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Modelling and inversion of FTMG airborne data acquired in Ransko gabbro-peridotite massif (Czech Republic)

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Airborne Full Tensor Magnetic Gradient (FTMG) data was acquired by SUPRACON AG in Ransko gabbro-peridotite massif of Czech Republic as a part of SEMACRET project activities. The area is known for numerous mineral deposits that have been intensively studied by Geological Survey of Czech Republic in the past. According to these studies, the known Ni-Cu and Cu-Zn mineralized zones occur as relatively narrow sub-vertical bodies inside mafic and ultramafic rocks. That is why direct detection of these zones by traditional total magnetic intensity (TMI) mapping is challenging due to high values of magnetic susceptibility of surrounding rocks. However, petrophysical studies show that mineralized zones in Ransko have generally the higher values of magnetic susceptibility than the mafic and ultramafic rocks there, which means that the high-resolution FTMG technology could be capable to map these mineralization zones directly. Therefore, demonstration of possibilities of the FTMG airborne technology to map directly mineralized zones in orthomagmatic mineral deposits was one of the purposes of airborne FTMG measurements in Ransko. The measured area was 3,8 km x 5,6 km large, with flight line spacing of 100 m. After raw data reprocessing that included data correction, synchronization, balancing, coordinate transforms and tensor build, the resulting data was low-passed filtered and resampled into a regular grid. The FTMG data included six magnetic gradient tensor components (Bxx, Bxy, Bxz, Byy, Byz, Bzz). In addition, the TMI map was calculated based on the mentioned data set and resampled for proper use after an adapted filtering. A comparison between TMI map, different FTMG component maps and the geological map showed that anomalies associated with outcropped mineralization zones are either weakly visible or not visible in the TMI data whereas anomalies that are spatially coincident with the outcropped mineralized zones are clearly visible in the FTMG components data. For more detailed data processing and inversion we selected an area that contains the known outcropped deposits. In order to obtain the 3D distribution of mafic and ultramafic rocks inside the Ransko massif we inverted the FTMG data using the UBC-GIF (University of British Columbia-Geophysical Inversion Facility) MAG3D-software. The model demonstrates large amounts of mafic and ultramafic rocks with high magnetic susceptibility inside the Ransko massif. To detect anomalies in FTMG data that could be related to compact inversion source structures (mineralized areas) we applied the Helbig's transform. Based on these results we selected several areas with compact sources for more detailed modeling and inversion of FTMG data. We used a parameterization of compact sources represented by magnetic ellipsoids of arbitrary orientation

and different main axes. The FTMG data was then inverted using ideal point method of multi-objective optimization. The parameters of magnetized bodies obtained were verified with the known geological and petrophysical information. Generally, our study demonstrated that the airborne FTMG surveys can be used to directly map the mineralized zones inside mafic and ultramafic complexes.