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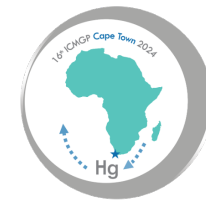
Orlando Vaselli

The former Hg-mining area of Abbadia San Salvatore (Mt. Amiata, central Italy): geochemical investigation vs. remediation activities

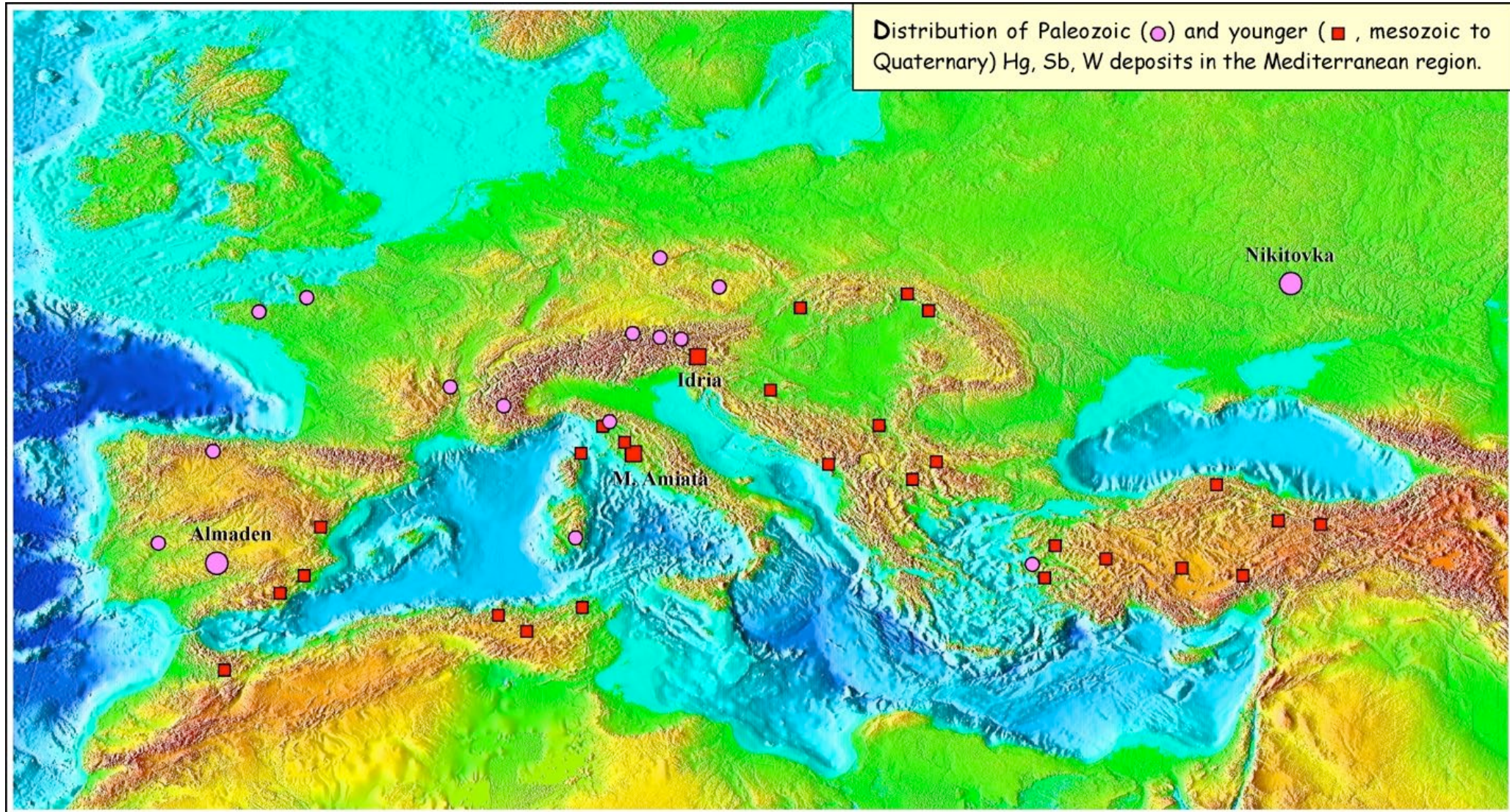
Nisi B., Bianchi F., Meloni F., Cabassi J., Rappuoli D., Esposito A., Piccinelli F.



