Identification of the different sources of contaminants in the metal impacted Gromolo Torrent and related marine sediments

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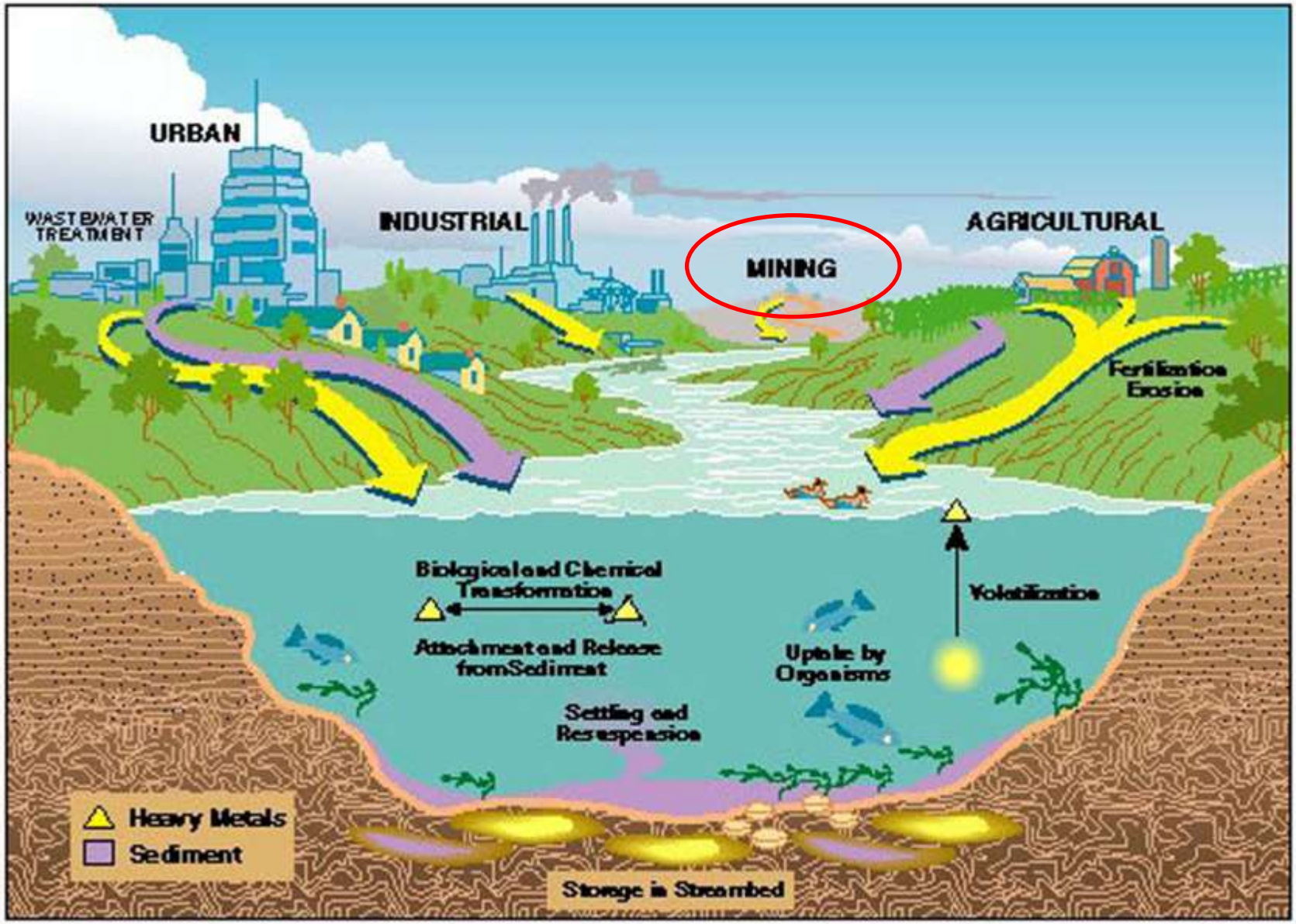
Sources of contaminated sediments



