Gatelite-(Ce), a new REE-bearing mineral from Trimouns, French Pyrenees: Crystal structure and polysomatic relationships with epidote and törnebohmite-(Ce)

PAOLA BONAZZI,[1,*] LUCA BINDI,[1] AND GIANCARLO PARODI[2]

[1]Dipartimento di Scienze della Terra, Università di Firenze, via G. La Pira 4, I-50121 Firenze, Italy
[2]Laboratoire de Minéralogie, Museum National d'Histoire Naturelle, 61 rue Buffon, F-75005 Paris, France

ABSTRACT

Gatelite-(Ce), ideally $(Ca_1REE_3)_{\Sigma=4}[Al_2(Al,Mg)(Mg,Fe,Al)]_{\Sigma=4}[Si_2O_7][SiO_4]_3(O,F)(OH,O)_2$, is a newly identified mineral from the Trimouns talc deposit, Luzenac, Ariège, French Pyrenees. The mineral occurs as striated colorless crystals finely intergrown with minute lamellae of törnebohmite-(Ce). Associated minerals include pyrite, aeschynite-(Y), dolomite, törnebohmite-(Ce), dissakisite-(Ce), talc, and quartz. Gatelite-(Ce) is insoluble in HCl, relatively hard (Mohs hardness 6–7), brittle with irregular fracture, and exhibits good {100} and imperfect {001} cleavages. Gatelite-(Ce) is monoclinic, space group $P2_1/a$, with the following unit-cell parameters: $a = 17.770(4)$, $b = 5.651(1)$, $c = 17.458(4)$ Å, $\beta = 116.18(2)°$, $V = 1573.3(6)$ Å^3, and $Z = 4$. The strongest five powder-diffraction lines [d in Å (I/I_o) (hkl)] are 15.67 (87) (001); 3.49 (50) ($\overline{4}$12); 2.97 (100) ($\overline{2}$15); 2.83 (44) (020); and 2.61 (56) ($\overline{6}$12). Electron-microprobe analysis supported by single-crystal structure determination yielded the following empirical formula: $(Ca_{1.09}La_{0.54}Ce_{1.36}Pr_{0.14}Nd_{0.75}Sm_{0.11}Dy_{0.01}Y_{0.04})_{\Sigma4.04}(Al_{3.06}Mg_{0.51}Fe^{2+}_{0.32}Nb_{0.01})_{\Sigma3.90}Si_{5.06}O_{20.26}(OH)_{1.60}F_{0.14}$. The calculated density (from the empirical formula) is 4.51 g/cm^3. The structure was solved by direct methods and refined to $R_{obs} = 4.65\%$. It consists of edge-sharing octahedral chains running along the **b** axis, cross-linked by SiO_4 and Si_2O_7 groups. The remaining large cavities are occupied by Ca and REE. The structure of gatelite-(Ce) can be easily described as a regular alternance of slabs of epidote-type structure (E) and slabs of törnebohmite-type structure (T) parallel to the (001) plane. Gatelite-(Ce) can be regarded as a ET polisome within a polysomatic series having epidote and törnebohmite as end-members.