The Mediterranean Hg belts



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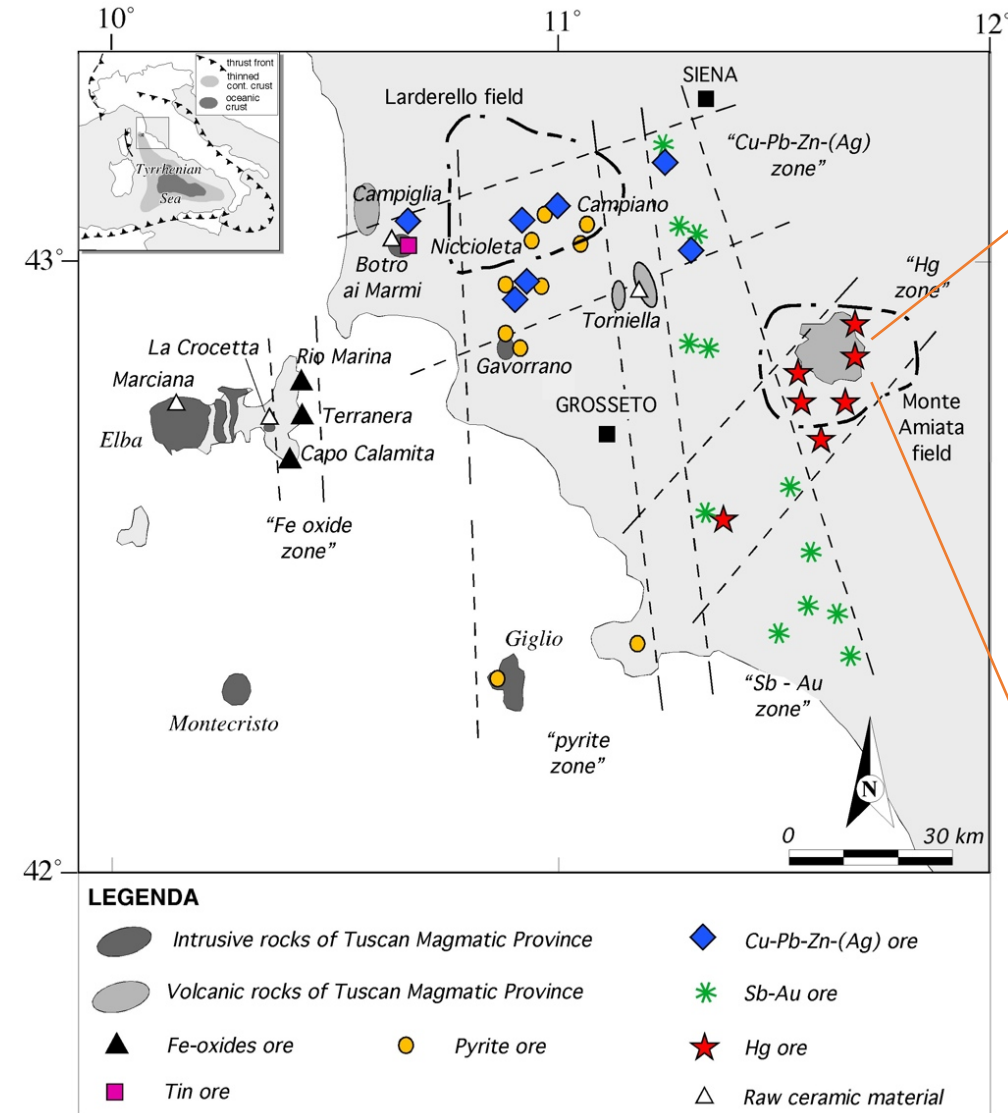


The southern Tuscany mines

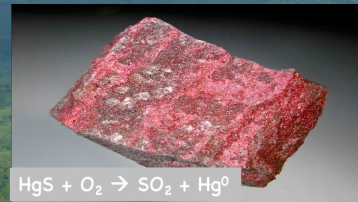
The Mt. Amiata Hg district



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Mt. Amiata (a 200,000 years old dacitic, rhyodacitic and olivine-latitic volcano)



Abbadia San Salvatore

From 1850 to 1982 >100,000 tons (i.e. 3×10^6 flasks = 34.46 kg) of metallic Hg were bottled. > 10,000 tons escaped by the 3 chimneys during the cinnabar roasting phase.



Before the remediation operations

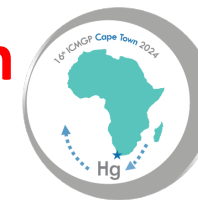


After the closure (1982)
liquid Hg is still
dropping from the
condensers

2 cm

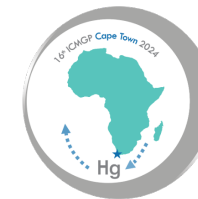


During the remediation operations



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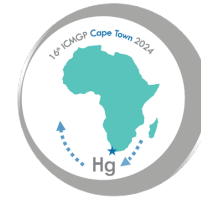
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www.mercurycapetown.com



Mining park museum

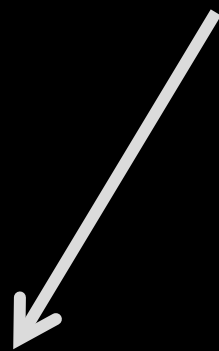


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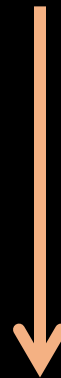


In 2008, an agreement between E.N.I. (National Agency for Hydrocarbons, AGIP Division), the previous owner of the mining concession and the Municipality of Abbadia San Salvatore signed an agreement to transfer the ownership of the reclamation to the public agency. The Department of Earth Sciences and the CNR-IGG of Florence were involved in the...

