MINERALOGICAL NOTES

BUERGERITE, A NEW SPECIES OF TOURMALINE

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The name buergerite is proposed for any tourmaline that has, as its
major component, the idealized end member \( \text{NaFe}_3^3+\text{Al}_6\text{Si}_6\text{B}_3\text{O}_{27}\text{F} \). Buergerite is chemically related to the schoen end member as follows:

\[
\text{NaFe}_3^3+\text{Al}_6\text{Si}_6\text{B}_3\text{O}_{27}(\text{OH})_4\text{F} \leftrightarrow \text{NaFe}_3^3+\text{Al}_6\text{Si}_6\text{B}_3\text{O}_{27}\text{F} + 3/2\text{H}_2\text{O}.
\]

A ferric tourmaline from Mexquitic, San Luis Potosi, Mexico, has the
following composition, which supersedes the one previously reported
(Mason et al., 1964): \( \text{SiO}_2 \) 33.86, \( \text{B}_2\text{O}_3 \) 10.86, \( \text{Al}_2\text{O}_3 \) 30.79, \( \text{TiO}_2 \) 0.55,
\( \text{Fe}_2\text{O}_3 \) 17.62, \( \text{FeO} \) 1.27, \( \text{MnO} \) 0.13, \( \text{MgO} \) 0.13, \( \text{CaO} \) 0.69, \( \text{Na}_2\text{O} \) 2.46,
\( \text{K}_2\text{O} \) 0.07, \( \text{H}_2\text{O}^- \) none, \( \text{H}_2\text{O}^+ \) 0.40, \( \text{F} \) 1.86, sum 100.69-(O=F) 0.78
= 99.91%. Spectrographic examination (by N. H. Suhr) shows Sr, Ba,
Cr, Be, Ni, Co, V less than 0.017%. Fluorine was determined, after \( \text{Na}_2\text{O} \) fusion and steam distillation
from phosphoric acid, by thorium nitrate titration (Ingamells, 1962).

Tourmaline requires special analytical methods. After fusion with
\( \text{Na}_2\text{O} \) in platinum at 500°C. (Belcher, 1963), \( \text{H}_2\text{BO}_3 \) was used to remove
fluorine, then \( \text{CH}_3\text{OH} \) to remove most of the boric acid, before hydro-
chloric acid dehydration of the \( \text{SiO}_2 \). Boron contamination of the amno-
group oxides was determined by the curcumin method of Heyes and
Metcalfe (1963). Manganese, calcium and magnesium were separated as
usual with persulfate, oxalate, and phosphate respectively.

Boron was determined after \( \text{Na}_2\text{O}_2-\text{Na}_2\text{CO}_3 \) fusion, leaching with
water, filtration, and a \( \text{CaCO}_3 \) precipitation, by second derivative poten-
tiometric acid base titration of the filtrate using mannitol (Frank,
1963). All precipitates and residues were combined, ignited at low tem-
perature, mixed, and examined for boron with curcumin. About 3 per
cent of the boron in the sample was retained by the residues, so that
failure to examine them would have caused appreciable error.

Fluorine was determined, after \( \text{Na}_2\text{O}_2 \) fusion and steam distillation
from phosphoric acid, by thorium nitrate titration (Ingamells, 1962).

For sodium and potassium, a sample was dissolved in dilute nitric
acid after \( \text{LiBO}_2 \) fusion (Ingamells, 1964), and the flame photometer was
used. Colorimetric determinations of Fe, Al, Ti, and Mn on the same
solution gave values which agree within 1 per cent with those obtained
in the detailed analysis.

Ferrous iron was determined by the pyrophosphate method (Ingam-
mells, 1960), and confirmed by an Fe K absorption-edge study by E. White (priv. comm.), who estimates that more than 90 per cent of the iron is in the ferric state.

It is known that the structure of tourmaline contains 150 atomic sites per cell. On this basis (Donnay, 1964), the cell content of the Mexquitic mineral is

$$(\text{Na}_2.17\text{K}_{0.06}\text{Ca}_{9.18})(\text{Fe}^{3+}_{6.87}\text{Fe}^{2+}_{0.52}\text{Ti}_{0.21}\text{Mg}_{0.16}\text{Mn}_{0.06}\text{Al}_{14.81})\text{Al}_{18.09}\text{B}_{9.27}(\text{Si}_{17.51}\text{B}_{0.42})$$$$(\text{O}_{38.76}\text{OH}_{1.22})(\text{F}_{2.08}\text{OH}_{0.16})$$

The crystals have short prismatic habit and show the forms \{1120\}, \{30\30\}, \{10\11\}, \{02\21\}. Goniometric measurements gave $c/a = 0.4521$. Single crystal and diffractometer data gave $a = 15.873$, $c = 7.187$ Å, standard deviation 0.002 Å, $c/a = 0.4528$. The mineral has a distinct prismatic cleavage, in contrast to the very poor cleavage usually reported for tourmaline. A plot of $c$ vs. $a$ shows that this tourmaline falls outside the usual series limits (Mason et al., 1964, Fig. 1).

Crystals are dark brown, almost black, with a bronze schiller and a yellow-brown streak. Optically uniaxial, negative, with $\omega = 1.735$, $\epsilon = 1.655$ (both ± 0.003), birefringence 0.080 (nearly twice the maximum previously reported for tourmalines), pleochroic with $\omega$ yellow-brown, $\epsilon$ very pale yellow. $G = 3.31 ± 0.01$ (higher than other tourmalines).

Material with similar unit cell and composition ($a = 15.860$, $c = 7.173$ Å) has been synthesized hydrothermally by Mr. Randolph Barton, Jr., in Professor H. Eugster’s laboratory at the Johns Hopkins University.

The type material has been deposited in the American Museum of Natural History (specimen no. 35468), New York, N.Y.

The name honors Professor M. J. Buerger, Massachusetts Institute of Technology, in whose laboratory much work on the structure of tourmaline has been carried out. The Commission on New Minerals and Mineral Names, I.M.A., has approved the name in advance of publication.

References


