

# The impacts of Sn-W, Ba-Pb-Zn and W-Au-Sb old mine workings on the environment at central Portugal

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At Segura, granitic pegmatite veins with cassiterite and lepidolite, hydrothermal Sn-W quartz veins and Ba-Pb-Zn quartz veins intruded the Cambrian schist-metagraywacke complex and Variscan granites. They were exploited for Sn, W, Ba and Pb until 1953. At Sarzedas, W-Au-Sb quartz veins and Sb-Au felsitic dikes intersect the complex and were exploited for W, Au and Sb until 1951. Tin, W, B, As and Cu anomalies in soils and stream sediments from Segura are related to Sn-W quartz veins, whereas Ba, Pb and Zn anomalies in soils and stream sediments from this area are associated with Ba-Pb-Zn quartz veins. At Sarzedas, Sn, W, As and Sb anomalies in soils and W, Pb and Sb anomalies in stream sediments are associated with W-Au-Sb quartz veins and Sb-Au felsitic dikes. The contents of trace elements decrease from soils to stream sediments and waters, due to their relatively low mobility. Soils from Sarzedas must not be used for agriculture, human residence, commerce and industry due to their high Sn, As and Sb contents, whereas soils from Segura should not be used for agriculture and human residence due to their high Sn, B, As and Ba contents and industry due to the high As content. Among these trace elements, the most abundant in soils and stream sediments are Sb at Sarzedas and Ba at Segura. There is no significant acid drainage associated with old mine workings in both areas due to neutralization of acid waters, attributed to marble intercalations in the schist-metagraywacke complex and also siderite in the mineralized veins and dikes from Sarzedas. At Segura, waters associated with Sn-W quartz veins and As anomalies in soils are the richest in As, whereas the waters related to the Ba-Pb-Zn quartz veins are the richest in Fe and Mn. These waters from Segura should not be used for human consumption and agriculture due to their high As, Fe and Mn contents, whereas waters related to W-Au-Sb quartz veins and Sb-Au felsitic dikes from Sarzedas must not be used for human consumption due to their high Fe, Mn and Sb contents. Arsenic, Fe and Mn reach higher contents in waters from Segura than in those from Sarzedas. The W-Au-Sb and Sb-Au old mine workings caused higher impacts on soils and stream sediments, but lower impacts on waters than Sn-W and Ba-Pb-Zn old mine activities.