulfide mines in Cyprus – sampling locations

# 2. Experimental

## **Experimental Setup**

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- > Water soluble metal particles are continuously sampled through a multi-channel denuder into an extractive electrospray ionization (EESI) source and intersect with a highly charged spray generated by a conventional electrospray capillary.
- > Soluble components are extracted in the spray and ionized by the Coulomb explosion method before detection by the ToF-MS.

ppm of disodium EDTA dehydrate



coupled to a TOF-MS system.





### Figure 6: Examples of liquid samples taken from sulfide mine craters.

ETHzürich



### Calibration curves for Zn, Pb, Ba and Cd 0.3 $R^2 = 0.9987$ $R^2 = 0.9998$ $R^2 = 0.9994$ = 0 999 Lead - m/z 497 Cadmium - m/z 403 • Zinc - m/z 353 Barium - m/z 427 20 30 50 10 40 60 Concentration (ng/m<sup>3</sup>)

**Figure 5.** Representative calibration curves for a) zinc, b) lead, c) barium and d) cadmium obtained from the EESI-TOF-MS.

- > Max values measured in all location show a close variation between 50-115 mg/m<sup>3</sup>
- > Location F has the highest concentration between samples due to acid mine drainage (solution taken after waste dumps extracted by rain

## 5. References

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