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Resistivity profiling to locate an infiltration area and the possible recovery of the dried Andara lake (Picos de Europa National Park, Spain)

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The Ándara Lake constituted the third mass of water by extension (approximately 19000 m2) within the calcareous Picos de Europa Massif in NW Spain, but only a small pond remains today (about 1250 m2). The lake developed in a former glacial valley and its sudden draining occurred in the second decade of the 20th century, during the development of underground Pb-Zn mining, between 1889 and 1929, in the vicinity. Old mining maps show that there were shallow galleries active below the bottom of the ancient lake. The present study was requested by the Picos de Europa National Park Administration (Spanish Ministry of Environment) with the purpose of: i) localizing the areas of water infiltration and ii) establishing the cause of the draining, specially its possible relation with the mining activity in the surroundings. With this aim a geological study of the substrate of the lake was made, followed by a series of electrical resistivity profiles.

Three resistivity parallel profiles were recorded along the axis of the dried lake on the 29th July. Each profile included 56 electrodes with 5 m spacing for a total profile length of 275 m. Data was recorded in both dipole-dipole and Schlumberger array configuration. The western profile had been recorded earlier in the summer (30th June) and was also repeated towards the end of the season (3rd September) in order to evaluate the evolution of the infiltrations. The results showed two areas of infiltration to the NE and SW of the present-day pond. Both of them cut across the underlying carboniferous limestone. However. the southwestern anomaly does not reach the surface and may be related with water flowing in karstic conduits in the limestone. The northeastern one reached the surface and the anomaly decreased as the pond dried during the summer allowing us to interpret it as the main area of infiltration. This area coincides with the intersection of two seams exploited both on the surface and by underground mining. This corroborates the relationship between the water disappearance and the mining activities, which is an indispensable condition for the National Park management to consider taking any future actions aimed to a possible recovery of the original water mass.