From **USGS**

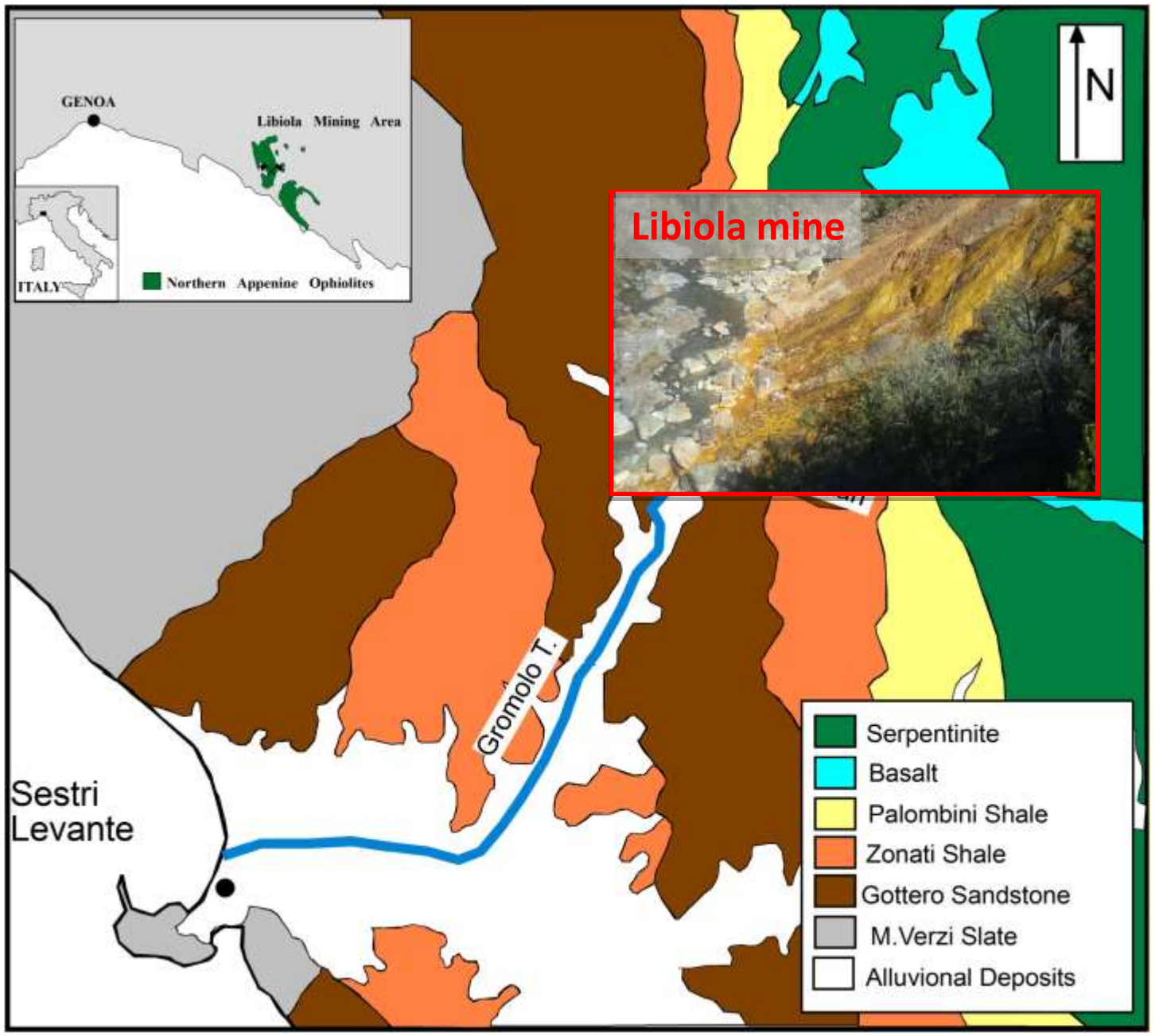
Study area: **Gromolo Torrent**

Gromolo Torrent catchment: 18 km^2

High mean steepness

First part of the basin is characterised by ophiolitic rocks, then sedimentary rocks, and finally the alluvial plain

In the upper part, the torrent drains the Libiola Cu mine



Acid Mine Drainage

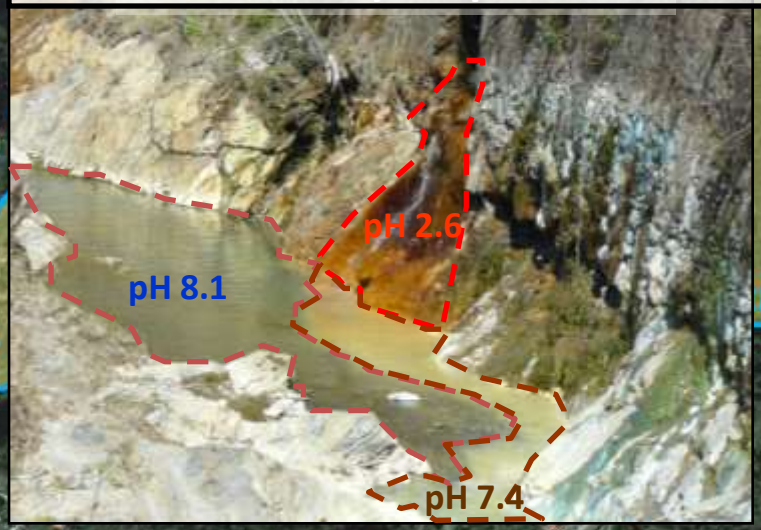
- Very acidic solutions with a high amount of dissolved metals
- Massive precipitation of nanocrystalline (colloidal) phases

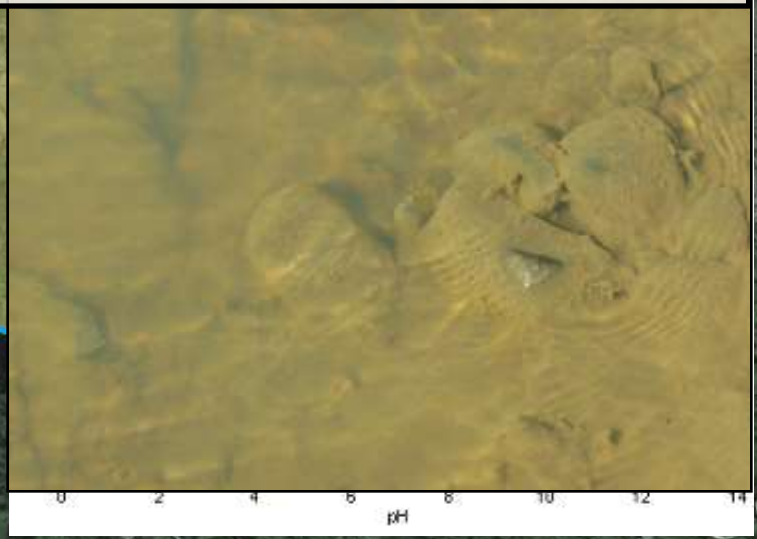
$$FeS_2 + 15/4O_2 + 7/2H_2O = Fe(OH)_3 + 2(SO_4)^{2-} + 4H^+$$




Aim of the work

- Study the dispersion of contaminants along the Gromolo Torrent
- Assess the results of the Gromolo Torrent on the marine sediments
- Identification of the source(s) of contaminants in the studied area





