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Are Non Invasive Methods of Exploration Efficient?

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It is indubitable that the discovery of new deposits will be required to support our efforts towards energy transition and climate neutrality. At the same time, the growing opposition to mining threatens many new exploration projects. In fact, social attitude towards mining activities is becoming the main barrier to metal sourcing. New approaches to exploration are required and the use of remote techniques will be necessary to ensure the social acceptance of new projects. Remote sensing and airborne geophysics are good candidates but doubts remain regarding their ability to efficiently contribute to discovery. We recently set up three reference sites in Europe within the EU funded project INFAC. One of the objectives of our research was to benchmark new non-invasive exploration techniques not only in terms of technical efficiency but also their environmental impact and social acceptability. We assessed several geophysical methods such as ambient seismic noise airborne electromagnetics and drone-borne magnetics. We also conducted several experiments with hyperspectral imaging methods (VNIR-SWIR-LWIR) placed on a variety of platforms such as tripods, drones or airplanes. We developed an innovative 3D approach to process and display remote sensing data. We demonstrated that innovative geophysical and remote sensing technologies can contribute to discovery if they are used properly and provided guidelines. More importantly we showed that the integration of several technologies using machine learning techniques boost their potential. The 3D data help to characterize potential mineral deposits. These digital twins can be integrated in usual exploration workflows to support decision making. We do not advocate that non-invasive technologies will or should replace drilling but could largely contribute to a reduction of in-situ activities and therefore improve social acceptance.