APPLICATION OF GEOPHYSICAL DATA IN GEOLOGICAL INVESTIGATIONS

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Interpretation of geophysical survey data strives for finding geological reasons for geophysical anomalies. The objective of interpretation is to extract geological information from a geophysical survey in order to improve understanding of the anomaly source rocks, their mineralogy and dimensions. By geophysical means the known geological features can be extended to areas where outcrop information is limited. Geophysical interpretation involves qualitative and quantitative interpretation. Qualitative interpretation aims to define geophysically similar units and to assign geological characteristics to these geophysical units. By pinpointing anomalous geophysical signatures, targets for more detailed investigations and modeling can be selected. Quantitative interpretation considers numerical estimates of the depth and dimensions of the source anomalies. Airborne geophysical surveys produce multivariate data to describe the composition of rocks or soils and structures in the ground. Finland has been covered by airborne geophysical measurements in two successive mapping programs (Moore 2008). The first, so-called 'high-altitude' mapping program started in the early 1950s' and lasted for approximately 20 years. It was followed by higher-resolution surveys of the so-called 'low-altitude' mapping program. The Geological Survey of Finland (GTK) conducted these programs in a systematic way with the goal to create uniform country-wide airborne geophysical databases to be used as reference in geological mapping and exploration. The 'low-altitude' measurements were carried out at 30 meters nominal flight altitude and with 200 meter line spacing. The final results include digital, corrected data in two formats: corrected data along true flight lines and with original sampling intervals, and interpolated grids with 50 meter cell size. The '3-in-1' approach is characteristic of GTK surveys: simultaneous measurement of magnetic, electromagnetic (EM) and radiometric data (see Airo 2005 and articles therein). In particular, GTK focused on developing the frequency-domain EM method that suited well for mapping sulphide deposits close to surface. Typical applications of the '3-in-1' surveys involve nowadays bedrock mapping, environmental monitoring and raw-material investigations. GTK also emphasized collection of country-wide rock physical reference data that supports the interpretation of the airborne geophysical survey data. Combining the '3-in-1' data and the national petrophysical database offers a unique basis for geophysical and geological investigations, modeling and GIS-interpretation. The high quality and density of GTK's aerogeophysical data sets allow applying statistical and neural network approaches to encourage data mining processes and mapping mineral potential. Application of GTK's airborne geophysical and petrophysical databases and examples of multivariate data-analysis and will be presented to enlighten the application of geophysical data in geological investigations. References Airo, M-L. (ed.) 2005. Aerogeophysics in Finland 1972-2004: Methods, System Characteristics and Applications. Geological Survey of Finland, Special Paper 39, 197 p. Moore, G. 2008. Finland's national airborne geophysical mapping programme and the '3-in-1' approach. EAGE First Break Volume 26, November 2008, 7 p.