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Correianevesite, $Fe^{2+}Mn^{2+}_2(PO_4)_2 \cdot 3H_2O$, a new reddingite-group mineral from the Cigana mine, Conselheiro Pena, Minas Gerais, Brazil

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Abstract

Correianevesite, ideally $Fe^{2+}Mn^{2+}_2(PO_4)_2 \cdot 3H_2O$, is a new reddingite-group mineral approved by the CNMNC (IMA 2013-007). It occurs in a phosphate-rich granite pegmatite that outcrops near the Cigana mine, Conselheiro Pena, Rio Doce valley, Minas Gerais, Brazil. Associated minerals are: triphylite, lithiophilite, frondelite, rockbridgeite, eosphorite, vivianite, fairfieldite, leucophosphite, cyrilovite, phosphosiderite, etc. Correianevesite occurs as grayish-brown to reddish-brown transparent bipyramidal crystals up to 4 mm in size. The streak is white, and the luster is vitreous. Mohs hardness is 3½. Cleavage is poor on (010). Fracture is laminated, uneven across cleavage. The measured density is 3.25(2) g/cm^3; the calculated density is 3.275 g/cm^3. The mineral is biaxial (+), $\alpha = 1.661(5)$, $\beta = 1.673(5)$, $\gamma = 1.703(5)$, $2V_{meas} = 70(10)°$, $2V_{calc} = 65.6°$. The IR spectrum confirms the presence of H_2O. The Mössbauer spectrum shows the presence of two sites for Fe^{2+} and one site for Fe^{3+} occupied in the ratio $Fe1^{2+}:Fe2^{2+}:Fe^{3+} = 39:55:6$. The chemical composition is as follows (electron microprobe, H_2O determined by gas chromatography of ignition products, Fe apportioned between FeO and Fe_2O_3 based on Mössbauer data, wt%): MnO 29.21, FeO 21.74, Fe_2O_3 1.54, P_2O_5 34.59, H_2O 12.6, total 99.68. The empirical formula, based on 11 O apfu, is $H_{5.78}Mn_{1.70}Fe^{2+}_{1.25}Fe^{3+}_{0.08}P_{2.015}O_{11}$. The strongest lines of the powder X-ray diffraction pattern [*d*, Å (*I*, %) (*hkl*)] are: 5.08 (43) (020), 4.314 (28) (002, 210), 3.220 (100) (221, 202), 3.125 (25) (122), 2.756 (35) (103, 230), 2.686 (25) (222, 113), 2.436 (22) (123), and 2.233 (23) (411, 331). The crystal structure is solved ($R_1 = 0.0176$). Correianevesite is orthorhombic, space group *Pbna*, $a = 9.4887(2)$, $b = 10.1149(2)$, $c = 8.7062(2)$ Å, $V = 835.60(3)$ Å^3, $Z = 4$. The refined crystal-chemical formula is: $(Fe^{2+}_{0.72}Mn^{2+}_{0.20}Fe^{3+}_{0.08})(Mn_{1.48}Fe^{2+}_{0.52})(PO_4)_2\ (H_2O,OH)_3$.

Keywords: Correianevesite; new mineral; phosphate; reddingite group; Cigana mine, Conselheiro Pena, Rio Doce valley, Minas Gerais, Brazil; crystal structure; Mössbauer spectroscopy