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Sodic-ferripedrizite, a new monoclinic amphibole bridging the magnesium-iron-manganese-lithium and the sodium-calcium groups

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ABSTRACT

Sodic-ferripedrizite, ideally Na(LiNa)($Fe^{3+}_2Mg_2Li$)$Si_8O_{22}(OH)_2$, is the second new amphibole end-member found in episyenites formed after cordierite-bearing porphyritic granites in the East Pedriza Massif (Central System, Spain). It is green, vitreous, translucent, non-fluorescent and brittle, and has gray streak, H(Mohs) = 6, splintery fracture, perfect {110} cleavage, D_{meas} = 3.15, D_{calc} = 3.15 g/cm^3. In plane-polarized light, sodic-ferripedrizite is strongly pleochroic, *X* = green blue, *Y* = blue green, *Z* = yellow green ($X > Y > Z$); $Y = b$, $X \wedge c = 4°$, $Z \wedge c = –8°$. It is biaxial positive: α = 1.694 (1), β = 1.698(1), and γ = 1.702(1); $2V_Z$ = 83(2)° and $2V_{Z,calc}$ = 85(3)°, dispersion $r > v$. Sodic-ferripedrizite is monoclinic, space group *C*2/*m*, *a* = 9.536(1), *b* = 17.789(2), *c* = 5.277(1) Å, β = 102.53°, *V* = 873.8(1) Å^3. The five strongest lines in the X-ray powder-diffraction pattern [*d* in Å[*I*] (*hkl*) are 3.397[3](131), 3.056[10](310), 2.749[5](330), 2.699[6](151), and 1.639[4](461). Analysis by electron microprobe and flame photometry gave an average chemical formula of $^{A}(Na_{0.70}K_{0.03})$ $^{B}(Li_{1.34}Na_{0.58}Ca_{0.08})$ $(Mg_{1.75}Fe^{3+}_{1.65}Li_{0.88}Fe^{2+}_{0.32}Al_{0.21}Ti_{0.11}Mn^{2+}_{0.07}Zn_{0.01})Si_{8.00}O_{22}(OH_{1.35}F_{0.65})$. Structure refinement of one crystal of pedrizite and of another crystal with higher clinoholmquistite component, both of which were also analyzed by ion microprobe for light and volatile elements, allowed us to assess Li partitioning among the B- and C-group sites and the active crystal-chemical mechanisms; Li is ordered at the [6+2]-coordinated position in the M4 cavity and at the M3 site. Thus, sodic-ferripedrizite encompasses the different site-preferences and crystal-chemical mechanisms observed for Li in amphiboles of the Mg-Fe-Mn-Li group (clinoholmquistite series) and the Na-Ca group (leakeite series). These data and other recent results on synthetic amphiboles suggest that miscibility between the two groups of B-cations is far more extensive than previously expected.