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The mobility of lead and other trace elements from soils to sediments from the Iberian Pyrite Belt region into the atlantic ocean

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An environmental study was conducted in 166 stream and 12 estuary sediments and 355 soils samples collected in the Guadiana River Basin in order to evaluate the trace elements transfer from one compartment into another. The dispersion of Pb, Cu, Zn and other chemical elements in the lower N-S sector of Guadiana River Basin until the Atlantic Ocean was also studied. The area partly includes the Iberian Pyrite Belt, a known base metals province which presents an important historic mining activity. The mobility of solid phases from soils to sediments depends on the physiographic characteristics of the basin, such as slope, and land use and vegetation cover. These factors are very heterogeneous in the lower sector of Guadiana River Basin. Dams and small reservoirs play an important role in preventing the downstream movement of sediments and, in the study area; there are several dams from more than 60000 square kilometers of area until small reservoirs of less than 5 square kilometers wide. Median and arithmetic mean concentrations of Pb, Cu and Zn of stream sediments are, in general, greater (median values: 27 mg Pb kg-1; 33 mg Cu kg-1and 75 mg Zn kg-1) than in the soils (median values: 25 mg Pb kg-1, 28 mg Cu kg-1 and 66 mg Zn kg-1) in the all set of samples. However, lead concentrations are greatest in stream sediments near S. Domingos mine, in Portugal, and Las Herrerias, in Spain, which show the chemical element dispersion with a local effect. The lithological variation in the upstream area is reflected, in general, in the patterns of soils and sediments in a similar way. Near the river mouth the largest Pb concentrations in sediments may result from upstream transport added to the precipitation of the chemical element as solid phases. This process occurred when saline and fresh waters interact, along with sedimentation regimes due to the tidal environment. Soils collected near the river mouth may be alluvial and so, not very different from the sediments, which have again largest Pb concentrations because of the intense Human activities that occur in this region. These activities, in this area, are clearly different from mining, and then different Pb origins were observed. The present study shows the different trace elements mobility factors and conditions, including the differences in the mobility observed between chemical elements in the same sub-catchments conditions, using GIS tools. These methodologies were applied recurring to geological and mining activity information.