µ-EDXRF tracing of uranium redistribution in volcanic rocks

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The Krasnokamensk area 400 km SE of Chita, Russia, is known for its rich ore bodies. The Tulukuevskoe U-deposit is hosted in Mesozoic volcanic caldera rocks that are characterized by strong tectonic faulting and hydrothermal-metasomatic alteration. Further to environmental impacts caused by the open pit mining, the migration of U and Th from the ore body into its host rocks and the underlying basement is of particular interest for subsidiary mineral resources and nuclear waste management purposes. Using the Tulukuevskoe open pit as a natural laboratory, the conditions under which uranium can be mobilized, transported and precipitated are being investigated. However, even localizing U-Th in the penetrated rocks is not trivial. Previously applied methods such as fission track analysis need completion by local element distribution patterns.

The three samples studied here constitute a profile next to a brittle fault zone that acted as post-ore-deposition fluid pathway in 20m distance from the vein ore body [1]. Bulk rock analyses show a homogenous overall rhyolitic composition of the volcanic welded tuff material. One sample shows very high U-content (165 µg/g) whereas the others only show less than 10 µg/g. Thorium abundances vary between 33 and 41 µg/g. Further to conventional bulk rock XRF we used an in-situ µ-EDXRF technique taking 1D profiles as well as 2D multi element mapping of more than 30 other elements to localize U-Th enrichments and identify possible proxies. The 1D profiles are taken by a 250 µm wide beam collecting the counts by an X-flash detector. 2D mappings are performed with a 100 µm beam either generating a 100 or a 50 µm spot size. Counts were collected by an N_2-cooled Si(Li) detector. Both systems run with a Mo-tube at 45kV and 30mA. To date, indistinct correlation of in situ detected U-rich zones and discrete uranium ore minerals or U-rich alteration products has been observed, suggesting a fine disperse distribution of the detected uranium. The in-situ µ-EDXRF data produced in this study allows for future detailed target-orientated investigation of small U-Th rich areas by electron microprobe techniques.

References

[1] Petrov V.A., Poluektov V.V., Golubev V.N., Andreeva O.V., Dubinina E.O., Lichtner P., Perry F., Galinov Y.N., Ovseichuk V.A., Schukin S.I., Lespinasse M., Sausse J., and Hammer J. (2005) ICEM´05, **1017**, 1-8.