Sampling sites: Gromolo Torrent

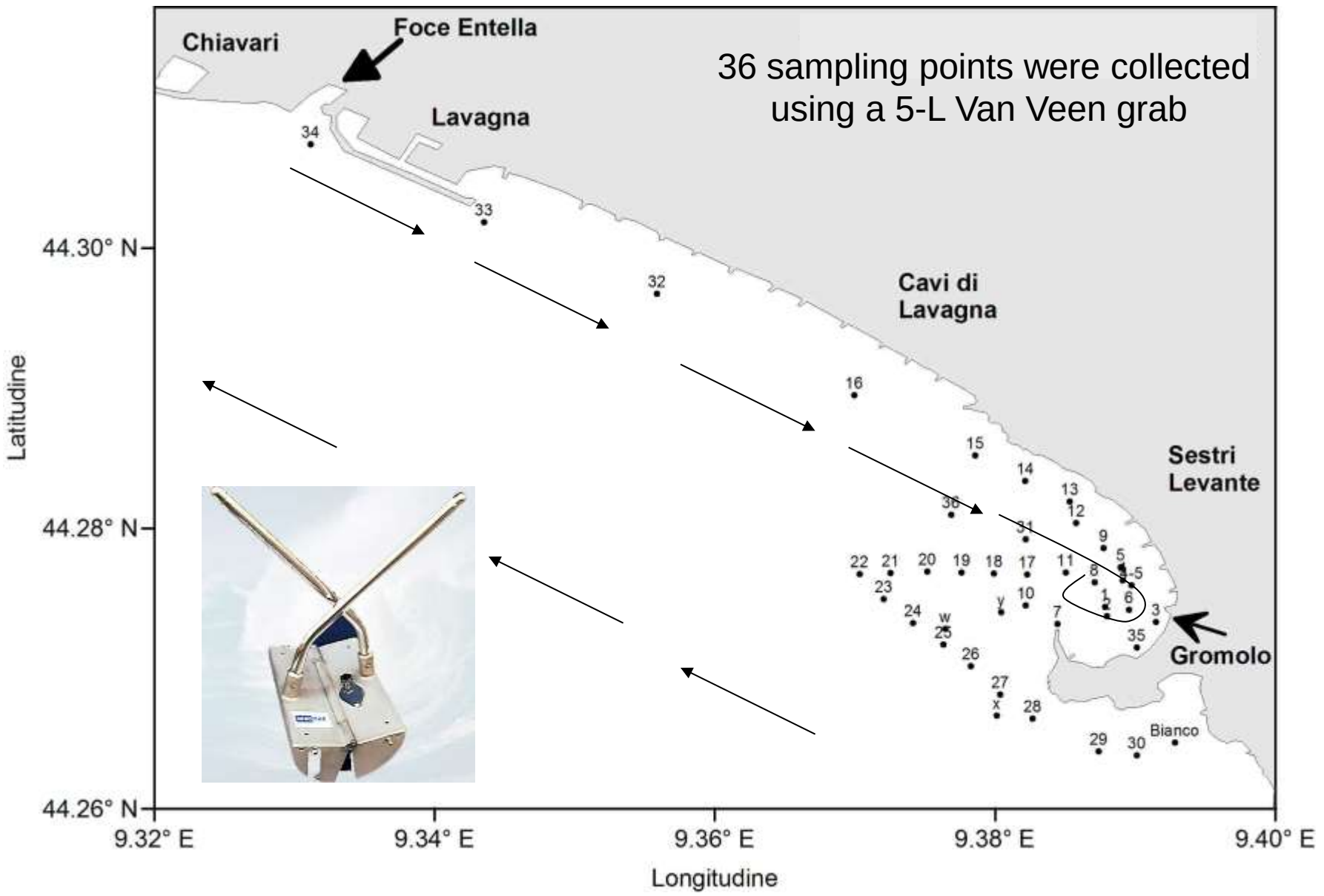
11 sites of superficial sediments
(depth < 2cm)

Marine environment

GRB
GR0
GR1
GR3
GR4
GR5
GR6
GR7
GR8
GR9
GR10
Gromolo Torrent

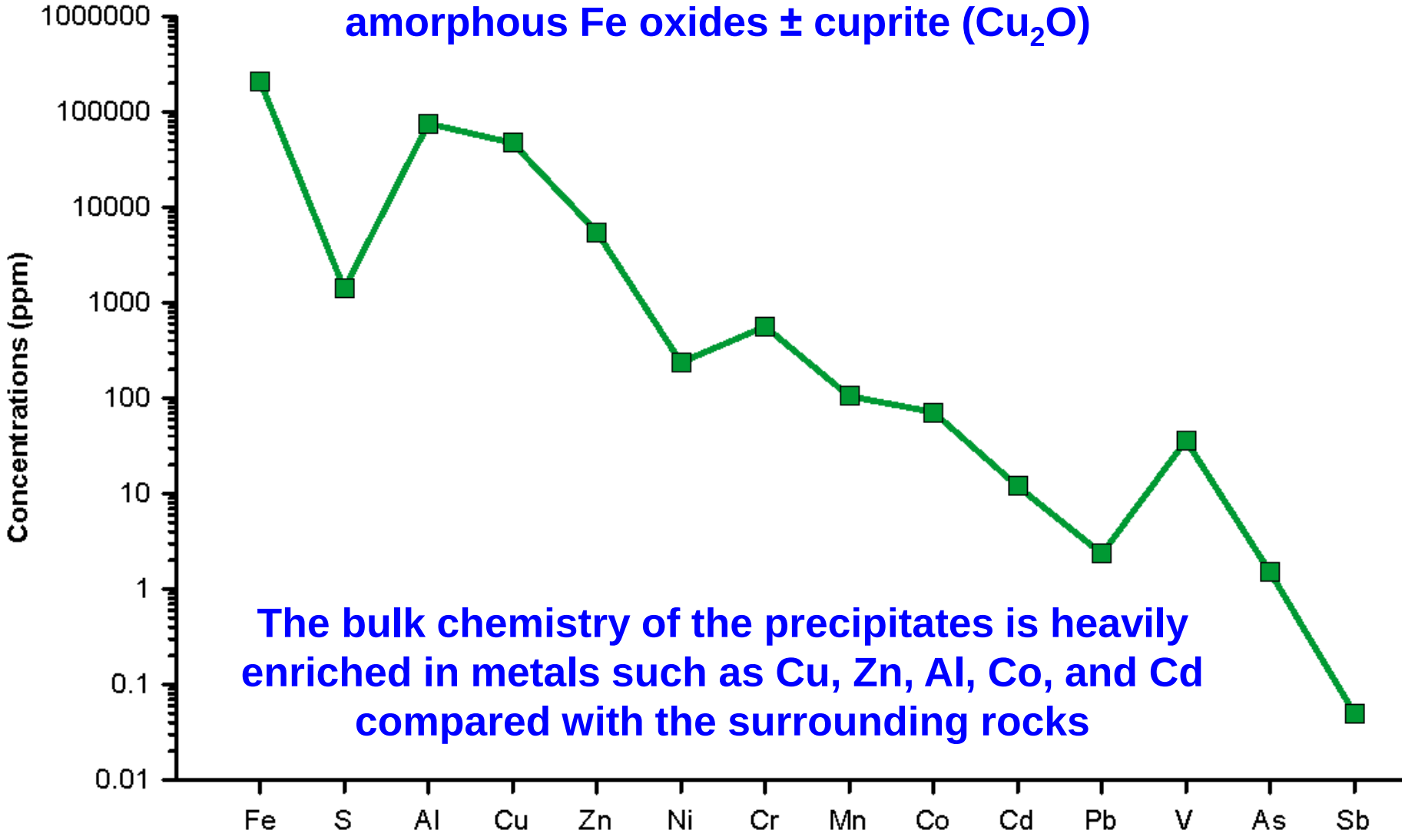
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2016 TerraMetrics

