Geophysical Research Abstracts
Vol. 21, EGU2019-8412, 2019
EGU General Assembly 2019
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The genesis of zirconium rims around Fe-Ti-V mineralization in the Suwałki Anorthosite Massif (NE Poland)

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Zircon rims around Fe-Ti oxides occur in a wide variety of forms in mafic plutonic rocks like anorthosite, norite and gabbronorite from the Proterozoic intrusions in the Grenville Province of Eastern Canada, Rogaland in Norway, Laramie Province in the USA and the Kola Peninsula in Northern Russia. First discoveries of such unique forms of Zr-Hf mineralization was found in the Suwałki Anorthosite Massif (SAM) in NE Poland (Ruszkowski, Wiszniewska, 2018).
Zirconium-hafnium rims were observed at boundaries of Fe-Ti oxides with plagioclases and pyroxenes in iron-titanium ores (ferrolites) of Krzemianka and Udryn deposits within SAM. The most frequent forms reach 80–350 μm in length and 4–50 μm in width. The most spectacular forms were “blown candle flame” structures. Their average width ranges from 45 to 65 μm and the length exceeds 750μm. Advanced geochemical composition analyses were carried out on the numerous group of samples to investigate their composition and origin. New research results allowed to confirm the origin of these structures as a result of Zr diffusion processes from ilmenite or rutile. Detailed studies of SEM-EDS revealed the dominance of Zr-Hf rims over Fe-Ti oxides (ferrolites) by completely surrounding them with the cooperation of later fluids inflow within the rocks. The largest clusters of zircon show high local enrichment of Hf (0.6–0.8wt.%) within the rim. The dating of this type of structures was carried out by SHRIMP IIe\Mc method at the Polish Geological Institute in Warsaw for the first time. This age yielded 1506±8 Ma, as the latest stage of mineral magmatic succession. The enrichment in hafnium content in zircon rims is related to decreasing of Th, U and Pb and increasing of Ti and Fe in zircon rims. A large variety of forms and variability of chemical composition within Zr-Hf rims have shown for complex latest physicochemical post-magmatic processes. The results of the previous pioneer work on this rare phenomenon of Zr-Hf rims around the Fe-Ti minerals (Morriset, Scoates,2008) has pointed out for their probable multistage fluid influxes and subsequent later evolution. On the basis of recently observed various forms of Zr-Hf rims and single zircon crystals in ferrolites and host SAM rocks, it was possible to recognize several stages of the mineral evolution succession: from magmatic to post-magmatic ones. Fluctuation of oxygen fugacity and variable temperature and pressure conditions of post-magmatic fluids caused the creation of zirconium-hafnium rims by diffusion process of Zr element from Ti-bearing minerals in slowly cooling zones of anorthosite-norite plutons.

References:
RUSZKOWSKI M., WISZNIEWSKA J. 2018 - Wstępne rozpoznanie obwódek cyrkonowo-hafnowych wokół minerałów kruszcowych w złożach Fe-Ti-V w suwalskim masywie anortozytowym (północno-wschodnia Polska), Przegl. Geol. vol.66 nr. 2.
MORISSET C.E., SCOATES J.S. 2008 - Origin of zircon rims around ilmenite in mafic plutonic rocks of Proterozoic anorthosite suites. Can. Mineral., 46

This research was funded by NCN project 2015/17/B/ST10/03540 and FUW project 35/04/2017