

## **The effect of phosphorus on manganocolumbite and manganotantalite solubility in peralkaline to peraluminous granitic melts**

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### **ABSTRACT**

Solubility experiments of Mn-columbite ( $\text{MnNb}_2\text{O}_6$ ) and Mn-tantalite ( $\text{MnTa}_2\text{O}_6$ ) were conducted under water-saturated conditions in synthetic haplogranitic melts containing different amounts of phosphorus at 800 °C and 100 MPa. All experiments were carried out in cold-seal rapid quenching pressure vessels (RQV) with water as a pressure medium. Experimental results show that: (1) the solubilities of  $\text{MnNb}_2\text{O}_6$  and  $\text{MnTa}_2\text{O}_6$  in peralkaline melts are higher than those in peraluminous melts; (2) phosphorus has strong influence on the solubilities of  $\text{MnTa}_2\text{O}_6$  and  $\text{MnNb}_2\text{O}_6$  in peralkaline melts,  $K_{\text{Sp}}^{\text{Nb}}$  and  $K_{\text{Sp}}^{\text{Ta}}$  decrease from  $104.89 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  and  $107.62 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  for melts without  $\text{P}_2\text{O}_5$  to  $16.11 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  and  $7.96 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  for melts containing ~4.00 wt%  $\text{P}_2\text{O}_5$ , respectively; (3) phosphorus has less influence on the solubilities of  $\text{MnTa}_2\text{O}_6$  and  $\text{MnNb}_2\text{O}_6$  in peraluminous melt,  $K_{\text{Sp}}^{\text{Nb}}$  decrease from  $4.50 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  for melts without  $\text{P}_2\text{O}_5$  to  $0.73 \times 10^{-4} \text{ mol}^2/\text{kg}^2$ , and  $K_{\text{Sp}}^{\text{Ta}}$  from  $3.57 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  to  $0.14 \times 10^{-4} \text{ mol}^2/\text{kg}^2$  for melts containing ~5.00 wt%  $\text{P}_2\text{O}_5$ . Taking the structural role of phosphorus into account, P decreases the solubility of Mn-columbite and Mn-tantalite via competing for network modifiers.

**Keywords:** Columbite, tantalite, solubility, phosphorus, melt