Sampling sites: marine sediments



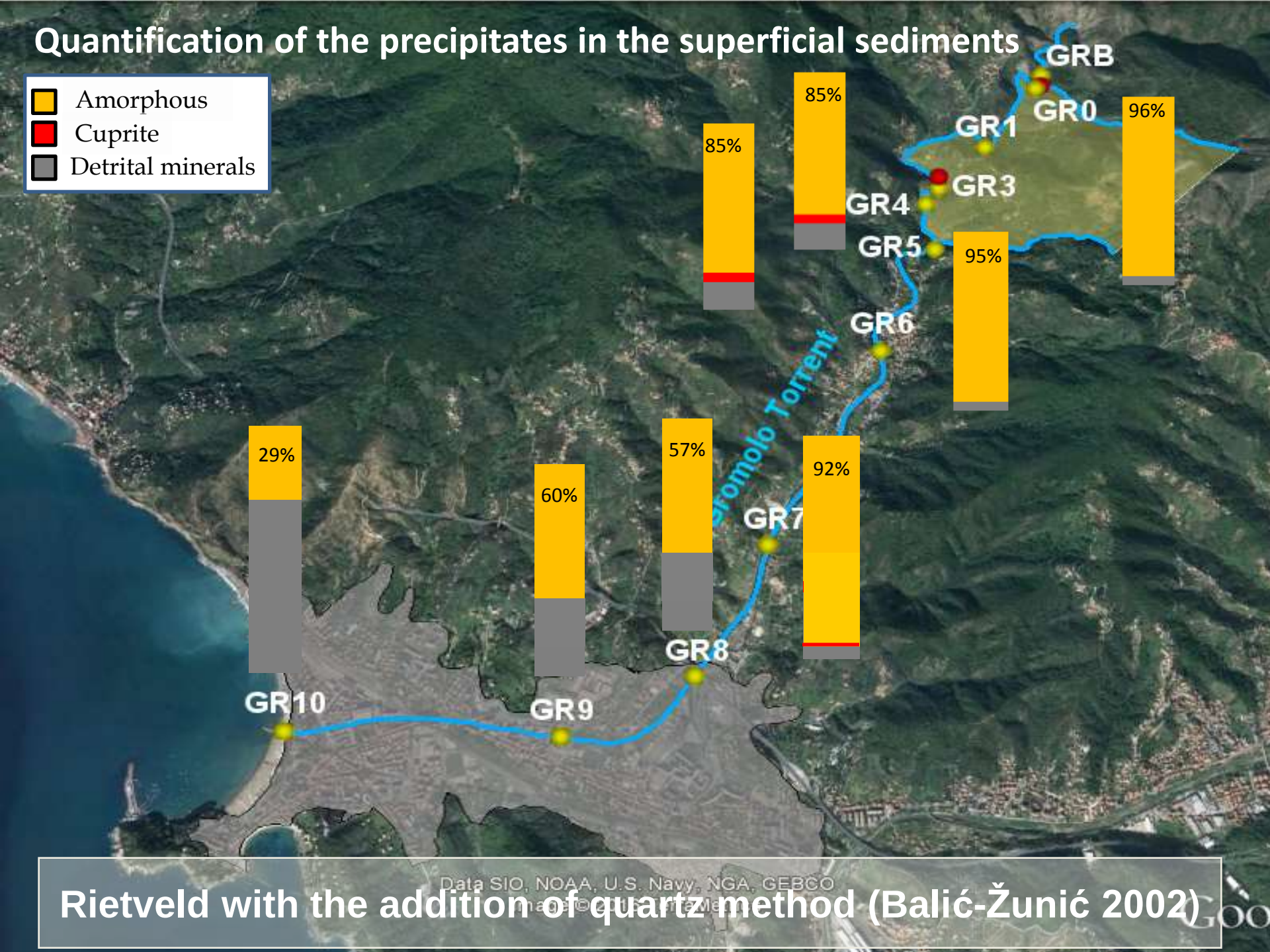
Mineralogical characterisation: Gromolo precipitates

The precipitates of the Gromolo Torrent are composed by amorphous Fe oxides ± cuprite (Cu_2O)



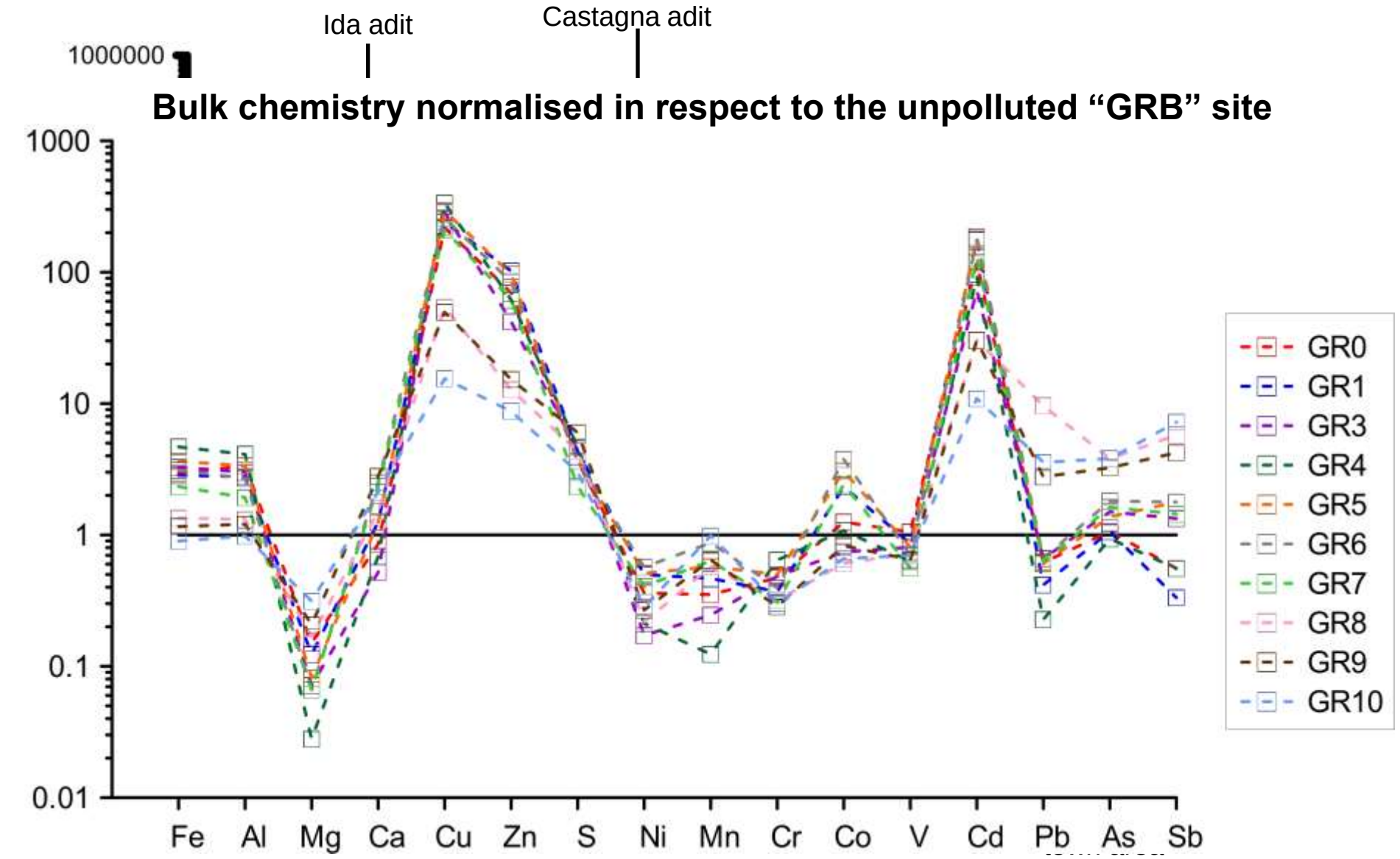
The bulk chemistry of the precipitates is heavily enriched in metals such as Cu, Zn, Al, Co, and Cd compared with the surrounding rocks

