

MINERALOGIA – SPECIAL PAPERS
Volume 50, 2022

Abstracts and field trip guide

27th Meeting
of the Petrology Group
of the Mineralogical Society of Poland

**GANGUE ROCKS:
INSIGHTS FROM NATURE, ANTHROPOGENE,
LABORATORY AND SOLAR SYSTEM**

October 20-23, 2022 | Rudy, Poland

Katowice-Wetłowiec dump, 13.01.2014

Organised by:
University of Silesia in Katowice, Faculty of Natural Sciences



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Experimental synthesis of ThSiO₄ by fluid-induced alteration of chevkinite-(Ce)

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During hydrothermal alteration, the REE-bearing minerals of the chevkinite group have the potential to release not only REE but also high field-strength elements and the actinides, including Th. The initial concentration of Th in a fresh chevkinite-(Ce) varies from 1.0 to 2.9 wt.% ThO₂. A series of hydrothermal experiments using different hydrous fluids (Ca(OH)₂, NaOH, NaF and CaF₂) and P, T conditions ranging from 500-600°C and from 200-400 MPa have been carried out. The products included ThSiO₄ showing a remarkable range of textures (see Figures). The textures provide significant new information on the incorporation of Th into hydrothermal fluids, the ways in which it is transported, the efficiency of various ligands in promoting the transport and the mechanisms of ThSiO₄ deposition. EBSD studies have revealed the structural nature of the ThSiO₄ and how it varied with mode of transport. The effects of the invading fluid(s) on the host chevkinite-(Ce) have shown that its structure has been maintained.

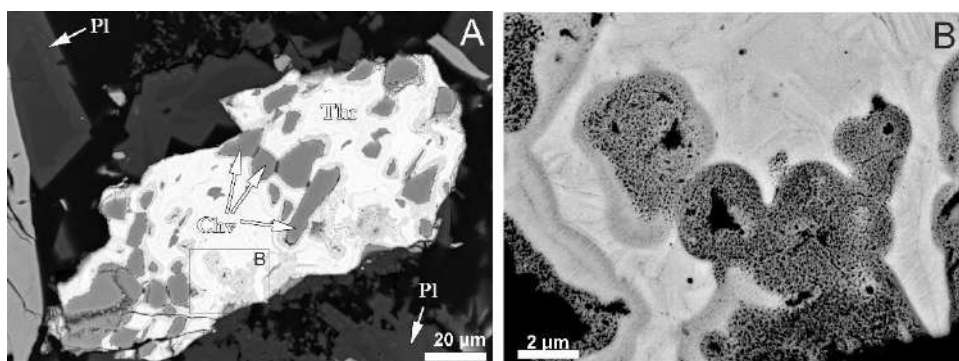


Fig. 1. BSE images: A. Chevkinite-(Ce) largely replaced by ThSiO₄, B. Unusual bubble aggregate of spherical forms in ThSiO₄

The quantity of Th which comes from altered chevkinite-(Ce) strongly depends on the fluid composition. For example, fluorine in the fluid appears to increase the mobility of the Th.

This study was financed from the National Science Centre, Poland (grant no. 2017/26/M/ST10/00407).