Dynamics of non-organic contaminants in meso-scale mountainous catchments

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Fine-grained sediments transported by rivers usually show increasing concentrations of contaminants and nutrients downstream, and there is thus an increasing awareness of the importance of non point-source pollution in fluvial systems. In mountainous basins, understanding the dynamics of the transport of sediment-related contaminants is necessary in order to select the optimum monitoring programme of the surface water quality.

This contribution reports some results of a case study located in a mountainous rural meso-scale catchment, with an area of 295 km^2, located in NE Portugal (the trans-boundary Douro river basin). The bedrock is composed of crystalline rocks; the land use is mainly forest and agriculture, with scattered urban settlements. The data discussed relate to the contents of selected metals in the fluvial sediments, which were sampled in two different periods of the hydrological year (high and low flow); the <63µm fraction was analysed to assess the potentially bioavailable elements. The established spatial trends are: a) Cu, Zn, Pb, Co and Mn are at anomalous levels in the samples from stations draining upstream agricultural areas; b) Cd occurs mainly in samples from stations draining areas with high urban pressure, where small agricultural fields intermix; c) Cu, Zn and Pb values reveal a general slight increase in these zones; d) As, Cr, Ni, and Fe present higher contents in the southern part of the basin, influenced by geological settings. A considerable proportion of these elements contents is found in the more labile fractions, which illustrate the important anthropogenic influence. Regarding bioavailability, the elements can be ordered by relative mobility: Cd>As>Co>Mn>Pb>Cu>Zn> Cr>Fe>Ni. The inter-site sampling variation of the relative contents of the metals is a response to the combination of geomorphology, rainfall events, use of river water for irrigation in summer time, and the consequent effect on streamflow regime at sampling site scale. The hydrodynamic regime controls the deposited sediment grain size, which in turns controls the distribution of mineral assemblages and metals associated with them.

Geochemistry of the Vila Nova granitic pluton (Central Portugal)

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The Vila Nova pluton is a small granitic pluton which occurs close to the contact between two major tectonoestratigraphic zones of the Iberian Massive, the Ossa-Morena Zone (OMZ) and the Central Iberian Zone (CIZ). The pluton intruded phyllites and metagraywackes of the Neoproterozoic-cambrian Beiras Group, which belong to the CIZ and originated a contact metamorphic aureole formed by micaschist with porphyroblasts in the outer zone and hornfelds in the inner zone. The pluton is affected by several minor shear zones and faults. The granitoid rock contains several small enclaves of surmicaceous composition which are enriched in andaluzite. It is a medium- to fine-grained rock and shows variable composition from tonalite to granite. The granitoid rock contains quartz, perthitic microcline, plagioclase, muscovite, biotite, apatite, zircon, monazite, rutile, pyrrhotite, ilmenite, pyrite and tourmaline. The alteration minerals are chlorite and muscovite. The textures are mainly magmatic except were the granite is affected by shear and the post-crystallization deformation originates kink-bands in the micas and in the plagioclase, mica-fish textures, very fine polygonal granoblastic texture in quartz, lamellas and deformation bands in quartz and K-feldspar.

The granitoid is enriched in muscovite (up to 12%), and its ACNK ranges from 1.31 to 1.69 so it can be classified as an S-type granite. It is also classified as a magnesian, calc-alkaline to alkaline-calcic granite. The ORG normalized pattern is crust-dominated with positive Rb, Th, Ce, Sm anomalies and its normalized primordial mantle pattern shows positive anomalies for K, U, Th and negative anomalies for Ba, Ta, Nb, Sr and Ti, characteristic of granites related to subduction.

The variation diagrams show regular trends with a decrease in TiO_2, Al_2O_3, FeO, MgO, Ba, Sc, V, Cr, Ni, Nb, Zr, Hf and □REE with the increase in SiO_2, while K_2O, Rb show segmented trends and CaO, Sr and Cs don't show any trend, which can be due to the hydrothermal alteration.

The REE patterns show a moderate negative Eu anomaly (0.47-0.77), a moderate fractionation of REE (La/Lu_N =7.04-9.65) and ΣREE varies from 126.84 to 179.61 ppm.