

Geothermometric study of Mg-rich spinels from the Somma-Vesuvius volcanic complex (Naples, Italy)

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ABSTRACT

The crystal chemistry of 13 spinel samples from the Somma-Vesuvius volcanic complex (Italy) was studied by crystal structural refinement and electron microprobe analysis, processing the data with a tested optimization model to obtain site populations. Five samples come from the volcanic xenoliths found in Pollena Quarry and belong to the deposits produced by the Pollena eruption of A.D. 472. All crystals are characterized by $\text{Fe}^{2+} \leftrightarrow \text{Mg}$ substitution and pertain to the Mg-rich portion of the spinel sensu stricto-hercynite join. The crystals show a partially inverted cation configuration with inversion degree ranging from 0.20–0.25. Aluminum contents characterize the crystal-chemistry: the unit-cell parameter decreases with increasing total Al and the *M*-O bond length decreases with increasing ^{*M*}Al. Using a well-tested geothermometer based on the ^{*M*}Al+^{*T*}Mg = ^{*T*}Al+^{*M*}Mg intracrystalline exchange, closure temperatures were calculated for the Pollena Quarry spinels. Results range from 694 to 809 °C. The latter value is assumed to be representative of the temperature of the Pollena eruption and is in excellent agreement with that reported in the literature (800 °C) and estimated by experimental phase equilibria.

Keywords: Spinel, crystal structure, chemical analysis, geothermometer, crystal chemistry, order-disorder, Vesuvius