



3&4D Geomodeling Applied to Mineral Resources Exploration - A New Tool for Targeting Deposits.

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3 & 4D geomodeling, a computer method for reconstituting the past deformation history of geological formations, has been used in oil and gas exploration for more than a decade for reconstituting fluid migration. It begins nowadays to be applied for exploring with new eyes old mature mining fields and new prospects. We describe shortly the 3&4D geomodeling basic notions, concepts, and methodology when applied to mineral resources assessment and modeling ore deposits, pointing out the advantages, recommendations and limitations, together with new challenges they rise. Several 3D GeoModels of mining explorations selected across Europe will be presented as illustrative case studies which have been achieved during the EU FP7 ProMine research project. It includes: (i) the Cu-Au porphyry deposits in the Hellenic Belt (Greece); (ii) the VMS in the Iberian Pyrite Belt including the Neves Corvo deposit (Portugal) and (iii) the sediment-hosted polymetallic Cu-Ag (Au, PGE) Kupferschiefer ore deposit in the Foresudetic Belt (Poland). In each case full 3D models using surfaces and regular grid (Sgrid) were built from all dataset available from exploration and exploitation including geological primary maps, 2D seismic cross-sections, and boreholes. The level of knowledge may differ from one site to another however those 3D resulting models were used to pilot additional field and exploration works. In the case of the Kupferschiefer, a sequential restoration-decompaction (4D geomodeling) from the Upper Permian to Cenozoic was conducted in the Lubin- Sieroszowice district of Poland. The results help in better understanding the various superimposed mineralization events which occurred through time in this copper deposit. A hydro-fracturing index was then calculated from the estimated overpressures during a Late Cretaceous-Early Paleocene up-lifting, and seems to correlate with the copper content distribution in the ore-series. These results are in agreement with an Early Paleocene paleomagnetic dating in the Germany part of the Kupferschiefer ore, and which perhaps represents the last mineralizing stages. Last, we discuss perspectives and make recommendations on applying 3&4 geomodeling in mineral resources appraisal.

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