Quantification of the precipitates in the superficial sediments



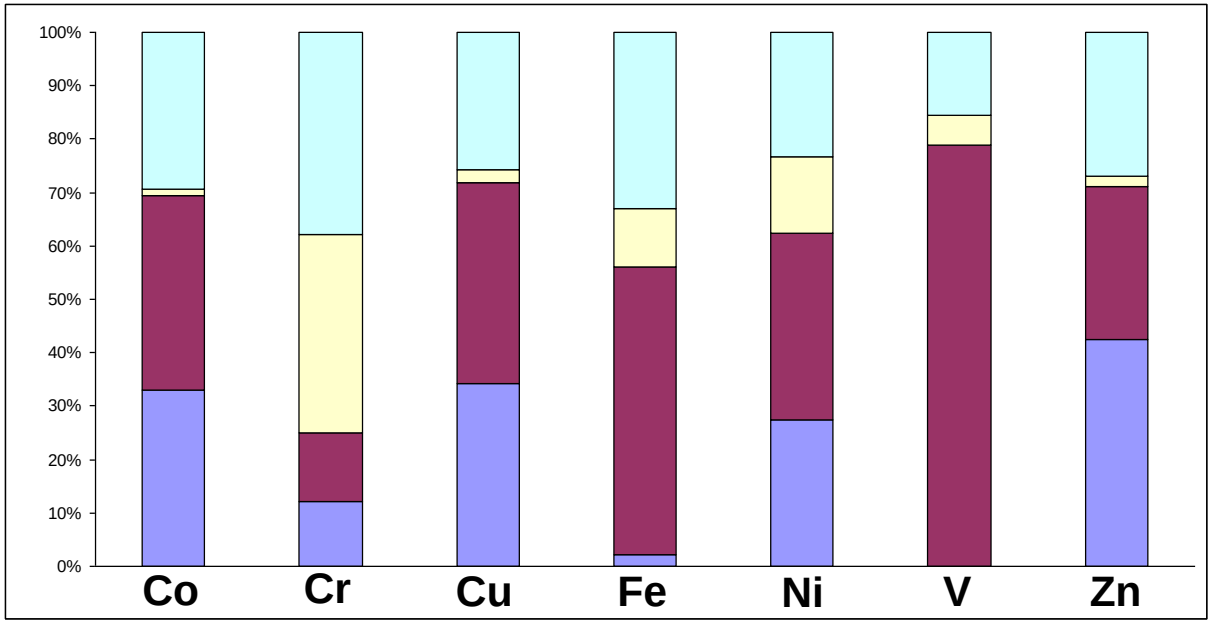
Rietveld with the addition of quartz method (Balić-Žunić 2002)

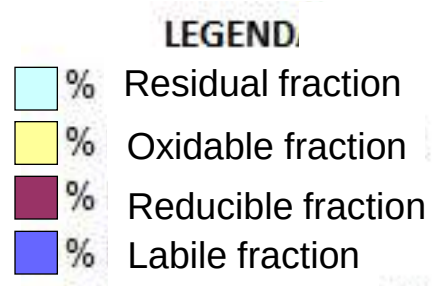
Dispersion of elements along the Gromolo Torrent

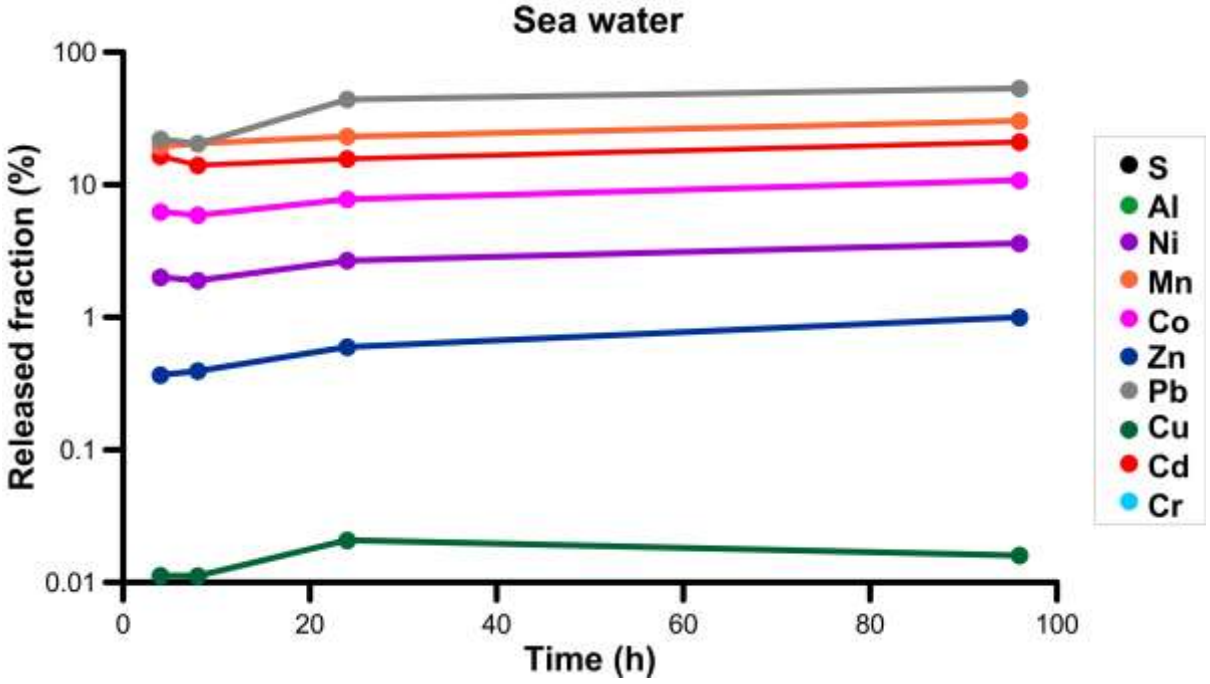


The effect of the precipitates on the bulk chemistry of the superficial sediments is evident: these phases control the dispersione of elements inside the basin

