

Crystal structure and iron topochemistry of erionite-K from Rome, Oregon, U.S.A.

PAOLO BALLIRANO,^{1,2} GIOVANNI B. ANDREOZZI,^{1,3} MERAL DOGAN,⁴ AND A. UMRAN DOGAN^{5,6,*}

¹Dipartimento di Scienze della Terra, Sapienza Università di Roma, P.le A. Moro, 5, I-00185 Rome, Italy

²CNR-IGAG, Istituto di Geologia Ambientale e Geoingegneria, Sede di Roma, Via Bolognola 7, I-00138 Rome, Italy

³CNR-IGG, Istituto di Geoscienze e Georisorse, Sede di Roma, P.le A. Moro, 5, I-00185 Rome, Italy

⁴Department of Geological Engineering, Hacettepe University, Ankara, Turkey

⁵Department of Geological Engineering, Ankara University, Ankara, Turkey

⁶Department of Chemical and Biochemical Engineering, The University of Iowa, Iowa City, Iowa 52242, U.S.A.

ABSTRACT

A complete crystal-chemical characterization of erionite-K from Rome, Oregon, was obtained by combining field emission scanning electron microscopy, laboratory parallel-beam transmission powder diffraction, and ⁵⁷Fe Mössbauer spectroscopy. Rietveld refinement results evidenced that the most striking difference in comparison with the structure of erionite-Ca is significant K at a K2 site ($\frac{1}{2}$, 0, 0), which is empty in erionite-Ca. In addition, site Ca1 shows low occupancy and Ca3 is vacant. The oxidation and coordination state of Fe, whose occurrence was revealed by chemical analysis, have been clarified by exploiting room- and low-temperature ⁵⁷Fe Mössbauer spectroscopy. The majority of Fe (95%) was attributed to Fe³⁺-bearing, superparamagnetic, oxide-like nanoparticles with dimensions between 1 and 9 nm, and the remaining 5% was attributed to hematite particles with size ≥ 10 nm, both located on the crystal surface.

Keywords: Oregon erionite, erionite-K, crystal structure, iron topochemistry, field emission, scanning electron microscopy, laboratory parallel-beam transmission powder diffraction, Rietveld refinement, ⁵⁷Fe Mössbauer spectroscopy