**Abstract # 26**
**Category:** *Technical developments in exploration*

**Title**: *Smart imaging sensor integration with innovative Machine Learning for efficient drill-core mapping*

**Presenter**: *Margret Fuchs, Researcher, Helmholtz-Zentrum Dresden-Rossendorf*

**Abstract:** Innovative exploration technology is receiving great interest for its potential not only to boost mining efficiency in terms of costs and time but also to overcome the increasing challenges of remote, complex, and often low-grade ore deposits. Innovative and non-invasive techniques are required for the evaluation of potential ore deposits in a fast and environmentally friendly manner. This implies a reduction of drilling allowed by a better targetting and efficient ways to handle core data. Drill-core analysis thus represents a critical bottleneck in the road to success of a mining operation.

A range of non-invasive, typically spectroscopy-based sensors, are available to perform surface scans to provide rapid and relevant information on the mineral composition of drill-cores. Combining various sensors in an automated way increases the accuracy of core-logging and consequently, provides the full range of information. However, such an approach faces three major obstacles: 1) accumulation of very large data sets, 2) different types and quality/precision/accuracy of data, and 3) multiple spatial resolutions (bridge the scales). These confrontations highlight the need for a smart integration of sensors and call for developing efficient machine learning algorithms.

We present here major advances in drill-core imaging using data fusion and machine learning techniques to tackle the challenges imposed by different technologies adopted in individual sensors. We propose to combine reflectance spectroscopy with novel laser-induced fluorescence-based emission as well as high-resolution mineralogical imaging technology. Scanning the reflectance and emission properties delivers robust continuous mineral maps without time-consuming discontinuous geochemical analysis for whole drill-cores. Integrating selective high-resolution imaging such as MLA (mineral liberation analysis) increases the depth of information on mineral associations. This allows us to exploit the complementary information of different imaging sensors, cross-validate mapping results and up-scale high-resolution analytics. For such integration and to extrapolate evident patterns across scales, we develop machine learning techniques.

**Authors:** *Margret Fuchs, Helmholtz-Zentrum Dresden-Rossendorf (HZDR) Helmholtz-Institute Freiberg for Resource Technology (HIF)*

*Sandra Lorenz, HZDR-HIF*

*Mahdi Khodadadzadeh, HZDR-HIF*

*Jan Beyer, TU Bergakademie Freiberg*

*Pedram Ghamisi, HZDR-HIF*

*Johannes Heitmann*