

NEW TYPE OF CORDIERITE ASSEMBLAGES FROM THE SLANSKÉ VRCHY MTS., EASTERN SLOVAKIA

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Rock quarries along the Slanské Vrchy Mts. volcanic range (Eastern Slovakia) are well known for the occurrences of xenoliths/enclaves. Apart from them, new type of hornfelse-like rocks with cordierite high-alumina mineralization was found here. Although a sample supposed to be a sekaninaite-bearing xenolith had been found even earlier – first in the Vehec quarry (DUDA, 1977), last years' research has brought findings of similar samples from 4 other quarries and repeatedly in Vehec. The distribution of localities suggests similar conditions in the deep levels beneath the volcanic massif, which is necessary to produce such uniform assemblages. Homogeneous black to dark-blue enclaves from all of the occurrences (Fintice, Borovnik, Brestov, Vehec and Vyšná Kamenica) are very similar to each other due to their compact glassy-like to fine-grained fabric and its mineral composition, too. Mineral grains are subhedral to anhedral, poorly distinct in thin sections, so the mineral composition was first examined by XRD analyses, and then the individual minerals were investigated by EMPA. Although the cordierite diffraction pattern resembles to that of amphibole, cordierite was clearly detected as a main phase in samples from Fintice and Borovnik; in enclaves from Brestov, Vehec and Kamenica plagioclase prevailed. Fine-grained polymineralic aggregates also consist of associated Fe-rich spinel / Ti-rich magnetite and/or K-feldspar, orthopyroxene (En), biotite, ilmenite, with zircon and apatite as accessories. The composition is not uniform, enclaves from Fintice and Vehec contain andalusite, too; in exceptional cases quartz (Borovnik), tridymite and corundum (Vehec) were also detected.

Bulk rock composition of the enclaves ranges from 44.7 to 49.9% SiO₂ (except for a more acidic sample from Borovnik: 54.7% SiO₂), Al₂O₃ ranges from 19.9 to 30.5% – in the most dry sample from Vehec. Reported samples are not hydrated – vibrational IR-spectra show only the traces of absorbed molecular H₂O. Cordierite series electron microprobe data reflect some differences among five localities: usually more magnesian (up to 9.8–10.3 wt% MgO, correspondingly to 6.1–6.7 wt% FeO, Borovnik) to most ferrous sekaninaite from Fintice (5.9–6.1 wt% MgO, with 12.0–12.6 wt% FeO). Each locality represents only a slight variability with respect to Mg/Fe ratio. Average X_{Fe} calculated for separate locality are: Fintice X_{Fe} = 0.53; Borovnik X_{Fe} = 0.26; Brestov X_{Fe} = 0.36; Vehec and Vyšná Kamenica X_{Fe} = 0.37. Intra-grain zoning was analyzed only in larger grains from the Vehec quarry, but decreasing Mg content from the core to rim, followed by increasing Fe was observed in all grains. Na contents of cordierite from all 5 localities range up to 0.25 wt% Na₂O, whereas K contents is higher, suggesting a metamorphic origin.

Cordierite is predominantly a product of metamorphism, but here it is found captured in andesite. It formed presumably by assimilation of argillaceous rocks. Intruded hot calc-alkaline magma can induce immediate metamorphic impact on crust metapelites (found frequently as xenoliths) or even high-alumina melt formation. We suppose that the observed cordierite enclaves may represent anatectic products of pelitic rocks around the contact aureole of the magmatic chamber. Such preposition supports the result of thin section investigation with observed plagioclase phenocrysts coming from andesite. The presence of mineral inclusions in cordierites and associated frequent Fe-rich spinel / Ti-rich magnetite could be a part of precursor assemblage of low Ti. Present concentration of ilmenite and Ti-rich magnetites in the mineral assemblage of enclaves is interpreted as the proof of long-lasting exposure of the protolith in the magma chamber level.

The equigranular fabric with minimum apparent porosity of the enclaves found in andesites has some similarities to dense cordierite ceramics, utilized as thermal shocks-resistant material. Artificial cordierite is usually produced by crystallisation at high temperature through amorphous glassy and intermediate silicate phases with spinel. The addition of boron, water and/or other catalyst fluids promotes its formation by attaining lower energy background (SUMI *et al.*, 1999). Natural enclaves described here have some similarities with artificial cordierite ceramics (SHU *et al.*, 2000). Relatively sharp bands of IR spectra, with splitting of broad bands between 500–400 cm⁻¹ suggest intermediate to fully ordered low cordierite internal structure and reflect gradual cooling before uprising. The Cl contents in cordierite from Fintice (up to 0.037 wt%) and Vehec (0.045 wt%) along with minimum CO₂, could be relics of channel fluids, decreasing the temperature of melt. A part of the chlorine (with boron eventually) could be originated from the Neogene salt-bearing sediments, deposited in the Karpatian age.

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References

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