Geochemical data as exploration tools in West and South Greenland

Exploration geochemistry

The philosophy behind the use of stream sediment in mineral exploration is that weathering products from mineral deposits exposed at the surface will be transported downhill and deposited in streams. Elevated concentrations of the ore metal(s) in systematically collected stream sediment samples will therefore often be indicative of mineralisation.

Exploration geochemistry is an obvious discipline to conduct in the process of prospecting for new mineral resources. The data acquired during such surveys may also be used for geological mapping and modelling and environmental studies. The 'Geochemical atlas of Greenland – West and South Greenland' is based on compilation of chemical analyses of stream sediment samples collected from 1977 to 1998 in surveys undertaken by the Geological Survey of Denmark and Greenland.

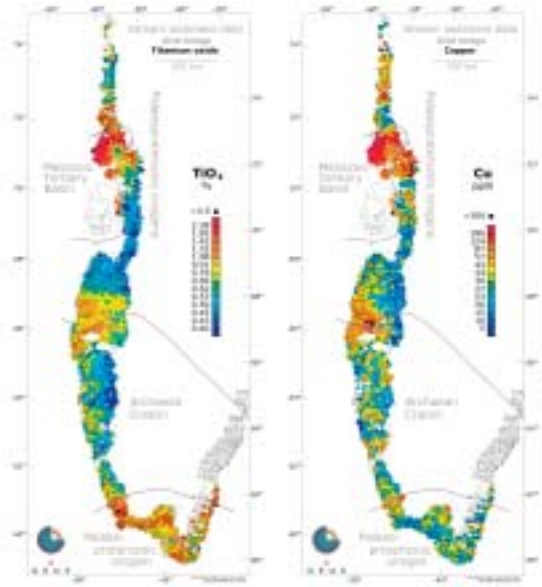
Use of regional geochemical data

The geochemical data set for West and South Greenland quantifies geochemical differences between rock complexes of different age and geological setting. Accordingly the data set is a documentation of the natural geochemical background over a large area. The geochemical maps within the atlas demonstrate, for the first time, the magnitude of the considerable natural variation in the concentration of chemical elements that exists over the selected area. This recognition has specific implications for mineral resource assessment in Greenland.

Stream sediment sampling

Stream sediments have been selected as sample medium for geochemical exploration in Greenland. The mountainous terrain together with melting snow and ice has created well-developed stream systems, and, contrary to soil or vegetation, streams are ubiquitous in Greenland. The sampling density has varied, but large parts of West Greenland have been sampled at reconnaissance scale, i.e. one sample per 20 to 40 km^2.

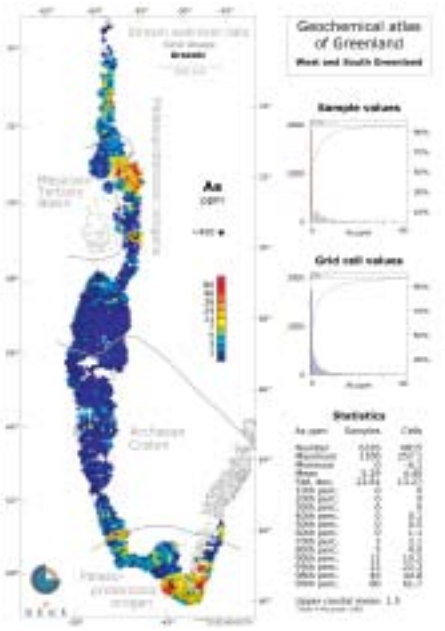
At each sampling site c. 500 g of stream sediment was collected. The sample was generally composed of subsamples from three to fifteen sediment deposits along 10 to 50 m of the stream course.



Chemical analysis

Sampling and sample preparation have followed the standard procedures throughout the period of the survey. Analytical treatment has been less systematic, mainly because of progress in analytical methodology.

Almost all samples have been analysed for major elements by XRF and for trace elements by INA. By contrast, trace element analysis by XRF, AAS and ICP-ES, have not been carried out for all samples.



The final data set comprises a total of 7122 samples, analysed for up to 43 elements. Chemical data from individual surveys were intercalibrated by means of reference material to eliminate analytical bias.

Major elements				*Trace elements*						
Si	*Fe*	*Ca*	*P*	*As*	*Co*	*Ga*	*Nb*	*Sc*	*Th*	*Yb*
Ti	*Mn*	*Na*		*Au*	*Cr*	*Hf*	*Nd*	*Sm*	*U*	*Zn*
Al	*Mg*	*K*		*Ba*	*Cs*	*La*	*Ni*	*Sr*	*V*	*Zr*
				Br	*Cu*	*Lu*	*Rb*	*Ta*	*W*	
				Ce	*Eu*	*Mo*	*Sb*	*Tb*	*Y*	

Element distribution maps

Each map sheet displays a contoured grid image of the variation in element concentration, a colour scale giving class intervals for the grid colours, and statistical information.

Mineral resource assessment

The use of the atlas data to identify high values, anomalies, is straightforward and is facilitated by showing the location of anomalies on the atlas maps. Several of these element anomalies are, in fact, located near known mineral occurrences containing the element in question, while others are located in areas where mineralisation is presently unknown. The latter category is particularly interesting to exploration companies and merits further investigation.

A more indirect way of using the data, is to identify geological environments with a high potential for formation of ore deposits. These environments, e.g. volcanic arcs, marine shales along escarpments and alkaline intrusions, may be identified using their geochemical signature together with information on structure, age, tectonic setting etc. For example, sedimentary sequences enriched in arsenic are considered a favourable source environment for gold deposits, and the high-arsenic regions in West and South Greenland are clearly outlined by the map of arsenic. The map of gold confirms the location of gold anomalies within the arsenic provinces, but also suggests that gold mineralisation, unrelated to arsenic, has taken place.

The geochemical data set behind the atlas is available at cost from GEUS.

Key references

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