

Goldschmidtitite, (K,REE,Sr)(Nb,Cr)O₃: A new perovskite supergroup mineral found in diamond from Koffiefontein, South Africa

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ABSTRACT

Goldschmidtitite is a new perovskite-group mineral (IMA No. 2018-034) with the ideal formula (K,REE,Sr)(Nb,Cr)O₃. A single grain of goldschmidtitite with a maximum dimension of ~100 μm was found as an inclusion in a diamond from the Koffiefontein pipe in South Africa. In addition to the dark green and opaque goldschmidtitite, the diamond contained a Cr-rich augite (websteritic paragenesis) and an intergrowth of chromite, Mg-silicate, and unidentified K-Sr-REE-Nb-oxide. Geothermobarometry of the augite indicates that the depth of formation was ~170 km. The chemical composition of goldschmidtitite determined by electron microprobe analysis ($n = 11$, WDS, wt%) is: Nb₂O₅ 44.82, TiO₂ 0.44, ThO₂ 0.10, Al₂O₃ 0.35, Cr₂O₃ 7.07, La₂O₃ 11.85, Ce₂O₃ 6.18, Fe₂O₃ 1.96, MgO 0.70, CaO 0.04, SrO 6.67, BaO 6.82, K₂O 11.53, total 98.53. The empirical formula (expressed to two decimal places) is (K_{0.50}La_{0.15}Sr_{0.13}Ba_{0.09}Ce_{0.08})_{Σ0.95}(Nb_{0.70}Cr_{0.19}Fe_{0.05}Al_{0.01}Mg_{0.04}Ti_{0.01})_{Σ1.00}O₃. Goldschmidtitite is cubic, space group $Pm\bar{3}m$, with unit-cell parameters: $a = 3.9876(1)$ Å, $V = 63.404(6)$ Å³, $Z = 1$, resulting in a calculated density of 5.32(3) g/cm³. Goldschmidtitite is the K-analog of isolueshite, (Na,La)NbO₃. Raman spectra of goldschmidtitite exhibit many second-order broad bands at 100 to 700 cm⁻¹ as well as a pronounced peak at 815 cm⁻¹, which is possibly a result of local ordering of Nb and Cr at the B site. The name goldschmidtitite is in honor of the eminent geochemist Victor Moritz Goldschmidt (1888–1947), who formalized perovskite crystal chemistry and identified KNbO₃ as a perovskite-structured compound.

Keywords: Perovskite, niobium, mantle, diamond inclusion, new mineral, Koffiefontein, Kaapvaal