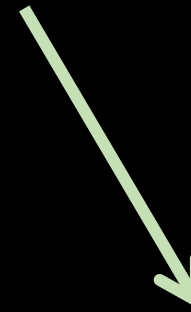
Geochemical Characterization Plan (GCP)



In-door/out-door and
interstitial soil Hg^0



Contaminated materials in
the mining structures



Dissolved Hg in the
groundwater system



Tuscany Region (D.R. n. 1447, Nov. 1998)

Leachates (MilliQ water) for any kind of material the target is $1 \mu\text{g/L}$, independently by the concentration of total Hg

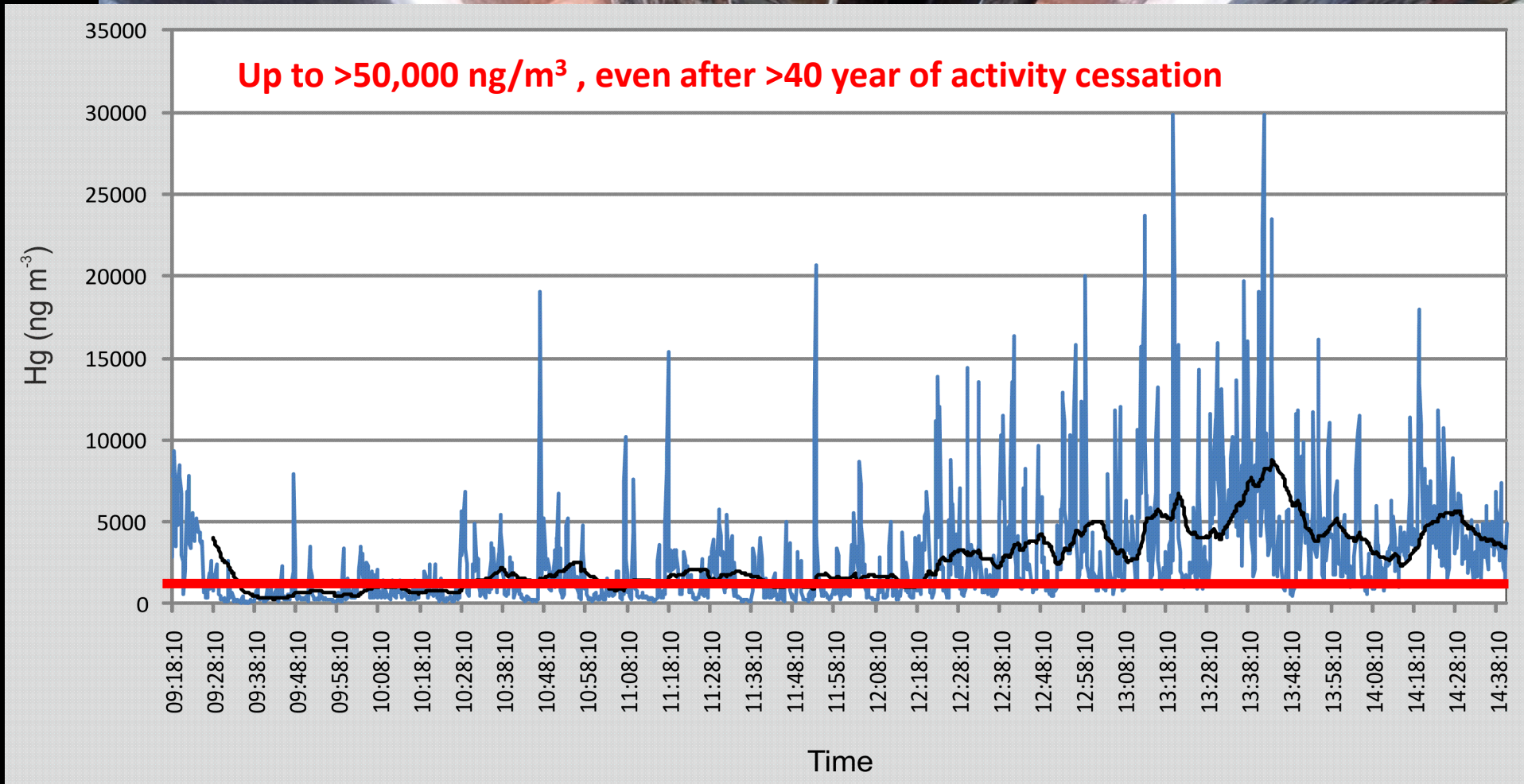
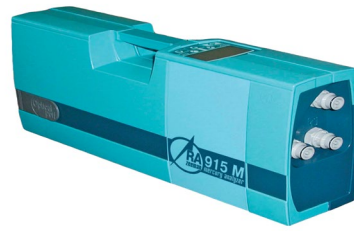
300 ng/m^3 (outdoor concentration);
 500 ng/m^3 (indoor concentration).

