Active and passive-source seismic imaging for exploration of deep-seated massive sulphide mineralization in the Zinkgruvan mine, south-central Sweden

Alba Gil de la Iglesia (1), Alireza Malehmir (1), Björn Lund (1), Bojan Brodic (1), Stefan Buske (2), Ramon Carbonell (3), Juan Alcalde (3), Dirk Orlowsky (4), Louise Lindskog (5), Anja Hagerud (5), and Matthew Penney (6)

(1) Department of Earth Sciences, Uppsala University, Sweden (alba.gil@geo.uu.se), (2) Technische Universität Bergakademie Freiberg, Germany, (3) Department of Structure and Dynamics of the Earth, Institute of Earth Sciences Jaume Almera, ICTJA-CSIC, Spain, (4) DMT GmbH & Co, Germany, (5) Zinkgruvan Mining AB, Sweden, (6) Lundin Mining Corporation, Canada

Population growth, together with overall improvement of life standards, greater level of environmental awareness and energy transition towards green technologies, result in globally increasing demand for mineral resources on a yearly basis. Considering that most of the shallow large-scale deposits have likely already been explored and mined out (or are being mined), there is a great interest to explore for deeper-seated deposits. For this purpose, the SIT4ME project, through EIT Raw Material Program was established, aiming to promote, improve and further establish seismic methods for mineral exploration in hard rock environments.

In November 2018, a multi-method seismic dataset was acquired in the Zinkgruvan mining area in the Bergslagen mineral province of Sweden. Both active (32t seismic vibrator truck as source) and passive data were acquired using a combination of sparse 3D grid and dense 2D profiles in an area of approximately 6 km2 enabling reasonable 3D subsurface illumination. For the data acquisition, a total of 1300 receivers were used across the study area, distributed along ten 2D-crooked-seismic lines and in a 3D mesh. This provided us with a comprehensive dataset, which would be used for a multitude of processing and imaging approaches. The objectives are to image any deep (> 500 m depth) massive sulphide mineralization and structures hosting them within this complex three-dimensionally deformed hard rock setting. Here, we present the acquisition setup, preliminary reflection seismic processing results obtained from active part of the dataset.