4.7.P06

Stream sediments geochemical mapping as a tool for wide scale Risk Assessment in Portugal

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Environmental Risk Assessment in Portugal was only treated academically until very recently. As a consequence, landfill sites and waste storage facilities were inadequately managed and inappropriate land use decisions were made. EC Directives led to the application of risk assessment methodologies by state institutions responsible for implementation and management of infrastructures that could pose hazards to the population. Geochemical baseline mapping is still neglected in Risk Assessments by decision makers, and this study was undertaken to demonstrate how geochemistry can be an important tool.

The methodology consists of the identification of DPSIR indicators (EEA definition for indicators) and their application to Risk Assessments. The first step was to build risk maps from factor maps using several parameters. These factor maps integrate indicators such as landuse (CORINE), geology, Quaternary lithologies, precipitation, temperature, abandoned mining sites, urban centres, number of water systems per municipality, stream sediment baseline geochemistry, and also GIS derived layers, such as slope (%) and flow accumulation.

Vulnerability is normally assessed in the context of humans [2] and in this case, vulnerability was estimated from both population density and number of inhabitants/water system. “Stream sediment metal contamination” was considered the hazard and both vulnerability factors were weighted 25%. The remaining 50% was distributed in different ways to test the influence of geochemistry. The absence of geochemistry was also tested.

Stream sediment geochemistry, identified as a state indicator, was used as a Geoaccumulation Index [1]. The results identify areas where potentially hazardous metals are already present at high levels in the catchment area, and the influence of their presence in the overall Risk Assessment. This is very important as when potentially hazardous metals have not yet reached critical values further contamination can be prevented by decision makers recognizing the importance of this and taking appropriate response measures.

References

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4.7.P07

Stream sediment geochemical survey across MCT zone in Garhwal Himalaya: Prospects for uranium and thorium mineralization

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Deformed, metamorphosed and sheared rocks characterize the Higher Himalayan terrain. These rocks are more intensely mylonitized in the proximity of major thrusts forming a zone referred to as the Main Central Thrust (MCT) zone. These rocks are sandwiched between two major thrusts called the Jutogh and Vaikrita Thrusts, in the south and north respectively. The exposed width of this formation (Munsiari or Baijnath crystallines) ranges from few kilometres to as thick as about 35 km and is extensively deformed and mylonitized. Thus, it provides a unique opportunity to study the trace elemental signatures as revealed by geochemical maps based on stream sediment sampling and analysis.

It was noted that U and Th are anomalously high in these zones, whereas Cu and Ni are relatively depleted. This behaviour is almost consistent through out the MCT zone in the studied area. The median values for U and Th in 67 low order stream sediment samples collected across the MCT zone are 5 and 19 ppm, respectively. A sizeable number of these samples show abnormally high values, up to 34 ppm U and 135 ppm Th, indicating the potential for mineralization. The correlation of U and Th with Zr is feeble and thus the high values of U and Th may not be controlled by the abundance of zircon alone. The Pb values are also moderately high in these samples. In fact, there are earlier reports of U mineralization at two locations, both at the tip of the Jutogh thrust. Exploration activities at these sites revealed the presence of radioactive ore minerals in minor veins, but they were not found to be economically viable. These locations are clearly identified by anomalous values in the present geochemical maps. However, some anomalies elsewhere are more intense, particularly near Sainj in Bhagirathi Valley, where U and Th as well as Pb show strongly anomalous levels. Thus the present investigation provides an sound basis for selecting areas for detailed mineral exploration.

Granitoids are the major protolith to these mylonitized rocks that are naturally enriched in radioactive elements. The reason for such high U and Th abundances in shear zones is not clear. However, recent studies indicate the crucial role of fluids in mobilizing these elements during shearing. The U and Th in fluid phases being subsequently precipitated in veins within, or in the proximity of, the MCT zone.