

SN-RICH PHOSPHATES KINTOREITE AND PLUMBOGUMMITE FROM RATIBOŘSKÉ HORY AG-PB-ZN DEPOSIT, CZECH REPUBLIC

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Geological setting

During the revision of the abandoned deposit Ratibořské Hory, phosphates from the plumbogummite group with unusually high contents of Sn were discovered. Historical hydrothermal ore deposit Ratibořské Hory represents a southern part of the Ag-Pb-Zn district Stará Vožice-Ratibořské Hory, situated 8 km northeast of Tábor (Southern Bohemia, Czech Republic). Ag-Pb-Zn district Stará Vožice-Ratibořské Hory is characterized by quartz-carbonate and rarely baryte gangue with abundant galena and sphalerite accompanied by Ag sulphides and with minor Fe-sulphides (ČECH *et al.*, 1952; VRTIŠKA *et al.*, 2019, 2020). Occurrences of supergene minerals there are very sporadic.

Characterization of studied minerals

Plumbogummite and kintoreite are a members of the alunite supergroup with general mineral formula $AB_3(XO_4)_2(OH, H_2O)_6$. Position A is occupied by large mono- (Na^+ , K^+ , Rb^+ , Ag^+ , NH_4^+ , H_3O^+ , Tl^+), di- (Ca^{2+} , Sr^{2+} , Ba^{2+} , Pb^{2+}) or trivalent (Bi^{3+} , REE^{3+}) cations. The octahedrally coordinated position B is usually occupied by trivalent cations such as Fe^{3+} , Al^{3+} , Cr^{3+} , V^{3+} and Ga^{3+} , in some cases it may also contain di- (e.g. Cu^{2+} and Zn^{2+}), or pentavalent (Sb^{5+}) cations. Position X is tetrahedrally coordinated and usually features S^{6+} , P^{5+} and As^5 (KOLITSCH & PRING, 2001; BAYLISS *et al.*, 2010).

Studied phosphates forms yellow, small, finely dispersed aggregates (5–100 μm) in veins with quartz, opal, pyromorphite, acanthite, sphalerite, galena, iodargyrite and undefined Pb-Mn oxide and Sn silicate. **Sn-rich kintoreite** contains in the A-site only Pb (1.01–1.08 *apfu*), B-site is dominated by Fe (2.10–2.85 *apfu*) with contents of Sn (0.16–0.82 *apfu*; up to 15.38 wt.% SnO_2 ; Fig. 1) and Zn (up to 0.11 *apfu*). Its empirical formula (based on P = 2 *apfu*; mean of the 19 point analysis) corresponds to $Pb_{1.05}(Fe_{2.46}Sn_{0.52}Zn_{0.06})_{\Sigma 3.04}(PO_{4.00})(PO_{3.00}OH)(OH)_{6.00}$. In much rarer **Sn-rich plumbogummite** the A-site is dominated by Pb (1.06–1.22 *apfu*). The B-site is occupied by Al (2.37–2.68 *apfu*), Sn (0.51–0.55 *apfu*; up to 11.27 wt.% SnO_2) and Fe (up to 0.05 *apfu*). Its empirical formula (based on P = 2 *apfu*; mean of the 6 point analysis) corresponds to $Pb_{1.14}(Al_{2.50}Sn_{0.52}Fe_{0.52})_{\Sigma 3.06}(PO_{4.00})(PO_{3.00}OH)(OH)_{6.00}$. An intermediate member between Sn-rich plumbogummite and Sn-rich kintoreite was also found. In this **Sn-Al-rich kintoreite** the A-site is occupied by

Pb (0.85–1.06 *apfu*) and Ca (up to 0.07 *apfu*), B-site is dominated by Fe (1.30–2.35 *apfu*) with contents of Al (0.33–0.74 *apfu*), Sn (0.47–1.29 *apfu*; up to 24.92 wt.% SnO_2) and Zn (up to 0.09 *apfu*). The X-site contents dominantly P (1.52–1.91 *apfu*) with minor contents of Si (0.06–0.32 *apfu*) and As (0.00–0.24 *apfu*). Sn contents correlate well with Fe+Al contents, which implies that Sn occupies position B. Such high Sn contents in phosphate minerals have not yet been published.

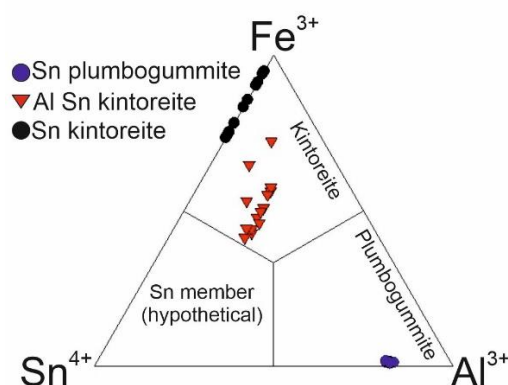


Fig 1.: Ternary diagram of Fe, Al and Sn contents (apfu) in studied phosphates from the Ratibořské Hory

Acknowledgements. This work was financially supported by the Ministry of Culture of the Czech Republic (long-term project DKRVO 2019-2023/1.II.c; National Museum, 00023272).

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