Content of Hg in (ground and surface) waters and $1 \mu\text{g/L}$
and waters discharged in surface waters (after being
treated): $5 \mu\text{g/L}$

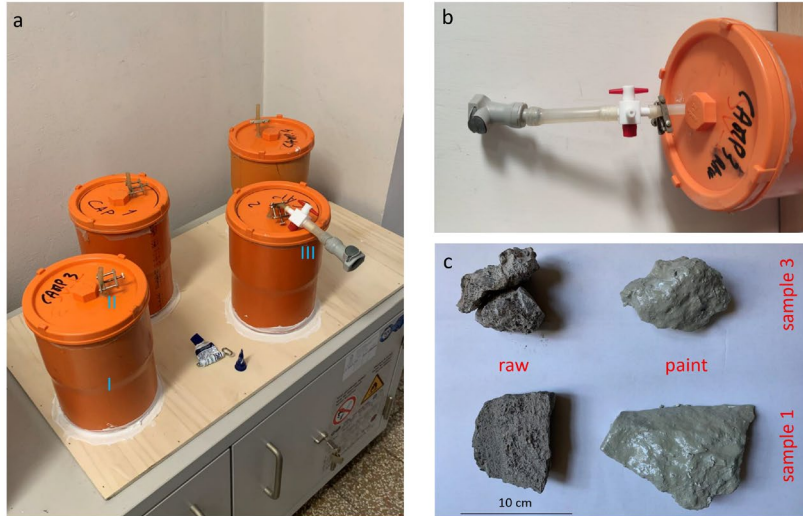
27.05.2011



GEM: Gaseous Elemental Mercury



Paint test results



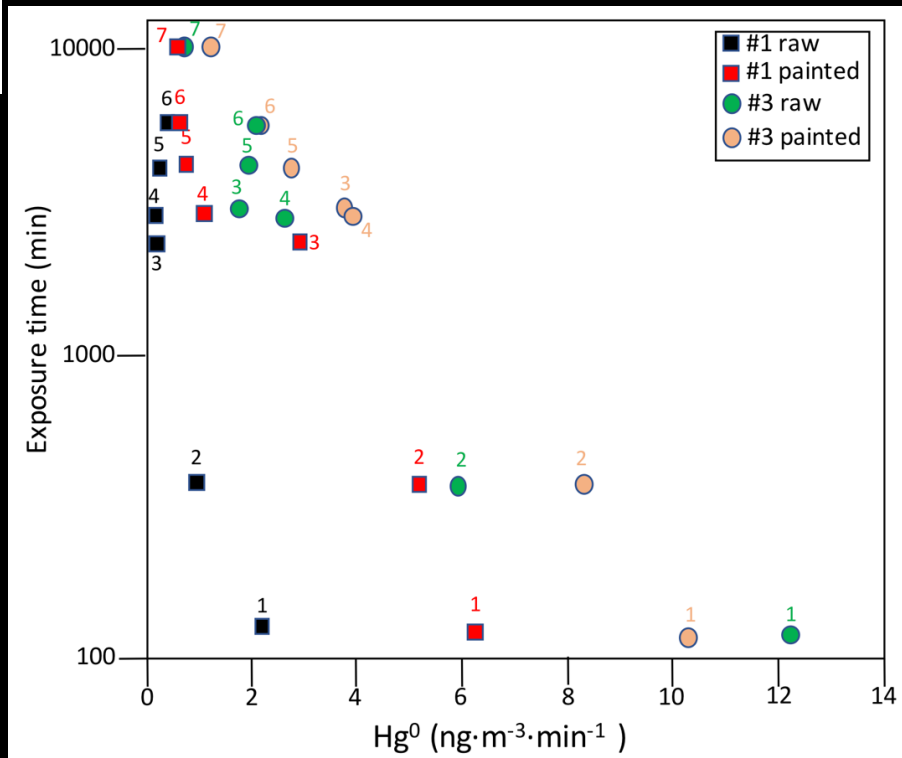
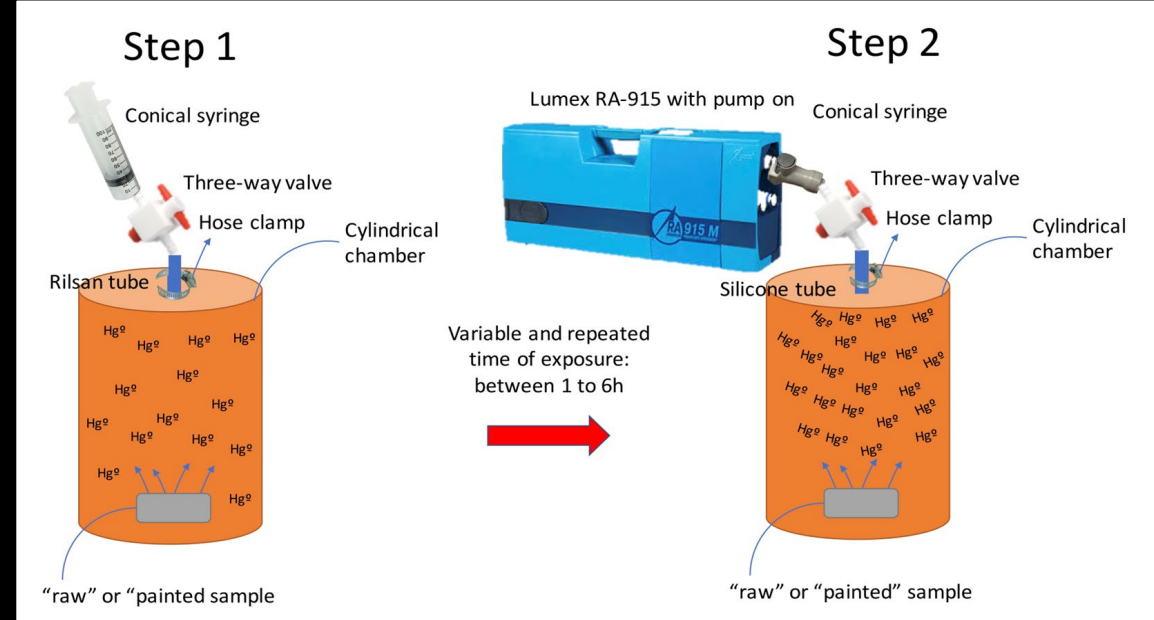
Hg_{tot}

