Automated mineralogy as efficient tool for provenance analysis of stream sediments and mineral exploration

Sophia Rütters (1), Jens Gutzmer (1), and Enrico Kallmeier (2)

(1) Helmholtz Institute Freiberg for Resource Technology, Analytics, Freiberg, Germany (s.ruetters@hzdr.de), (2) Beak Consultants GmbH, Freiberg, Germany

The Erzgebirge and neighboring Vogtland, are well known for the occurrence of granite-related mineral systems, represented as polymetallic skarn-, vein-, stockwork- and greisen-type deposits. Renewed exploration has been motivated by remarkable amounts of Sn, In and Li contained in some of the deposits. Some of the deposits currently explored have been exploited for centuries – others have been known for decades. The regional and local geological setting of these deposits is very well understood, especially concerning the magmatic and metamorphic lithological units. Therefore, the Erzgebirge and Vogtland are an excellent study area to test innovative exploration methods, such as the use of quantitative mineralogical data from modern stream sediments as a proxy for granite-related mineralization. The present study aims to provide such proxies of provenance and transport mechanisms by using automated mineralogy. The approach includes a grain-size window as wide as possible, and at the same time optimizes the statistical evaluation of both bulk sediment composition and single grain analyses.

Geochemical data from 209 samples of modern first- and higher-order streams are provided. To enhance the exploratory potential of the sand-sized sediments c.100 samples were analyzed, with a Mineral Liberation Analyzer (MLA). The MLA combines the information of Backscattered Electron Images (BSE) and Energy Dispersive X-ray-Spectrometry (EDS) to provide data of different features, such as mineralogy, mineral chemistry, particle size and particle shape. Results illustrate that the true potential of automated mineralogy data for mineral exploration goes far beyond the big database of quantitative data - in comparison to the standard petrographic methods such i.e. point counting. Rather, it is the possibility to implement efficient routines that allow to discover and track changes in mineralogy, mineral grain sizes, shapes or mineral associations within a complex population of sediment samples.