Scheuchzerite, Na(Mn,Mg)$_9$[VSi$_9$O$_{28}$(OH)](OH)$_3$, a new single-chain silicate

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ABSTRACT

Scheuchzerite, Na(Mn,Mg)$_9$[VSi$_9$O$_{28}$(OH)](OH)$_3$, is a new mineral from the metamorphosed syn-sedimentary exhalative Mn deposit of Fianel, Val Ferrera, Central Alps, Switzerland. It is dedicated to the Swiss naturalist Johann Jakob Scheuchzer (1672–1733). Scheuchzerite is associated with saneroite and tiragalloite in veins resulting from the remobilization of ore components during retrograde Tertiary Alpine metamorphism. Scheuchzerite forms yellow-orange, transparent acicular crystals up to 0.5 mm in length with yellow-orange streak and vitreous luster, Mohs' hardness ~2.5, d_{calc} 3.47 (electron micro-probe) to 3.52 g/cm^3 (structure refinement); d_{meas} 3.50(2) g/cm^3, good cleavage parallel to fiber elonga-tion. Scheuchzerite is biaxial positive, n_{min} = 1.74 and n_{max} = 1.75; n_{mean} (Gladstone-Dale) 1.74; weakly pleochroic, X = brown yellow, Y = pale yellow. The empirical chemical formula is Na$_{0.97}$(Mn$_{7.79}$Mg$_{0.95}$Zn$_{0.16}$Ni$_{0.04}$Ca$_{0.03}$Al$_{0.01}$)$_{\Sigma=8.98}$ (V$_{0.95}$As$_{0.02}$Si$_{9.08}$)$_{\Sigma=10.05}$O$_{32.05}$H$_4$. Scheuchzerite is triclinic, $P\bar{1}$, a = 9.831(5) Å, b = 10.107(5) Å, c = 13.855(7) Å, α = 86.222(10)°, β = 73.383(9)°, γ = 71.987(9)°; V = 1254.2(10) Å^3; Z = 2. The crystal structure was solved with direct methods on the basis of 1616 unique reflections with $I > 4\sigma F$ and refined to R_1 = 9.4%. The crystal structure consists of tetrahedral layers separated by layers containing chains of edge-sharing [Mn(O,OH)$_6$] octahedra as well as [NaO$_8$] polyedra. The tetrahedral layers consist of [Si$_9$O$_{25}$(OH)] loop-branched chains of corner-sharing silicate tetrahedra extending along [011]. The loops contain 6 tetrahedra and are separated by 3 tetrahedra in a broken 4-loop arrangement. A hydrogen atom is probably shared by two O atoms (symmetrical hydrogen bond), replacing the missing silicon atom. A vanadate (VO$_4$)$^{3-}$ tetrahedron branches off the 6-tetrahedra loop, and hence the overall formula of the tetrahedral chains is [VSi$_9$O$_{28}$(OH)]. In the notation of Liebau (1985), scheuchzerite is a single chain silicate (monopolysilicate) {olB,1$^1_\infty$}[VSi$_9$O$_{28}$(OH)]. The topology of the scheuchzerite structure is reminiscent of that of the double-chain silicates of the amphibole group, but scheuchzerite contains a new type of silica chain.

Keywords: Scheuchzerite, new mineral, Fianel mine, Val Ferrera, Central Alps, Switzerland, crystal structure, single chain silicate