Utilising CoDA based techniques for till and surficial geochemical data in mineral exploration for critical raw materials

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Compositional data, such as the geochemical data are the data that can be summed up to a fixed constant. There are two main till geochemical datasets available in Finland with different sampling densities. The targeting till geochemical data set is having sampling density of 6-12 samples per km^2 where the sampling density of regional till geochemical data is one sample per 4 km^2. A subset of data from the central Lapland in Finland has been considered. Quantile-quantile plots, principal component analysis (PCA) biplots and heatmaps were used to explore and analyse the different data sets and elemental association between different analysed elements. The distribution of elemental concentrations varies strongly between map sheets in targeting till data as well as they vary between targeting and regional till data sets despite compositional transformation. Thus, it was decided to analyse the map sheets (1:100 000 scale) separately. PCA biplots related to an area which contains two Ni-Cu-PGE deposits (Sakatti and Kevitsa), representing all data sets separately illustrate elements in distinguishable 2 elemental groups of Ti, Al, V and Cr, Ni, Mg which positively correlates with each other.

Another approach in surficial geochemistry is to test how the weak leach geochemical methods of upper soil as well as biogeochemistry are working in tracing the critical metal sources related to ultramafic rocks in different soil types and land use areas in Europe. The target areas locate in Czech Republic, Finland, Poland and Portugal. Upper soil analyses show a significant response to many elements with known mineralized bedrock targets observed in the suboutcrops and drill core data. An elemental distribution is also reflecting the lithological variations of rock units in the bedrock. In addition to the weak leach geochemical data, there is also good or moderate correlation for several elements between the biogeochemical data and underlying bedrock. However, there are significant differences between the plant species and parts which needs future studies. This research proves that surficial geochemical methods in different terrain types are an effective, environmentally friendly geochemical exploration technique for critical raw materials.

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