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HYPGEO - A collaboration between geophysics and remote sensing for mineral exploration

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The German Federal Institute for Geosciences and Natural Resources (BGR) aims to promote and design application oriented, generic techniques for the detection and 3D-characterisation of mineral deposits. Most newly developed mineral mining structures are still exploiting near surface sources. Since exploration and exploitation of mineral resources are increasingly under public review concerning environmental issues and social acceptance, non-invasive methods using satellites, fixed-wing aircraft, helicopters or unmanned aerial vehicles are preferred techniques within this investigation. Therefore, a data combination of helicopter-borne gamma ray spectrometry, hyperspectral imagery and full tensor gradient magnetometry is being evaluated. Test areas are open pit mining structures in Aznalcollar and Tharsis within the Pyrite Belt of southern Spain. First test flights using gamma-ray spectrometry and gradient magnetometry using SQUID-based sensors have been performed. Hyperspectral imagery has been applied on ground. Rock and core samples from the mines have been taken or investigated for further analysis.

The basic idea is to combine surface triggered signals from gamma-ray spectrometry and hyperspectral imagery to enhance the detection of shallow mineralisation structures. In order to investigate whether these structures are connected with near-surface ore veins, gradient magnetometry was applied to model subsurface formations. To verify that good correlations between the applied methods are given, open pit mining structures were chosen, where the mineral content and the local to regional geology is well known.