*American Mineralogist*; April; v. 93; no. 4; p. 667-675; DOI: 10.2138/am.2008.2590


# Synchrotron powder X-ray diffraction study of the structure and dehydration behavior of palygorskite

**Jeffrey E. Post[1,*] and Peter J. Heaney[2]**

[1] Department of Mineral Sciences, Smithsonian Institution, Washington, D.C. 20560-0119, U.S.A.
[2] Department of Geosciences, Pennsylvania State University, University Park, Pennsylvania 16802, U.S.A.

Correspondence: * E-mail: postj{at}si.edu

Rietveld refinements using synchrotron powder X-ray diffraction data were used to study the crystal structure and dehydration behavior of pure monoclinic palygorskite samples from Korea and Alaska. The 300 and 100 K palygorskite structures in air compare well with previous models but provide additional details about zeolitic $H_2O$ sites and reveal that the Al atoms are ordered into the inner M2 octahedral sites and the Mg cations into the M3 sites at the edges of the tunnels. Real-time, temperature-resolved synchrotron powder X-ray diffraction data and Rietveld refinements were used to investigate the monoclinic palygorskite structure from 300 to 1400 K (in air). Rietveld refinements showed that most of the zeolitic $H_2O$ is lost by ~425 K, accompanied by a decrease in the unit-cell volume of 1.3%, primarily owing to a decrease in the *a* unit-cell parameter and an increase in the β angle. The structurally bound $H_2O$ is lost in two stages, at temperature intervals of 475–540 and 580–725 K. Above ~825 K in air a portion of the Korean sample transformed to a folded structure; the Alaskan sample folded at ~575 K under vacuum. A structure model was refined for the folded structure. At ~1015 K for the sample heated in air, β-quartz diffraction peaks appeared and increased in intensity as heating continued to the maximum temperature. Cristobalite formed above ~1050 K, along with a small amount of clinoenstatite, and both phases persisted to the maximum temperature studied.

**Key Words:** Palygorskite • Rietveld • synchrotron • X-ray diffraction • time-resolved

# This article has been cited by other articles:

**Clay Minerals** HOME

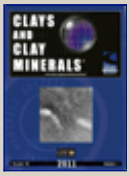
R. Giustetto and R. Compagnoni
An unusual occurrence of palygorskite from Montestrutto, Sesia-Lanzo zone, internal Western Alps (Italy)
Clay Minerals, August 26, 2011; 46(3): 371 - 385.
[Abstract] [Full Text] [PDF]

**European Journal of Mineralogy** HOME

E. T. Stathopoulou, M. Suarez, E. Garcia-Romero, M. S. Del Rio, G. H. Kacandes, V. Gionis, and G. D. Chryssikos
Trioctahedral entities in palygorskite: Near-infrared evidence for sepiolite-palygorskite polysomatism
European Journal of Mineralogy, August 1, 2011; 23(4): 567 - 576.
[Abstract] [Full Text] [PDF]

**European Journal of Mineralogy** HOME

R. Giustetto, D. Levy, O. Wahyudi, G. Ricchiardi, and J. G. Vitillo
Crystal structure refinement of a sepiolite/indigo Maya Blue pigment using molecular modelling and synchrotron diffraction
European Journal of Mineralogy, June 1, 2011; 23(3): 449 - 466.
[Abstract] [Full Text] [PDF]



**Clays and Clay Minerals** HOME

E. Garcia-Romero and M. Suarez
ON THE CHEMICAL COMPOSITION OF SEPIOLITE AND PALYGORSKITE
Clays and Clay Minerals, February 1, 2010; 58(1): 1 - 20.
[Abstract] [Full Text] [PDF]

**American Mineralogist** HOME

G. D. Chryssikos, V. Gionis, G. H. Kacandes, E. T. Stathopoulou, M. Suarez, E. Garcia-Romero, and M. S. Del Rio
Octahedral cation distribution in palygorskite
American Mineralogist, January 1, 2009; 94(1): 200 - 203.
[Abstract] [Full Text] [PDF]