

The hydrous component in leucite from Somma-Vesuvius and Roccamonfina volcanoes (southern Italy) – a FTIR spectroscopic investigation

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With 5 figures and 3 tables

Abstract: FTIR microspectroscopic data on the hydrous species occurring in leucites from different host rocks of Somma-Vesuvius and Roccamonfina volcanoes (southern Italy) are reported. All leucite samples contain significant amounts of structurally incorporated H₂O molecules, confirmed by the H₂O combination band at 5226 cm⁻¹. Three main types of infrared spectra can be discerned. Type 1, with a single band maximum at 3600 cm⁻¹ represents the typical spectrum of the Somma-Vesuvius samples, whereas type 2, revealing two additional band maxima at 3654 and 3506 cm⁻¹, characterises the Roccamonfina crystals. Type 3, showing a broad absorption band with a band maximum around 3390 cm⁻¹ was encountered only in two Vesuvian samples. Due to the presence of three discernible band maxima and of four to five deconvoluted component bands, the presence of at least two different H₂O molecules can be derived. Estimates of the water content give values between 40 and 2777 wt.ppm for the Somma-Vesuvius samples; a zoning of the water content is inherent to the Vesuvian leucite crystals. Roccamonfina leucites show significantly higher and very homogeneous water contents in the range of 4602 to 5700 wt. ppm, suggesting the influence of an environmental factor on the growth of the crystals.

Key words: leucite, trace hydrogen, Somma-Vesuvius, Roccamonfina, FTIR spectroscopy.

Introduction

Leucite, KAlSi₂O₆, is not a major rock-forming mineral but it is an important constituent of some silica-deficient igneous rocks. Its occurrence is scattered across the world and restricted to regions of alkaline volcanism and continental rifting, generally of Tertiary to recent age. In Italy, this feldspathoid occurs in the Roman Comagmatic Province (RCP), where some volcanics and ejected rocks sometimes show exceptionally large crystals. Leucite shows a complex phase transition behaviour and a considerable structural flexibility under variable thermodynamic conditions (PALMER et al. 1997). The naturally occurring leucites crystallize in the cubic system, space group *Ia3d* (PEACOR 1968). On cooling below $T_c \approx 938$ K, phase transitions occur to an intermediate tetragonal form, characterised by space group *I4₁/acd*, and to a tetragonal phase with space group *I4₁/a* at room temper-

ature (MAZZI et al. 1976). Synthetic leucite is a main crystalline component in most feldspathic porcelains and in the manufacture of glass-ceramics (SZABO et al. 2000, NOVOTNA et al. 2004).

Leucite represents an anhydrous mineral phase. However, most of those anhydrous minerals can contain trace amounts of a hydrous component, i. e. the so-called “Nominally Anhydrous Minerals”, NAMs (BELL & ROSSMAN 1992, BERAN & LIBOWITZKY 2003, LIBOWITZKY & BERAN 2004). In NAMs, hydroxide groups (OH⁻) are the chemical phase most commonly encountered, whereas molecular water (H₂O_m) generally occurs in potassium feldspar, feldspathoids and in open structure minerals (ROSSMAN 1996, JOHNSON & ROSSMAN 2003). Many research papers have demonstrated that also small contents of water in minerals are interesting to geologists, because they may control some mineral properties which are relevant for geologic processes (e. g. rheology