Multi-seismic imaging: Development of geological and geophysical models of the subsurface in the Iberian Pyrite Belt (SW-Iberia)

Ramon Carbonell¹, Handoyo Handoyo², Yesenia Martinez³, David Martí⁴, Juan Alcalde¹, Mario Ruiz¹, Puy Ayarza³, and Fernando Tornos⁵

¹Geosciences Barcelona, (Geo3BCN-CSIC) Spain (ramon.carbonell@csic.es)
²University of Barcelona, Spain
³Universidad de Salamanca, Salamanca, Spain
⁴Lithica S.L., Barcelona, Spain
⁵CSIC-IGEO, Inst. Geociencias Madrid, Spain

Control and natural source seismic reflection records were acquired in the early fall in 2018 in the Sotiel-Elvira mining prospect, as part of the SIT4ME project (funded by EIT RawMaterials). Over 700 seismic digital instruments were deployed in a pseudo-3D grid to register these seismic signals in order to image and characterize the subsurface of the study area. The 2- and 3-component instruments used recorded wide azimuth and relatively long offset data. A 32 Tn Vibroseis truck was used in 900 vibration points to complete the controlled source component of the experiment. The array of receivers (deployed within a grid of 10x10m) recorded P- and S- waves and allowed to develop seismic velocity models derived from first arrival travel time tomography and multichannel analysis of surface waves (MASW). Results are further constrained by density measurements of rock samples and surface geology. The integrated information places structural constrains in the subsurface and allows us to depict areas where higher than average P and S wave velocities, characteristic of massive sulphides, might point out to the existence of new or better delimited deposits within the Iberian Pyrite Belt (SW-Iberia). The area is under assessment for potential future exploitation. This experiment further demonstrates the potential of non-invasive and relatively inexpensive seismic techniques to address high-resolution imaging of mineralized areas.