

Indialite in xenolithic rocks from Somma-Vesuvius volcano (Southern Italy): Crystal chemistry and petrogenetic features

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ABSTRACT

The rare mineral indialite, a hexagonal high-temperature form of cordierite, has been discovered for the first time in Italy at Somma-Vesuvius volcano in unusual pyrometamorphic ejecta. The indialite-bearing xenoliths are composed of several pale yellow fragments consisting of very fine-grained indialite with traces of cristobalite. On the surface of the fragments, colorless indialite and pale-blue, prismatic osumilite crystals form whitish crusts, with subordinate phlogopite and trace amounts of corundum. Gypsum and Fe-oxides are ubiquitous. Chemical composition of the Italian indialite is characterized by high X_{Mg} (~0.95) and significant K_2O (~1.4 wt%). Single-crystal X-ray diffraction measurements give cell dimensions very similar to those of the indialite from the Bokaro coalfield. The diffraction pattern shows no significant deviation from the symmetry conditions of the space group $P6/mcc$, which is the space group generally accepted for high-cordierite. The presence of guest K (and lesser Ca) in the sixfold channel does not produce appreciable distortions in the framework of T2 tetrahedra, probably because of the weak interactions between guest and the ring O2 atoms. Indialite-bearing rocks originated through a pyrometamorphic process at shallow depth and at maximum temperature close to ~1200 °C. Rapid crystallization and subsequent quenching favored a higher symmetry, thus “freezing” the space group $P6/mcc$.