



Regional soil geochemistry in the Ojailén Valley: a realm dominated by the industrial and mining city of Puertollano (South Central Spain)

Miguel López-Berdonces, Sergio Fernandez-Calderón, Pablo Higuera, Jose María Esbrí, Beatriz Gonzalez-Corrochano, Eva M^a García-Noguero, Alba Martínez-Coronado, and Carolina García-Noguero
IGEA, Instituto de Geología Aplicada, Universidad Castilla la Mancha, Almadén, Spain (miguelangel.lopez@uclm.es)

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Authors: Miguel A. López-Berdonces¹; Sergio Fernández Calderón¹; Pablo Higuera¹; José María Esbrí¹; Beatriz González-Corrochano¹; Eva M^a García-Noguero¹; Alba Martínez-Coronado¹; Carolina García Noguero¹

¹Instituto de Geología Aplicada, Universidad de Castilla La Mancha, Almadén 13400 (Spain).

Ojailén Valley is situated in South Central of Spain, an area where livestock, agriculture, mining and industry coexist. This work tries to assess the relationships between these activities and local environmental compartments: water, soils and heavy metal contents, and establish the most appropriate methodology of sample treatment and analytical techniques that can be employed on this kind of studies.

For soil geochemistry, 152 samples were taken at two different depths, one at surface layer and another at 20 cm depth, and establish relationships between them and the possible sources. For this purpose, we determine soil parameters (pH, conductivity and organic matter) and total metal contents by Energy Dispersion of X Ray Fluorescence (EDXRF). Samples with higher nickel contents were analyzed with Inductive Coupled Plasma Spectroscopy (ICP-OES) after acid digestion. The study of surface waters includes 18 samples along the river and tributaries near mining and industrial areas. Water analysis was performed by ICP-OES.

Soil samples shows pH between 6 and 8.5, highest located near on the east part of the valley, in the vicinity of petrochemical complex. Conductivity values show higher levels ($1600 \mu\text{S cm}^{-1}$) in the vicinity of Puertollano and the industrial sites.

Local reference value (LRV) for contaminated soils were determined according to the methodology proposed by Jimenez-Ballesta et al. (2010), using the equation: $\text{LRV} = \text{GM} + 2\text{SD}$, where LRV: Local Reference Value, GM: Geometric Mean, SD: Standard Deviation. Trace metals values are significantly higher than calculated LRV, especially for Zn, Pb, (Average content: 230 mg kg^{-1} and 249.9 mg kg^{-1} respectively), probable due to Pb-Zn mining in the nearest Alcudia valley. Other elements seem to be influenced by petrochemical industry (Ni, V, and Cu) with LRV: 199.9 mg kg^{-1} , 39.2 mg kg^{-1} and 184.2 mg kg^{-1} respectively.

Most water samples have metal contents higher than levels for drinking water (WHO, 2006), especially Fe and Pb with $20 \mu\text{g l}^{-1}$ and $10 \mu\text{g l}^{-1}$ respectively. Higher metal contents were located on three different sites: downstream an open-pit coal mine, in stagnant water where we can find an old sewage treatment plant, and downstream a photovoltaic plant built in 2008. We can consider that Ojailén Valley is not an area with high contents in heavy metals in the environment, but Puertollano and its petrochemical complex have contents in Pb, Zn, Cu, As, Ni above the LRV. A comparison of results obtained by ICP-MS and XRF related to Pb, Zn, Cr, Ni in thirty-four selected samples, we can conclude that both techniques are qualitatively agree, although XRF cannot be considered suitable for establishing reference legal limits.

References

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