106 mg kg⁻¹
79 mg kg⁻¹
242 mg kg⁻¹
16.9 mg kg⁻¹

Hg_L

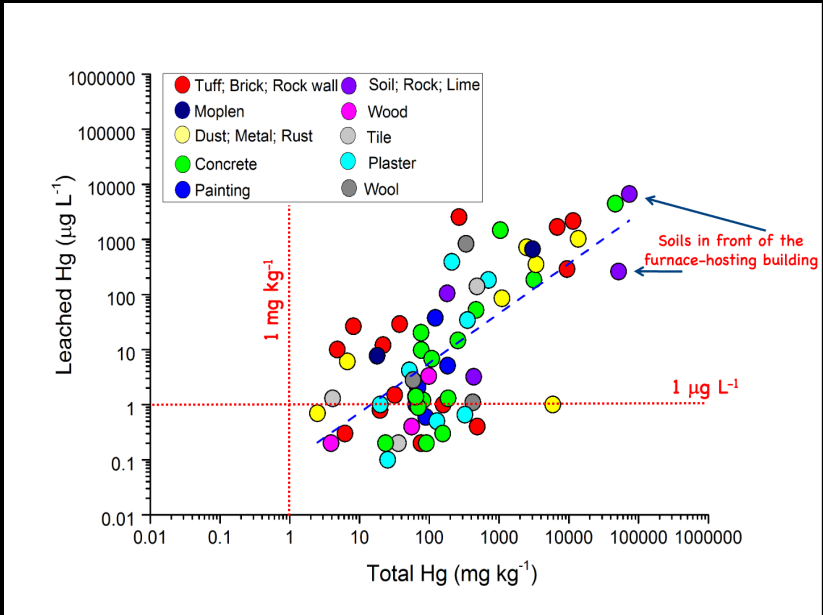
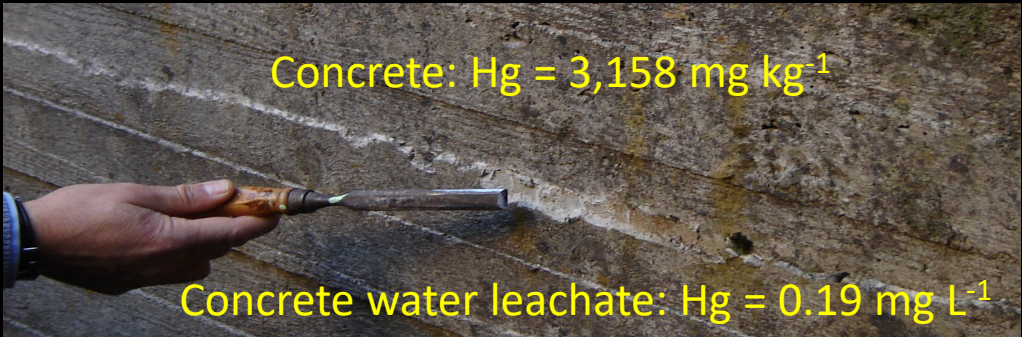
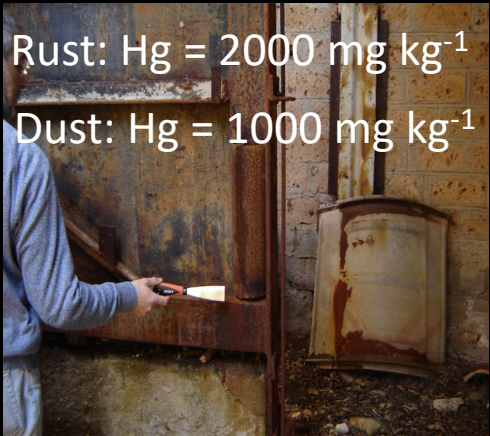
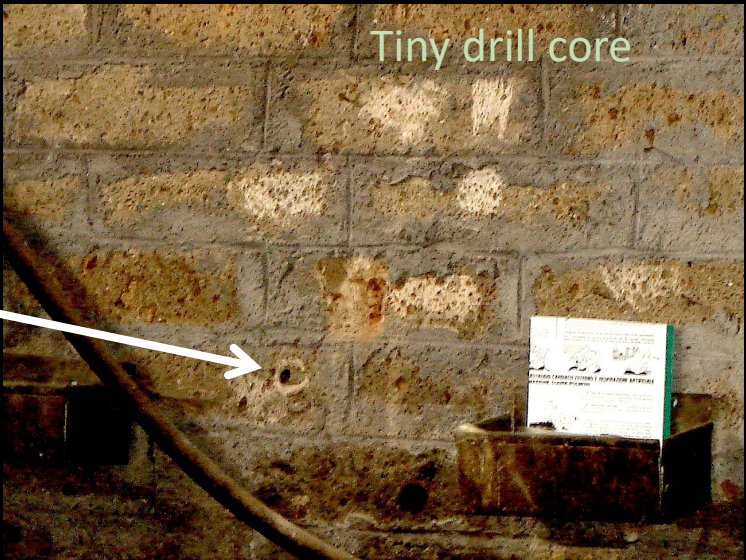
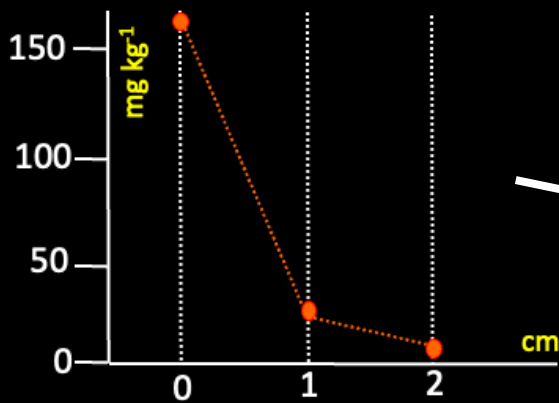
483.0 µg L⁻¹
19.9 µg L⁻¹
1350.0 µg L⁻¹
0.50 µg L⁻¹

