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Oxy-chromium-dravite and oxy-vanadium-dravite: new end-members of the tourmaline supergroup

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Oxy-chromium-dravite and oxy-vanadium-dravite are new end-member minerals of the tourmaline supergroup, with the ideal formulae $NaCr_3(Cr_4Mg_2)(Si_6O_{18})(BO_3)_3(OH)_3O$ and $NaV_3(V_4Mg_2)(Si_6O_{18})(BO_3)_3(OH)_3O$. Names and formulae were recently approved by the CNMNC (IMA 2011-097 and IMA 11-E). The samples representing these new end-member minerals were found in metamorphic rocks of the Sludyanka crystalline complex, on the southern shore of Lake Baikal (Russia). Oxy-chromium-dravite and oxy-vanadium-dravite are rhombohedral, space group $R3m$, with the respective unit-cell parameters: a = 16.1121(3) Å and 16.1908(4) Å, c = 7.3701(1) Å and 7.4143(2) Å, V = 1656.95(5) Å^3 and 1683.21(7) Å^3. The empirical structural formulae of the type specimen are: $^{X}(Na_{0.98}K_{0.02})\ ^{Y}(Cr^{3+}_{1.95}V^{3+}_{0.87}Mg_{0.14}Ti_{0.04})\ ^{Z}(Cr^{3+}_{3.37}Al_{0.69}Mg_{1.93})\ [^{T}(Si_{5.90}Al_{0.10})O_{18}]\ ^{B}(BO_3)^{V}_{3}(OH_{2.67}O_{0.33})\ \ ^{W}(O_{0.54}F_{0.46})$ and $^{X}(Na_{0.88}K_{0.07}K_{0.05})\ ^{Y}(V_{2.46}Mg_{0.48}Ti_{0.06})\ ^{Z}(V_{3.14}Mg_{1.74}Al_{0.91}Cr_{0.21})\ ^{T}(Si_{5.99}Al_{0.01}O_{18})\ \ ^{B}(BO_3)^{V}_{3}(OH)^{W}_{3}(O_{0.78}OH_{0.14}F_{0.08})$, respectively. The crystal structure of oxy-chromium-dravite and oxy-vanadium-dravite were refined to statistical index $R1$ for all reflections equal to 1.54% 1.44 % (respectively) using single-crystal X-ray data. Both minerals belong to the alkali group, oxy-subgroup 3, of the tourmaline nomenclature. Oxy-chromium-dravite is related to chromium-dravite, ideally $NaMg_3Cr_6(Si_6O_{18})(BO_3)_3(OH)_3OH$, by the heterovalent substitution $Cr^{3+} + O^{2-} \rightarrow Mg^{2+} + OH^{1-}$, to chromo-alumino-povondraite, ideally $NaCr_3(Al_4Mg_2)Si_6O_{18}(BO_3)_3(OH)_3O$, by the substitution $Cr^{3+} \rightarrow Al$ at the Z position of the general tourmaline formula, and to "oxy-dravite", ideally $NaAl_3(Al_4Mg_2)(Si_6O_{18})(BO_3)_3(OH)_3O$, by the substitution $Cr^{3+} \rightarrow Al$ at Y and Z. Oxy-vanadium-dravite is related to "vanadium-dravite", ideally $NaMg_3V_6(Si_6O_{18})(BO_3)_3(OH)_3OH$, by the heterovalent substitution $V^{3+} + O^{2-} \rightarrow Mg^{2+} + OH^{1-}$, and to "oxy-dravite" by the substitution $V^{3+} \rightarrow Al$ at the Y and Z positions.