The X-mine Project: Work Package 1

Ore Deposit Modelling lead by Geological Survey of Sweden (SGU)

Objective
This work package (WP) covers the development of geological 3D-models making use of up-to-date geophysical and geological modelling enhanced with high resolution drillcore XRF/XRT computed tomography data. These models are used for near-mine exploration (mine planning, drillcore targeting) and in-mine exploration along with ongoing mining exploitation and extractive operations of the ore bodies related to sulphide mineral systems present in the mines selected as demonstrators in this project.

The objectives of this WP are:
- To collect available and new multidisciplinary data from 4 mining sites. We will focus on geological, structural, 3D-geophysical, mineralogical and geochemical data derived from surface, drilling and in-mine surveys (task 1.1).
- To build multi-parameter 3D near-mine ore deposit models for 3 mining sites (task 1.2).
- In data from drillcore/drillchip conditioning with new (updated or complemented) data in order to produce high resolution 3D models of the mining sites (see task 1.2). The purpose of this task is to create and originate datasets, which can be used to map the subsurface geology around and within sulphide ore bodies at the test sites.

The workflow is as follows:
Geological data is generated through evaluation and reinterpretation of existing lithostratigraphic, structural and mineralogical information taking into account major and minor structural controls on hosts rocks and ore bodies as well as the post-ore geological evolution.

The in-mine data resulting from existing surveys will be assembled and new survey performed by the consortium (e.g. induced polarization surveys). These data will be complemented with old and new data on advanced geophysical imaging techniques and geochemical analysis.

Data from drillcore/drillchip will be obtained from efficient whole rock (WR) analysis, including XRF/XRT computed tomography, powder X-ray diffraction (pXRD) and laboratory bulk geochemistry.

TASK 1.1 Collecting available data from the mining sites
Lead: SGU; contributors; LOV, HG, AMED, HCM, IGR, UU

The task includes collecting and evaluation of existing geological, geophysical, mineralogical and drillcore/drillchip data, and integrate these with new (updated or complemented) data in order to produce high resolution 3D models of the mining sites (see task 1.2). The purpose of this task is to create and originate datasets, which can be used to map the subsurface geology around and within sulphide ore bodies at the test sites.

Deliverables D1.1: Data collection and evaluation report

TASK 1.2 Building the 3D ore deposit (near-mine) models
Lead: SGU; contributors; LOV, HG, AMED, HCM, IGR, UU

The task sets up a methodology for performing 3D processing/modelling based on the new multi-disciplinary datasets produced in task 1.1. Modelling will be performed using the integrated 3D-modelling suite D-CAD developed by Paradigm and the Mining Suite plug-in designed by Mira geosciences. Subsurface geological interpretations will be data-driven and based on advanced geometrical interpolation techniques and surface extractions from curvilinear grids hosting multiple-geological and geophysical parameters (Fig. 1).

The resulting models will reveal the spatial distributions of the rock types, alteration zones, ore, mineralogy as well as geochemical and geological signatures.

The models will act as guides in predicting the continuation of ore bodies outside of the drilled area. The task will integrate geological and geophysical data to produce robust framework models contributing to selective and efficient near- and in-mine exploration and production drill- ing, as well as mining planning issues, in combination with the real-time XRF/XRT sensing. This task will use the drillcore analysis prototypes built in WP4 (one prototype will be shipped to each mining site for drillcore analysis).

Deliverables D1.2: 3D ore deposit models of the target mining sites

TASK 1.3 Developing the applicability of constructing 3D high-resolution in-situ ore ore models in combination with XRF/XRT real-time sensing
Lead: UU; contributors; LOV, HG, AMED, HCM, SGU, IGR, UU

The task will demonstrate the applicability of 3D ore zone characterization, utilising all methods outlined and developed in tasks 1.1 and 1.2, using also drillcore/drillchip compositional data measured through real-time XRF/XRT analysis at in-mine drill core sites. The task will make use of both the chemical quantification from the XRF/XRT scanning as well as from the resulting 3D tomographic drill core structural data for building 3D models contributing to, in combination with the models developed in task 1.2, to in-mine exploration and production drilling activities. The high-resolution in-situ ore ore models will then form the basis for improving accuracy when deciding what part of the rock to blast and extract, minimizing waste rock and optimizing removal of ore. The in-situ ore ore models will also provide feedback into the near-mine models, task 1.2, which can then be updated and improved by the new local constraints produced in this task. In addition, the outcome of unique, high-resolution data derived from XRF/XRT scanning, such as the 3D outline of minor fractures, will progressively lead to better in- and near-mine models. These results and methods generated by this WP will form a basis for the demonstration part in using 3D models in WPS.

Deliverables D1.3: 3D in-situ ore ore models integrating XRF/XRT sensing

General information
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