



NEWSLETTER – MAY 2021
NOVEL X-RAY TECHNOLOGIES IN MINING AND EXPLORATION
2 PILOT UNITS IN OPERATION IN
ASSAREL-MEDET JSC, PANAGYURISHTE, BULGARIA
FINAL EVENT – X-MINE PROJECT 23 JUNE 2021



Assarel-Medet JSC Mining and Processing Complex is the first and largest Bulgarian company for open pit mining and processing of copper ore, providing around 50 % of the national production of this vital metal.

It is also the only Bulgarian company, which forms part of the large-scale research X-Mine project - Real-Time Mineral X-Ray Analysis for Efficient and Sustainable Mining, coordinated by VTT, Technical Research Center of Finland. The X-Mine research project has a total budget of 12 million Euro and it was funded under Horizon 2020 program of the European Commission. The International innovation consortium unites scientific institutes, equipment manufacturers and mining companies from various European countries. The X-Mine project develops new geological exploration sensor technologies and implements digital applications for deposit modelling and more efficient ore processing.

The new sensor technologies are demonstrating how novel use of the X-Ray Fluorescence (XRF), X-Ray Transmission (XRT) and 3D visualization technologies, integrated in the drill core scanning and in mineral sorting equipment can improve the efficiency and sustainability of the mining operations. The project has deployed drill core analyzer and mobile sorter demonstrators in existing mining operations in Sweden, Greece, Cyprus and Bulgaria. The pilots are evaluated in the context of scientific, technical, socio-economic, life cycle, health and safety performances. Altogether, installations and experiments of 4 drill core analyzer pilots, one for each mine, and 2 sorting pilots, shared between the locations, were carried out. The mines are of different sizes (from small-scale to large-scale) and target different minerals (zinc-lead-silver-gold, copper-gold, gold). The four sites offer different geology and challenges to the equipment, which widens the experience base for continuous development of the technology. Thanks to the X-Mine project, the mining companies are anticipated to achieve reduction of their transportation costs, waste, carbon emissions and lower power consumption.



1. The first pilot on the project - GeoCore X10 drill core scanner of Orexplore, Sweden

On 30 July 2020, GeoCore X10 drill core scanner arrived at Assarel-Medet JSC, Panagyurishte, Bulgaria. Once on-site in the drill core shed, the team conducted online training with an Orexplore instructor for radiation safety, handling of the machine, loading and operation of the device, as well as how to use the specialized software for the implemented technology.



Figure 1. Drill core sampling from Assarel mine



Figure 2. Preparation of the drill cores for scanning

The drill core has been scanned with the base metal version of the X-MINE drill core scanner GeoCore X10 by Orexplore, Sweden and the data was used for the ore body definition, 3D-modelling, resource calculation and a review of the plan.



Figure 3. Arrival of the GeoCore X10 scanner at ASSAREL-MEDET JSC



Figure 4. Training

Figures 3 and 4 show the arrival, initiation of the experiments, training and demonstration at the Assarel-Medet JSC site. The scanning procedure included inserting the core, setting the depth, scan in progress. The results from the drill core scanner were used in the field of exploration, 3D modelling and estimation of mineral resources.

Field exploration and ore body definition - A large benefit is that the geologists can examine, evaluate and process the obtained data (mineralogy, density, lithology, structural geology, and geochemistry) in a very short time.

3D Modelling and estimation of mineral resources - Results from the scanner are included in the block model, which is a part of the foundation for business planning and decision making and also provide detailed information on alteration, leading to a better understanding of the ore deposit genesis and more accurate and quicker 3D modelling and resources calculation.