Metal Remobilisation potential from the sediments



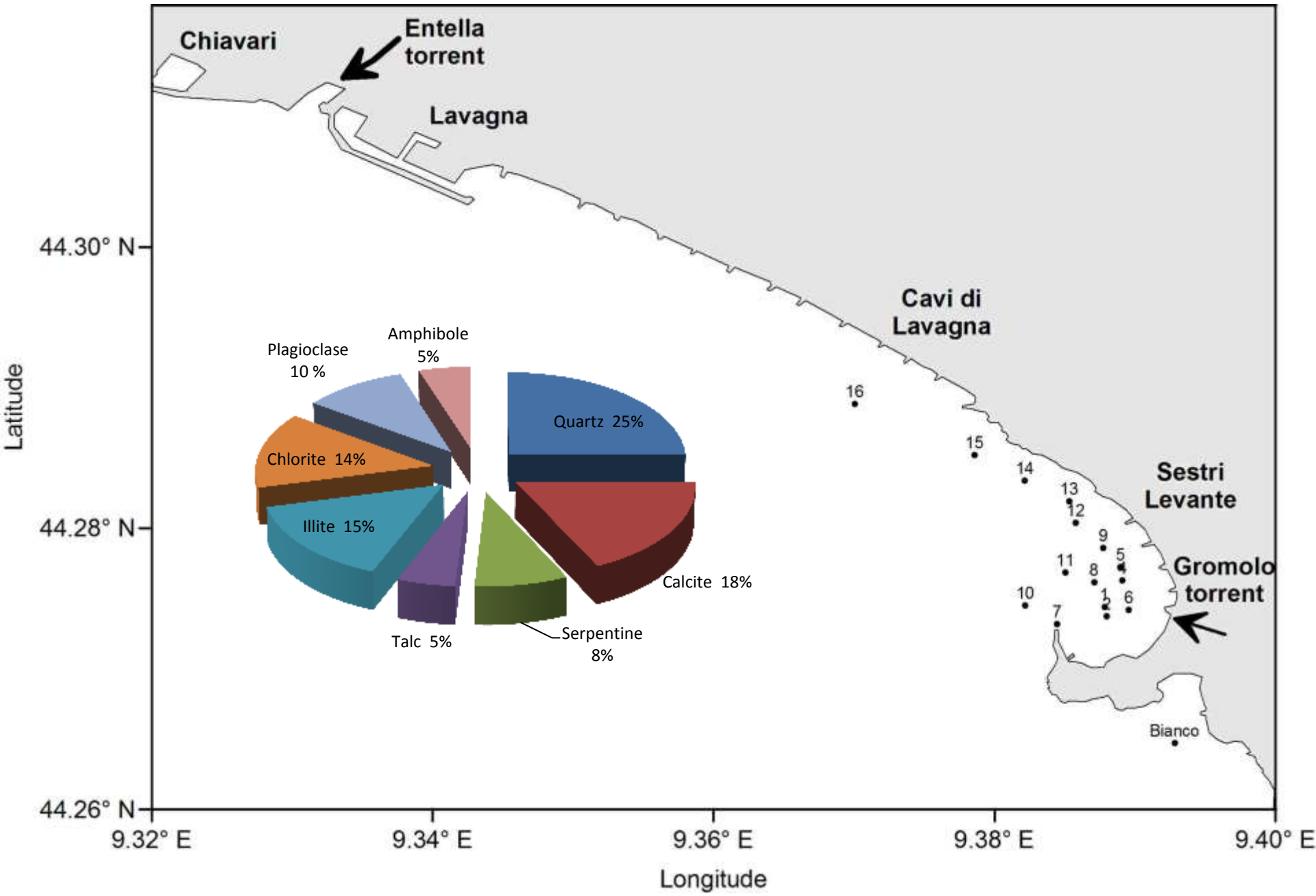




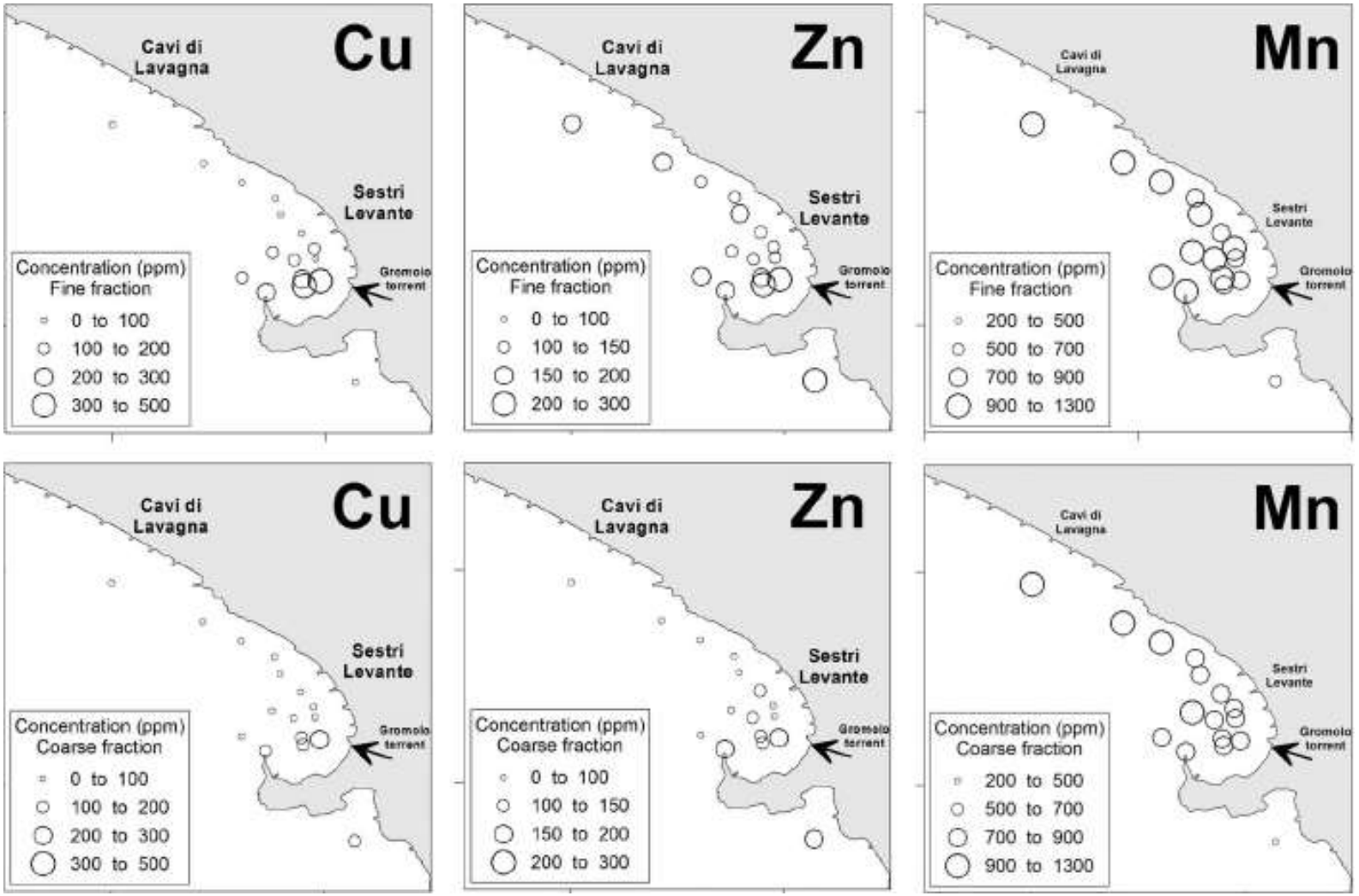
From BCR sequential extraction, high concentrations of elements are in the **labile fraction** or **incorporated inside the structure of the amorphous Fe oxides**. Organic matter also play a role.