Hg^0 : from hundreds to thousands ng m⁻³



The paint did not shield the Hg^0 emissions of the selected man-made materials.

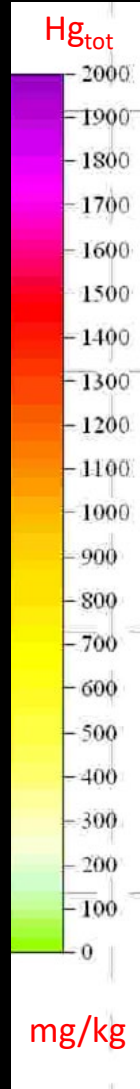




The surface layers of most walls from most edifices were removed and the Hg⁰ strongly decreased, afterwards.



Soils in the former mining area

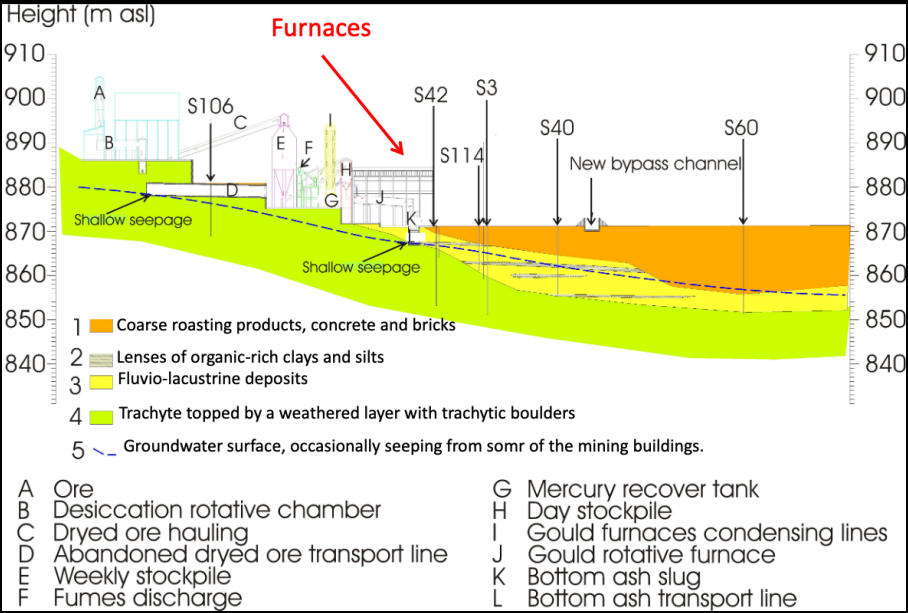
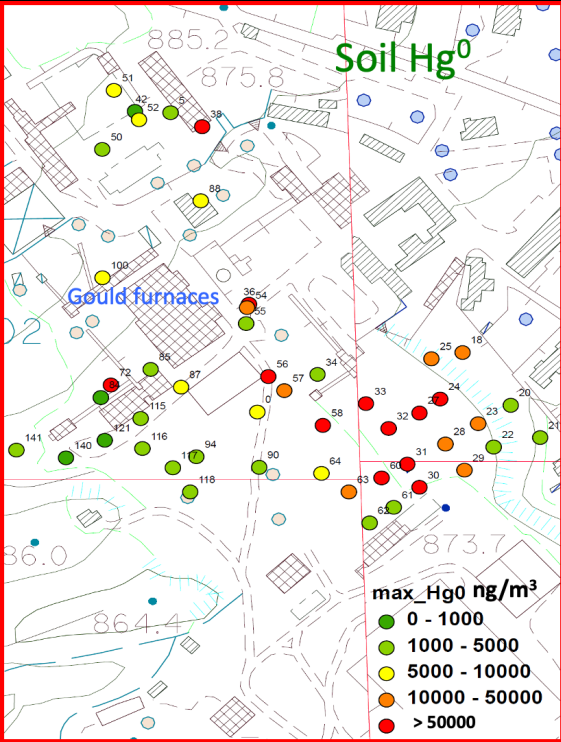


