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Mineralogical characterization of Ni-Cu-PGE-bearing mafic dikes of the Lusatian Block (Germany/Czech Republic)

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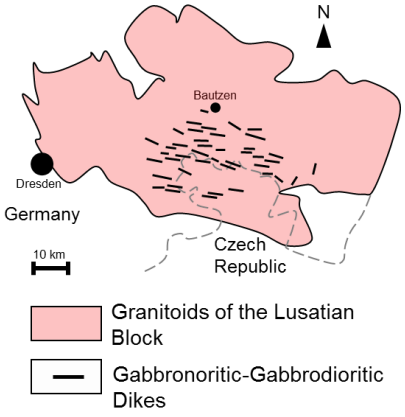
The Cadomian Granodiorite Massif of the Lusatian Block hosts predominantly WNW-ESE striking mafic dike swarm systems, characterized by a significant Ni-Cu-PGE tenor [1,2]. The small-scale gabbronoritic to gabbrodioritic dikes (< 5 km strike, < 50 m width) show an age of about 350 Ma [3] and occur within an area of 40 x 30 km. They are dominantly composed of plagioclase (30-50 vol. %) and clinopyroxene (20-50 vol. %) while olivine, orthopyroxene, amphiboles and biotite occur mostly in smaller amounts < 20 vol. %. Several of these dikes feature fine-disseminated Ni-Cu-PGE-bearing sulfides (< 2 cm) in form of pyrrhotite (Po), pentlandite (Pn) and chalcopyrite (Ccp) usually accompanied by magnetite. Larger, lense-like sulfide accumulations were found in the dikes of Sohland-Rozany (DE/CZ), Kunratice (CZ) and Grenzland-I (DE). The Sohland-Rozany dike was mined from 1901-1920 and had a production of 20 kt ore @ 2 to 4 wt. % Ni, 1 to 2 wt. % Cu and 0.1 wt. % Co [4]. In the 1980s geomagnetic and geoelectric exploration campaigns by the Central Geological Institute of the German Democratic Republic also showed a sulfide potential for other mafic dikes in this area. At least three ore textures can be distinguished in dump samples from the former Ni-Cu mine "Bergsegen" of Sohland-Rozany: pyrrhotite-dominated disseminated ore (Po > Pn > Ccp, grain sizes < 2 cm), chalcopyrite-dominated disseminated ore (Ccp > Po > Pn, grain sizes < 2 cm) and massive pyrrhotite-dominated ore (Po > Pn > Ccp, grain sizes > 5 cm). Pentlandite is often replaced by violarite as an effect of late-stage hydrothermal alteration. Former bulk geochemical analyses indicated a minor PGE and Au content of the massive sulfide ores (max. 0.8 ppm PGE, max. 0.5 ppm Au) [4]. Our SEM analyses show that all ore types feature small amounts of sperrylite, merenskyite + melonite-merenskyite series, michenerite and other Pd-Pt-bismuthotellurides. However, the highest PGM amounts are associated with the massive sulfide ores. Besides the PGMs native gold, electrum, hessite, empressite, melonite, tsumoite, tellurobismuthite, altaite and vavrinite could also be found by SEM analyses. The PGMs and tellurides (1-25 µm) occur for the greater part at grain boundaries of sulfides and silicates or in form of inclusions mainly in pyrrhotite and pentlandite/violarite. Inclusions of PGMs in silicates are rarely detectable.



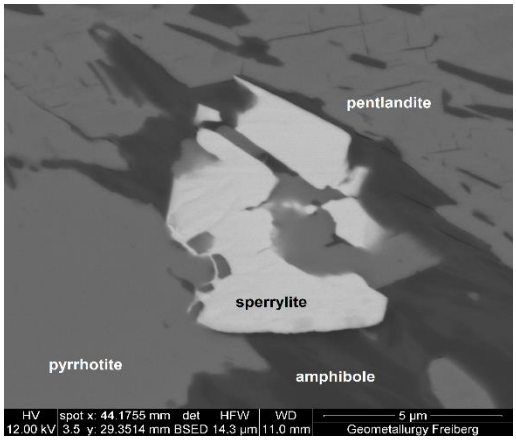


Figure 1: Simplified geological map of the Lusatian Block. 1 – Sohland-Rožany dike [DE/CZ], 2 – Kunratice dike [CZ], 3 – Grenzland-I dike [DE].

Figure 2: Sperrylite at the grain boundary of sulfides and silicates (massive sulfide ore, Sohland-Rožany dike [DE/CZ].

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