

## Aiolosite, $\text{Na}_2(\text{Na}_2\text{Bi})(\text{SO}_4)_3\text{Cl}$ , a new sulfate isotypic to apatite from La Fossa Crater, Vulcano, Aeolian Islands, Italy

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### ABSTRACT

Aiolosite, ideally  $\text{Na}_4\text{Bi}(\text{SO}_4)_3\text{Cl}$ , or better  $\text{Na}_2(\text{Na}_2\text{Bi})(\text{SO}_4)_3\text{Cl}$ , is a new sulfate mineral isotypic to apatite. It was found in an active medium-temperature intracater fumarole at La Fossa crater, Vulcano Island, Aeolian archipelago, Sicily, Italy. It occurs as acicular to slender prismatic crystals up to 0.5 mm long in an altered pyroclastic breccia, together with alunite, anhydrite, demicheleite-(Br), demicheleite-(Cl), bismuthinite, and panichiite. The symmetry is hexagonal (class  $6/m$ ), space group  $P6_3/m$ , with  $a = 9.626(3)$ ,  $c = 6.880(3)$  Å,  $V = 552.1(3)$  Å<sup>3</sup>,  $Z = 2$ . The habit is prismatic, terminated by the pinacoid or, more rarely, by a bipyramid. Aiolosite is colorless to white, with white streak; the luster vitreous. It is non-fluorescent. The calculated density is 3.589 g/cm<sup>3</sup>. The mineral is nonpleochroic, uniaxial (+),  $n_o = 1.59(1)$ ,  $n_e = 1.60(1)$ , mean  $n_{\text{obs}} = 1.593$  (589 nm),  $n_{\text{calc}} = 1.620$ . The chemical analysis gave  $\text{Na}_2\text{O}$  20.65,  $\text{K}_2\text{O}$  0.96,  $\text{Bi}_2\text{O}_3$  32.49,  $\text{SO}_3$  41.27,  $\text{Cl}$  4.02,  $\text{Br}$  0.75,  $(\text{H}_2\text{O})$  0.57 from structure refinement),  $-\text{O} = (\text{Cl} + \text{Br})$  0.98 wt%, total 99.73, corresponding to the empirical formula calculated on the basis of 13 anions:  $\text{Na}_2(\text{Na}_{1.95}\text{K}_{0.12}\text{Bi}_{0.83}^{3+})_{22.90}\text{S}_{3.06}\text{O}_{12.08}[\text{Cl}_{0.67}\text{Br}_{0.06}(\text{H}_2\text{O})_{0.19}]_{\Sigma 0.92}$ . The crystal structure has been refined to a final  $R$  index of 0.048. One of the two independent Ca sites of apatite is exclusively occupied by Na, and the other one by statistically distributed Na and Bi. The  $\text{SO}_4^{2-}$  anion replaces the  $\text{PO}_4^{3-}$  anion of apatite; the chloride anion is located in the partially occupied (s.o.f. = 0.81) position at  $x = 0$ ,  $y = 0$ ,  $z = 0$ . Whenever the chloride position is vacant, the position at  $x = 0$ ,  $y = 0$ ,  $z = 1/4$  is occupied by water (s.o.f. = 0.19). The strongest 6 lines in the X-ray powder diffraction pattern [ $d_{\text{obs}}$  (Å) ( $hkl$ )] are: 2.853 (100) (121), 2.775 (85) (112), 3.432 (45) (002), 1.965 (35) (222), 2.306 (25) (310), 4.787 (20) (110). Both the mineral and the mineral name have been approved by the IMA CNMNC (No. 2008-015).

**Keywords:** Aiolosite, apatite structure, new mineral species, bismuth, sulfates, crystal structure, Vulcano Island, Aeolian Islands, Italy