Up 7% of Hg_{tot} and up to 7,000 $\mu\text{g/L}$ of Hg_L

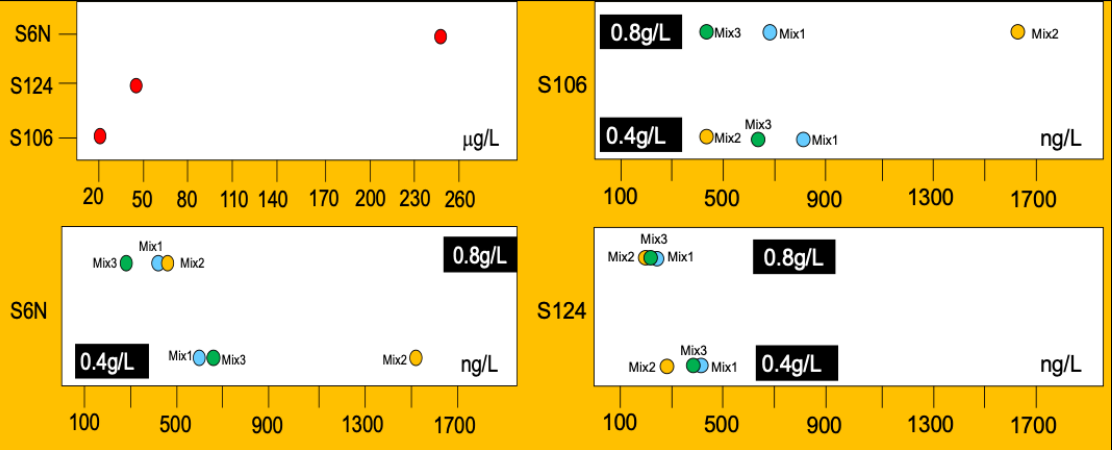
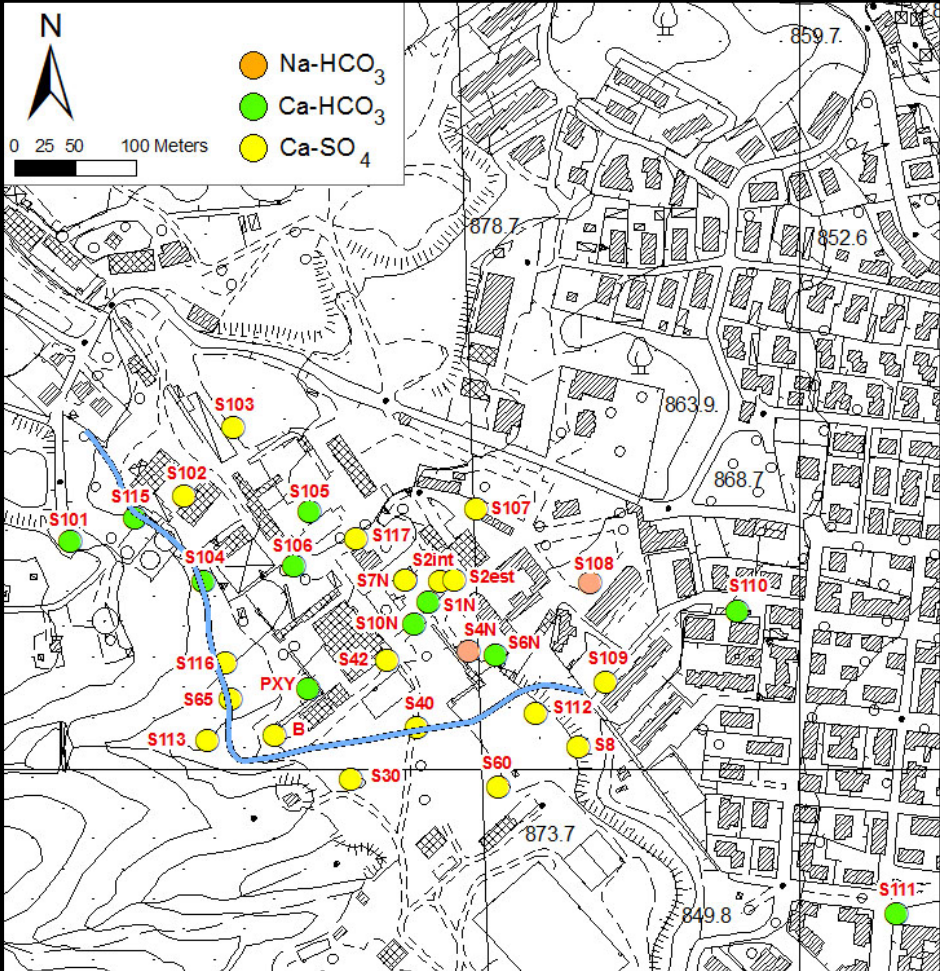
Total concentrations of Hg in the top-soils in front of the Gould furnaces. Soil leachates in the great majority of cases were $> 1 \mu\text{g/L}$.



