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Buergerite, uniformity of composition

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Abstract

Analaysis of fourteen samples of buergerite indicates they are quite homogeneous in composition, and lack the compositional variation common in many tourmalines.

Buergerite, $NaFe_3^{3+}Al_6Si_6B_3O_{30}F$, is a ferric iron tourmaline. Fe^{3+} occupies the sites normally filled by divalent cations, and there is a concomitant substitution of 3 $(O)^{2-}$ for 3 $(OH)^{1-}$ to effectuate a charge balance. Buergerite is a one-locality mineral; it has been found only at Mexquitic, San Luis Potosi, Mexico, in cavities in rhyolite, and is probably of pneumatolytic origin. It was described by Mason *et al.* (1964) and by Donnay *et al.* (1966).

The tourmaline group exhibits broad and extensive substitution of cations, wherein the monovalent site may be occupied by sodium or calcium, the divalent site by magnesium, ferrous iron, ferric iron, or aluminum/lithium, and the trivalent site by aluminum, ferric iron, or chromium. Inasmuch as only one analysis of buergerite had been published, it was decided to analyze a number of specimens to determine the limits of miscibility between buergerite and the other members of the tourmaline group.

Fourteen buergerite specimens in the collections of the National Museum of Natural History were examined. One crystal was removed from each sample, and the fourteen samples were partially analyzed with an ARL-SEMQ electron microprobe, using an operating voltage of 15 kV and a beam current of 150nA. Type buergerite was used as a standard. The resultant analyses are presented as Table 1. It is obvious from these analyses that there is very little cationic substitution in these buergerites. There is no substitution of Al^{3+} for Si^{4+} in the tourmaline structure (Deer *et al.*, 1962), and the variance in the aluminum content is balanced by a concomitant variation in the iron content, more than 90 percent of which is trivalent (White in Mason *et al.*, 1964). There is very little substitution among the other cations, and these specimens exhibit a quite homogeneous composition, relatively uncommon for a tourmaline. A sectioned crystal (cut normal to *c*) was analyzed by traversing the plane (0001) with no evidence of compositional variation.

An average of the 14 analyses is presented in Table 1, together with the original analysis of the type buergerite. In this average, total iron is calculated as Fe_2O_3. In summary, buergerite, known only from

TABLE 1. Partial microprobe analyses of 14 specimens of buergerite

	Range	Mean	Donnay**
SiO_2	32.99-35.15	34.22	33.86
Al_2O_3	29.33-31.46	30.30	30.79
Fe_2O_3*	17.59-20.04	18.77	19.03***
MgO	0.08- 0.35	0.16	0.13
CaO	0.24- 0.99	0.64	0.69
MnO	0.07- 0.14	0.10	0.13
Na_2O_3	2.32- 2.47	2.38	2.46
TiO_2	0.31- 0.80	0.55	0.55

Accuracy of data ± 2% relative.
*Total iron calculated as Fe_2O_3.
**Plus 0.40 H_2O^+, 0.07 K_2O, 10.86 B_2O_3, 1.86 F. Donnay et al. (1966).
***Iron given by Donnay et al. as 17.62% Fe_2O_3, 1.27% FeO.

Mexquitic, Mexico, is quite uniform in composition, and shows no compositional zoning.

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