

Environmental geochemical mapping of soils in the city of Huelva (SW Spain)

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Environmental geochemical mapping with GIS is becoming a very useful tool in the study of contaminated soils [1]. In this study 186 surface (1-10 cm) soil samples from the city of Huelva and the metropolitan area have collected and analyzed for mayor and trace elements. The city of Huelva is highly vulnerable from the environmental point of view [2] since it concentrates an intense agricultural and industrial activity, and it is also located at the confluence of the Tinto and Odiel rivers, one of the most polluted fluvial-estuarine systems in the world. The main objective of this work has been the determination of background and/or baseline [3] values to be used as reference. Table 1 shows calculated background values for Huelva area.

As	Cd	Co	Cr	Cu
63.71	0.85	13.57	50.33	391.65
Ni	Pb	Zn	Ag	Hg
22.84	154.52	321.01	0.44	0.51

Table 1: Background values (in ppm) for the study area.

Enrichment Factor (EF) maps of the analysed elements show high EF values for metals and metalloids such as Cu, Pb, As, Ag, Cd, Zn and Hg close to the areas where the industrial activity (main source of pollutants) has been developed. The analyzed elements have been classified in terms of their EF values as: (i) strongly enriched elements ($10 < EF < 100$): Cu and Hg; (ii) enriched elements ($2 < EF < 10$): Pb, Zn, Ag, As and Cd; and (iii) weakly enriched elements ($1 < EF < 2$) or depleted elements ($EF < 1$): Co, Cr and Ni. Huelva and its metropolitan area soils show high concentrations (EF values between 2 and 100) for many potentially harmful elements, of anthropic origin, which may represent a risk for the people living in this area.

[1] Cicchella *et al.* (2005) GEEA **5**, 29-40. [2] Aguilera *et al.* (2008) STOTEM **407**, 669-678. [3] Albanese *et al.* (2007) JGE **93**, 21- 34.

Accuracy and application of sulfur quantification in fluid inclusions by LA-ICPMS

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Sulfur quantification in fluid inclusions by Laser Ablation ICPMS has recently become possible, thanks to instrument optimisation and careful baseline definition [1]. For the further understanding of processes forming economic ore deposits, the investigation of fluids enclosed in minerals is a promising option. Sulfur plays an important role in metal transport and sulfide ore deposition [2], and the possibility to quantify this element in palaeofluids accurately and precisely is central to further improve our understanding of ore-forming hydrothermal processes.

To validate the method LA-ICPMS for sulfur quantification in fluid inclusions, synthetic inclusions were produced independently in two different laboratories and subsequently analyzed. First results show that the reproducibility is very similar to that found in a natural brine assemblage and is in the range of 35% relative standard deviation. However, it seems that during the experiment some sulfur loss from the fluid is possible, probably by precipitation of sulfides in the capsules, depending on the sulfur speciation and other elements present during the experiment.

The accuracy and reproducibility of sulfur and other elements in synthetic fluid inclusions measured by LA-ICPMS will be discussed. Different sulfur species as well as different concentrations were investigated. The analytical technique was used to determine the sulfur partitioning between brine and vapor inclusions from magmatic hydrothermal ore deposits. A recent study [3] analyzing cogenetic brine and vapor inclusions from magmatic-hydrothermal ore deposit show that sulfur is enriched in vapor-like fluids, correlates with copper concentrations and is always present in excess over ore metals.

[1] Guillong *et al.* (2008) *J. Anal. At. Spectrom.* **23**, 1581-1589. [2] Heinrich *et al.* (1999) *Geology* **27**, 8, 755-758 [3] Seo *et al.* (2009, in review) *EPSL*.