Soils in the former mining area



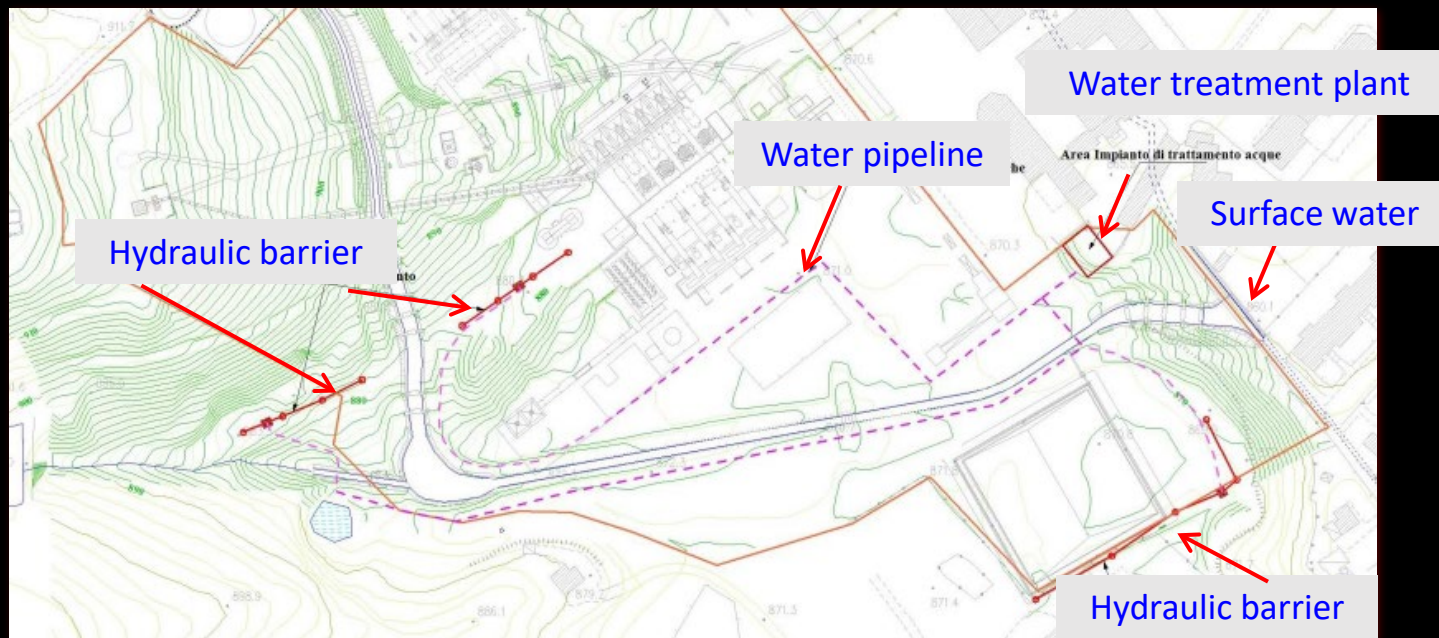
Dissolved Hg in the local groundwater system:
Filtered at 0.45 µm:
Up to 350 µg/L;
unfiltered:
>600 µg/L



Test Capterall for Solvay srl

Removal of dissolved Hg





Filtration and pumping units

Hydraulic barrier



Water treatment plant (Capterall)



Control unit



Discharge to surface water (<5 µg/L of dissolved Hg)



Piezometric level



Conclusions

- The most important remediation operations are going to be concluded at the beginning of 2025,
- The monitoring activity and the geochemical surveys have facilitated the remediation plans and favored most of interventions, also minimizing the financial impact,
- The open question is still related to the treatment of the surface and ground waters.

Thank you!

The Mercury Team

