

## Thermodynamic stability of pyromorphite-vanadinite solid solution series

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Pyromorphite  $Pb_5(PO_4)_3Cl$  and vanadinite  $Pb_5(VO_4)_3Cl$  are comparatively rare secondary minerals, which belong to the apatite supergroup. Lead apatite, especially pyromorphite, have gained considerable attention as metal sequestration agents in water treatment and contaminated soil remediation [1, 2]. This is caused by the fact that they are one of the most stable lead compounds in the earth-surface environments. However, the crystal structure and chemistry of these minerals allow for numerous substitutions [3]. Natural pyromorphite often exhibit a certain degree of anionic substitutions, mainly arsenates and vanadates. Therefore, the knowledge about the impact of anionic substitutions on the thermodynamic stability of these minerals is very important.

Pyromorphite-vanadinite solid solutions were synthesized from aqueous solutions to obtain homogeneous phases. The precipitates were characterized by X-Ray diffraction (XRD), scanning electron microscopy (SEM/EDS), infrared absorption spectroscopy (FTIR) and Raman spectroscopy methods. Thermodynamic properties of studied samples were calculated based on results of the dissolution experiments. Synthetic phases were dissolved in 0.05 M  $NH_4NO_3$  solution at three different temperatures (25, 45 and 65°C) with initial pH values between 2.0 and 6.0. The content of Pb(II) and V(V) were measured using atomic absorption spectroscopy (AAS). P(V) and Cl concentrations were determined colorimetrically by UV-Vis spectrophotometry. The results show that thermodynamic stability of studied solid solutions are correlated with regularities of changes in their structure and chemical composition.

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[1] Ma *et. al* (1993) *Environ. Sci. Technol.* **27**, 1803-1810. [2] Ruby *et. al* (1994) *Environ. Sci. Technol.* **28**, 646-654. [3] Pan & Fleet (2002) *Rev. Mineral. Geochem.* (Kohn, Rakovan & Hughes, eds.) **48**, 13-49.