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Bismuth phosphates from the Sítio do Castelo mine, Folgosinho (Portugal): description and Raman spectroscopy

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Abstract

Two bismuth phosphates, zaïrite and monoclinic analogue of ximengite, are described from the Sítio do Castelo mine, Folgosinho (Portugal). Zaïrite is known from Folgosinho for a long time, but no analytical data have been published so far. On the studied samples, it forms bright yellow crystals of variable morphology, from tabular to columnar and spindle-shaped crystals. Electron microprobe analysis showed the relative purity of the zaïrite with a minor content of elements typical for minerals of the plumbogummite group. The empirical formula can be expressed as $(Bi_{0.84}Sr_{0.08}Ca_{0.06}Pb_{0.01})_{\Sigma 0.99}Fe_{3.07}[(PO_4)_{1.91}(SO_4)_{0.09}]_{\Sigma 2.00}[(OH)_{6.01}F_{0.09}]_{\Sigma 6.10}$. The Raman spectrum of zaïrite is dominated by vibrational bands of $(PO_4)^{3-}$ and $(OH)^-$ units. Monoclinic bismuth orthophosphate, unknown as a mineral species until now, was rarely found as aggregate up to 30 μm in size rimmed by zaïrite. Its empirical formula is $(Bi_{0.97}Fe_{0.04}Ca_{0.02})_{\Sigma 1.02}(PO_4)_{1.00}F_{0.09}$. The Raman spectrum agrees with published data for the $BiPO_4$ polymorph of $SbPO_4$-type, space group $P2_1/m$. The two described bismuth phosphates at the Sítio do Castelo mine were formed by the decomposition of unspecified primary bismuth minerals due to the activity of late hydrothermal to supergene phosphorus-rich solutions.

Key words: *zaïrite, plumbogummite group, $BiPO_4$, monoclinic analogue of ximengite, chemical composition, Raman spectroscopy, Folgosinho, Portugal*

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