Bulk Leaching tests with seawater showed that **important concentrations of some metals can be released in solution**

Mineralogical results of marine sediments

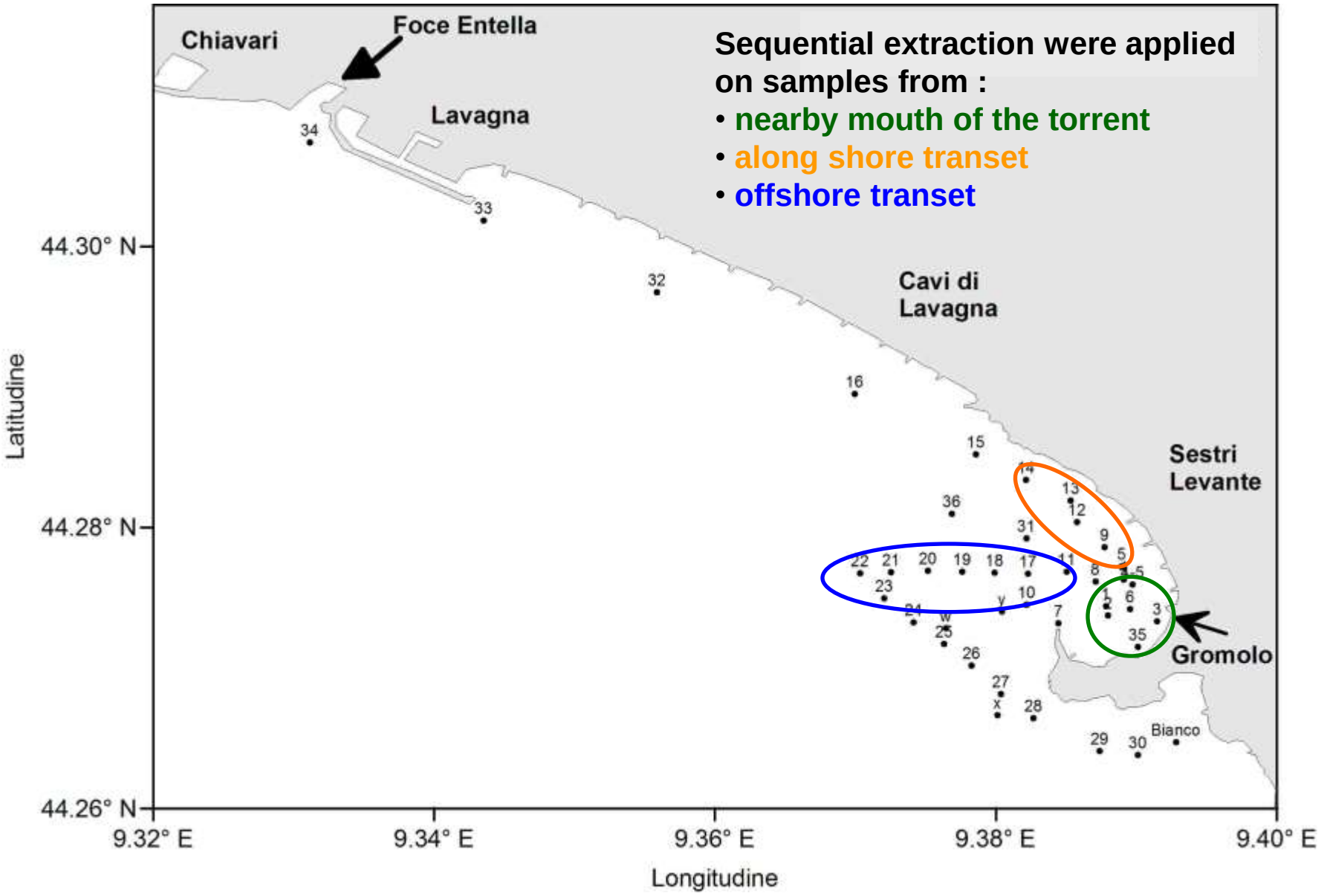


Metal concentration in the marine sediments



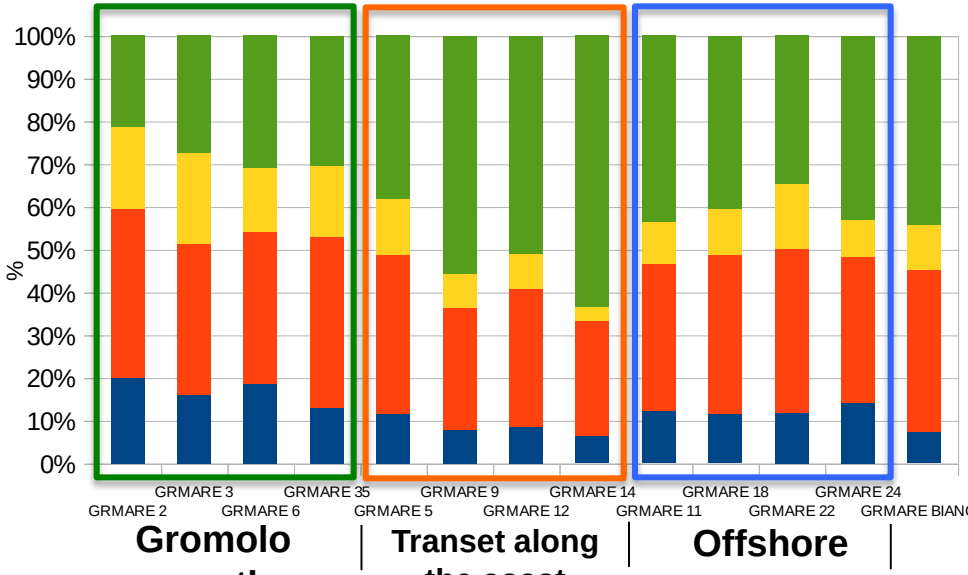
The input of the Gromolo Torrent has an impact on the concentration of elements such as Cu and Zn. On the contrary, the drift along the coast of materials from the Entella Torrent probably controls the distribution of Mn

Sequential extraction on marine sediments

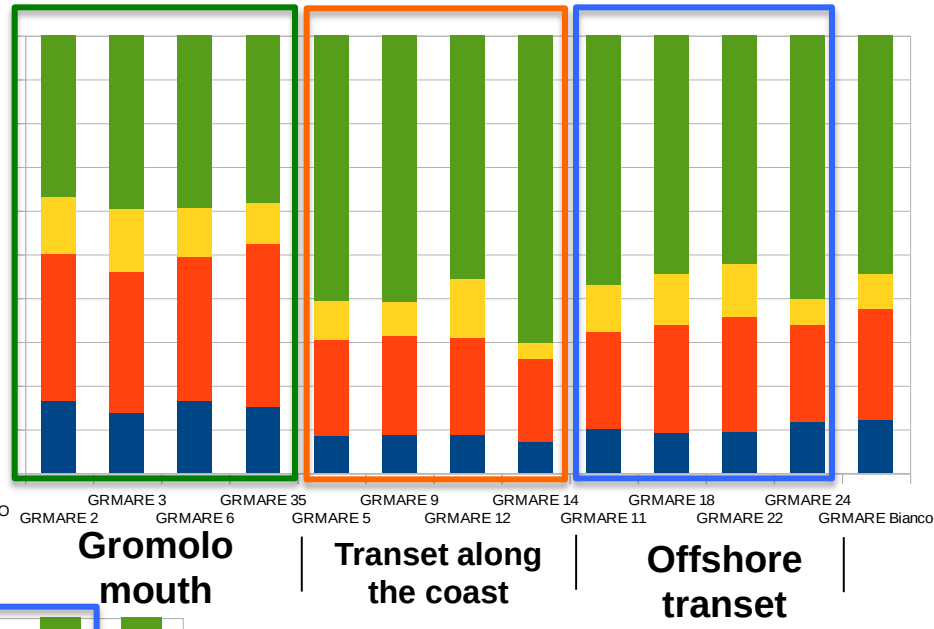


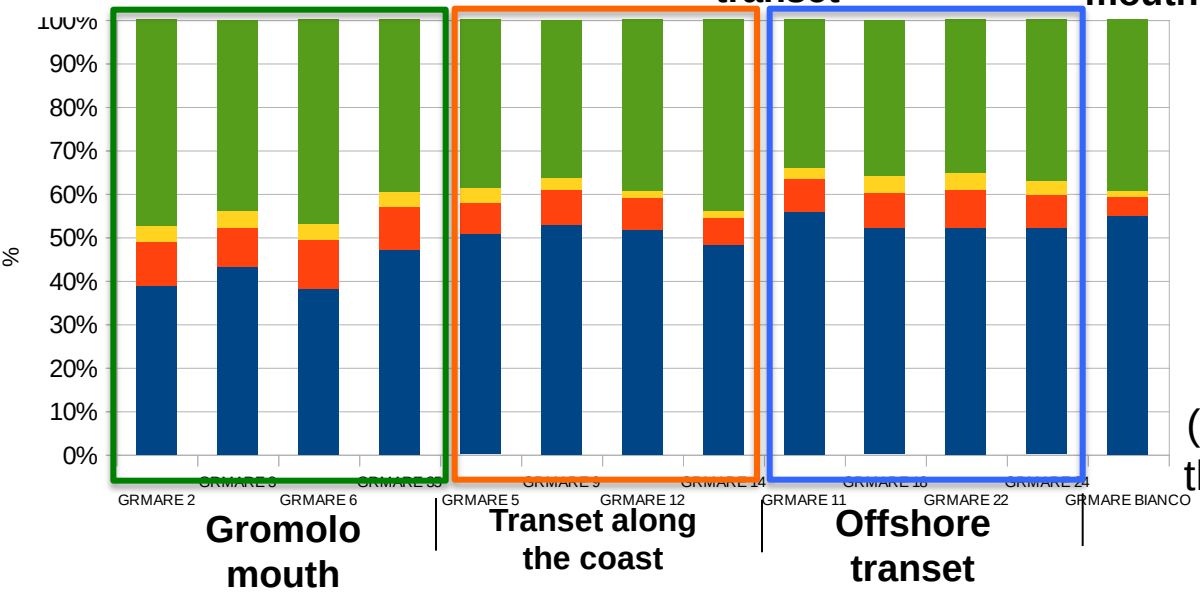
Sequential extraction results on marine sediments

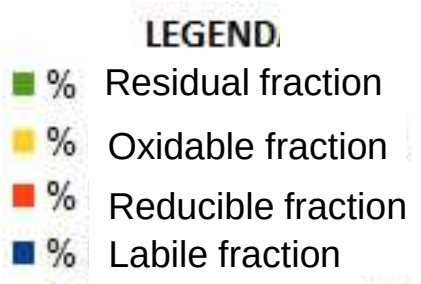
Cu: in front of the Gromolo Torrent mouth the labile fraction increases



Zn: in front of the Gromolo Torrent mouth the labile fraction increases







Mn: generally high in labile fraction (carbonates), tends to increase along the coast. Probably due to the Entella sediments input

Concluding remarks

- In the studied area, three different metal sources were identified. The main is the abandoned Cu mine of Libiola, the second is human activity, and finally the input of sediments from the Entella Torrent

- The amorphous precipitates are the main constituent of the Gromolo torrent superficial sediments and control the mobility of metals

- In marine sediments, the contribution of the Gromolo Torrent precipitates could still be detected. Currents play an important role in the distribution of metals

Thanks for your attention