Figure 5. Assarel mine drilling

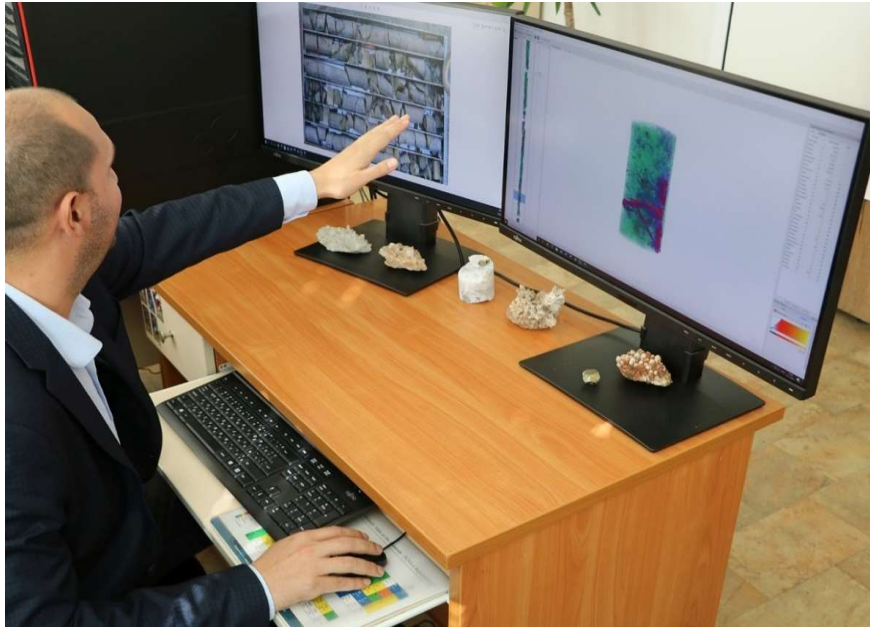


Figure 6. Results of scanning, displayed from Orexplore's Insight software

An improved 3D model was made for Assarel mine. Evaluation of the first results indicate that the pilot unit delivers invaluable information about the drill core, which has not previously been accessible to the mine geologist. The tomographic image is very useful and gives detailed information about structure, distribution of individual minerals and indicative chemistry.

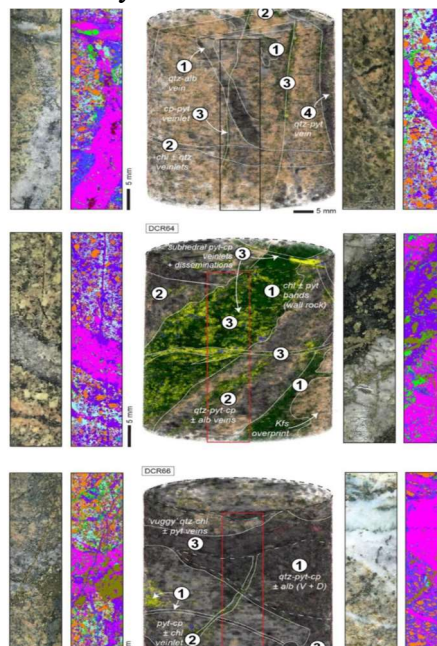


Figure 2. Tomographic image of drill core



2. The second pilot on the project – Comex Poland sorter

The goals of the tests in Assarel-Medet JSC with the OCXR-1000 sorter (Comex, Poland) were to sort the ore scrap from the ball mills of the processing plant. The main aims are to get rid of as much of the waste rock, but save the valuable copper bearing minerals. The statistics from the sorter was compared to the laboratory analysis.

The sorter arrived in Assarel-Medet facilities on the 19 February 2021.



Figure 1: Sorter – final positioning

A wheel loader was used for the sorter feeding.



Figure 2. Wheel loader/forklift supporting machine

Operators training was started by Comex instructor remotely during the second week of April 2021.



Assarel-Medet JSC staff have received the necessary training, which included radiation safety, handling of the machine, loading and operation of the device.



Figure 3: General flow chart of the whole sorter stages

There are two versions of the mineral sorting prototype: the so-called baseline version with conventional X-ray sensors, and the version with the new X-MINE sensors. The container-based pilot sorting prototype was used as a pre-concentration method after ore crushing. Assarel-Medet JSC has been running the baseline experiments with the conventional sensors. Some testworks had been made with mechanical and manual feeding. Also experiments with different calibration settings (high density and low-density rejection) had been done. The products were analysed by chemical analysis. The achieved results showed that the presented material is hard to be sorted on the base of copper content. The main presumable reason is the fine dissemination of the copper minerals into the samples. The sorter has been also run with a lower and higher capacity in the feed. As a result of these tests, we know the capability of the sorter in different case scenarios. Some other products from the processing plant were also tested with the sorter in an attempt to achieve the best possible results.

Based on our experiences, the mobile sorter performs well. However, it is probable that the fine dissemination of the copper minerals in the Assarel material requires the new X-MINE sensors to be used in the sorting equipment. Sorting with the X-MINE sensors will be studied during the last months of the X-MINE project and the results will be published in the public deliverables of the project by the end of the year 2021.



Assarel-Medet JSC believes that the X-MINE project is very promising and it will have a high impact on the mining industry. The implementation of the XRF-XRT-technology can make mining more resource efficient and reduce its environmental impact.

The results from the four-year H2020 funded X-Mine project will be presented in an on-line Final Event on **23 June 2021 from 10:00 to 17:00 EET.**

The event will demonstrate how implementation of the new XRF-XRT-technology in scanning of exploration drill core, collection of data for 3D-modelling of ore deposits and sorting of minerals can improve the efficiency in exploration and increase the sustainability of mining operations.

***You are welcomed to register for the event on the X-MINE project website
www.xmine.eu***

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