Goldschmidt 2022 Abstract
https://doi.org/10.46427/gold2022.11987

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Fluid-driven reactions in Ca-Mg-skarns from the SW East European Craton (Lithuania): microstructural study and dating of ore-forming events

GRAZINA SKRIDLAITE[1], LAURYNAS SILIAUSKAS[1], ULF SÖDERLUND[2] AND TOMAS NÆRAA[2]

[1]Nature Research Centre
[2]Lund University
Presenting Author: grazina.skridlaite@gamtc.lt

The Varena Iron Ore deposit In the SW East European Craton is situated in the metamorphosed and hydrothermally reworked Palaeproterozoic dolostones. A detail microstructural study supplemented with isotopic investigations allowed for dating of ore-forming events.

High-grade forsterite, spinel, -orthopyroxene assemblages, calcite with sparse magnetite (Mag1) grains were produced during metamorphism of 750^{o} C and 5-6 kbar with presence of a water-rich fluid. The following drop in pressure and influx of an oxidized, somewhat richer in CO_2, fluid have triggered Mg mobility resulting in dolomitization of calcite, inclusion-rich Mag1 dissolution, inclusion-free magnetite (Mag2) precipitation, and replacement of the high-grade assemblages by phlogopite, chlorite, serpentine and amphiboles. The Mag1 and Mag2 have high Al and Mg, low Ti and Mn contents, plot in Mg-skarn or hydrothermal fields on the discrimination diagrams and record T of 300-500^{o} C. The dolomitization of calcite is more intense closer to the ore-enriched zones suggesting their simultaneous formation.

In the thin-layered skarn (982-3 sample), oval-shaped monazite grains are located in carbonate-rich stripes spotted with serpentine pseudomorphs after olivine. Featureless monazite grains are surrounded by a network of tiny magnetite films that might indicate their hydrothermal origin. Prismatic baddeleyite grains grew together with polygonal magnetite (Mag2) aggregates at contact with chlorite. Aggregates of irregularly-shaped zircon and magnetite grains form clots in a phlogopite-rich serpentinite crosscut by numerous calcite and magnetite veinlets (D8-1 sample). Remnants of baddeleyite in the zircon grains may indicate that it was replaced by zircon with increasing silica content.

LA ICP-MS study was applied to the monazite, zircon and baddeleyite grains. All the obtained ages fell into a range of 1.73-1.70 Ga ages. This age post-dates the high-grade skarn formation and records subsequent hydrothermal reworking and ore enrichment.

The ore mineralization of 1.73-1.71 Ga is contemporaneous with ca. 1.73-1.70 Ga metamorphic reworking (Siliauskas et al., 2018) of the host rocks in the region. These events may be related to the continental-margin type TIB magmatism further west, in south-central Sweden.

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