# Raman investigation of potential new mineral - $Fe^{3+}$-analogue of wadalite from calcareous-silicate xenoliths of the Upper Chegem caldera, Northern Caucasus, Russia

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A new $Fe^{3+}$-analogue of wadalite was discovered in altered calcareous-silicate xenoliths in ignimbrites of Upper Chegem volcanic caldera, Kabardino-Balkaria, North Caucasus, Russia [1,2]. $Fe^{3+}$-analogue wadalite was found in altered larnite-rondorfite skarns, associated with larnite, cuspidine, wadalite, rondorfite, lakargiite, srebrodolskite, reinhardbraunsite, chegemite, hydroxylellestadite, perovskite, dovyrenite, tazheranite, kerimasite, andradite, hillebrandite, awfillite, ettringite group minerals, hydrogrossular [1]. Both high-temperature phases and low-temperature alteration products are associated with $Fe^{3+}$-analogue wadalite [1,3]. It forms fine, numerous crystals, up to 5 µm, together with srebrodolskite in the external zones of rondorfite crystals and usually they are associated with larnite inclusions crystals. Larger crystals, up to 10 µm, form rare inclusions within partially altered larnite grains and are limited to surface of rondorfite as inclusions. Based on microprobe analyses, the calculated empirical formula for $Fe^{3+}$-analogue of wadalite is $Ca_{12.222}(Fe^{3+}_{9.407}Al_{1.259}Si_{2.963}\ Ti^{4+}_{0.112}\ Mg_{0.037})_{\Sigma 13.778}\ O_{31.889}Cl_{5.038}$.

In the present study the $Fe^{3+}$-analogue wadalite $Ca_{12}(Fe^{3+}_{10}Si_4)_{\Sigma 14}O_{32}Cl_6$ spectrum was compared with the spectra of mayenite $Ca_{12}Al_{14}O_{33}$ and wadalite $Ca_{12}(Al_{10}Si_4)_{\Sigma 14}O_{32}Cl_6$. The main bands on Fe-analogue wadalite spectrum are as follows ($cm^{-1}$): 927, 787, 700, 466, 414, 325, 309, 256, 182. A band shift on $Fe^{3+}$-analogue wadalite spectrum to lower frequencies relative to wadalite and mayenite spectra is observed. The main band on mayenite spectrum is 777 $cm^{-1}$ and it is responsible for the $[AlO_4]^{5-}$ stretching vibrations. Intensive bands near 700-710 $cm^{-1}$, responding stretching vibrations of $[Fe^{3+}O_4]^{5-}$, appear on spectra of mayenite and wadalite. One intensive band near 700 $cm^{-1}$ (stretching vibrations of $[Fe^{3+}O_4]^{5-}$) keeps on Fe-analogue wadalite spectrum. In the high-wavenumber region responsible for OH vibrations there are no bands for $Fe^{3+}$-analogue wadalite, which are characteristic for mayenite and wadalite containing both OH-groups and $H_2O$.

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