COMPOSITION OF VEATCHITE[1]

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ABSTRACT

Veatchite was described in 1938 as a hydrous calcium borate, $2CaO \cdot 3B_2O_3 \cdot 2H_2O$, a lower hydrate of the colemanite-inyoite series. Reinvestigation shows that it is a strontium borate with the probable formula $3SrO \cdot 8B_2O_3 \cdot 5H_2O$.

INTRODUCTION

Veatchite was described by Switzer[2] as a new hydrous calcium borate, $2CaO \cdot 3B_2O_3 \cdot 2H_2O$, from Lang, California. Shortly thereafter it was pointed out by Dr. W. T. Schaller[3] of the U. S. Geological Survey that on the basis of his studies of the colemanite-meyerhofferite-inyoite series[4] the physical properties of veatchite were not consistent with its chemical composition, as given. It was at his suggestion, therefore, that veatchite was re-examined. A spectrographic examination of veatchite, kindly made by K. J. Murata of the U. S. Geological Survey, showed that the mineral is a strontium borate and not a calcium borate, as first reported. Veatchite is the only known naturally occurring strontium borate.

In a second find of veatchite, recently made at Lang, the mineral has a platy rather than a fibrous habit. It occurs in thin seams associated with colemanite in gray shale. Surfaces parallel to these seams are coated by a very thin layer of veatchite having a pronounced pearly luster.

Although veatchite is the first reported strontium borate, other strontium minerals are found in or near many of the Mohave Desert region borate deposits. Strontianite is found in deposits of commercial importance 10 miles north of Barstow, San Bernardino County, California.[5] Celestite has been noted in the borate deposits at Borate, San Bernardino County, California; at Mt. Blanco, Death Valley, California, and at White Basin, Clark County, Nevada.

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[1] Published by permission of the Secretary, Smithsonian Institution, and of the Director, U. S. Geological Survey.

[2] Switzer, George, Veatchite, a new calcium borate from Lang, California: *Am. Mineral.*, **23**, 409–411 (1938).

[3] Personal communication.

[4] Schaller, W. T., Borate minerals from the Kramer district, Mohave Desert, California: *U. S. Geol. Survey, Prof. Paper* **158**, 169 (1930).

[5] Knopf, Adolph, Strontianite deposits near Barstow, California: *U. S. Geol. Survey, Bull.* **660**, 257–270 (1917).

CHEMICAL ANALYSES

The original analysis of veatchite reported SrO+CaO all as CaO, resulting in an incorrect formula being deduced. The spectrographic analysis, showing dominant strontium, also showed that a little calcium was present so that a new chemical analysis was required.

A new partial analysis of the type material (Table 1, column 1) was made on a sample very kindly furnished by Dr. Clifford Frondel of Harvard University. The analysis given in Table 1, column 3 was made on the material of platy habit described above. Both new analyses were of necessity made upon 0.1 to 0.2 gram samples.

TABLE 1. CHEMICAL ANALYSES OF VEATCHITE

	1 ✓	2 ✓	3 ✓	4	5	6	7	8	9
SrO	29.5	29.7	29.8	30.3	31.08	31.20	30.0	$.317=3\times.106$	32.45
CaO	1.7	1.7	1.3	1.4			1.6		
B_2O_3	57.3	57.8	57.7	58.6	59.03	59.26	58.5	$.840=8\times.105$	58.16
$H_2O(+)$			9.6	9.7	9.50	9.54	9.6	$.533=5\times.107$	9.39
Insol.	1.0				0.62				
			98.4	100.0	100.23	100.00	100.00		100.00

1. Veatchite, Lang, California. Fibrous habit. New partial analysis of type material. (Harvard Museum No. 92944 and U. S. National Museum No. 105697) W. W. Brannock, analyst.
2. Same as 1, recalculated to correct for insoluble.
3. Veatchite, Lang, California. Platy habit (U.S.N.M. R-8327). W. W. Brannock, analyst.
4. Same as 3, corrected for insoluble and calculated to 100%.
5. Veatchite, Lang, California. Original analysis. F. A. Gonyer, analyst.
6. Same as 5, corrected for insoluble and calculated to 100%.
7. Average of 2, 4 and 6.
8. Molecular ratios. Formula becomes $3(Sr, Ca)O.8B_2O_3\cdot 5H_2O$.
9. Calculated composition for $3SrO\cdot 8B_2O_3\cdot 5H_2O$.

The chemical data are summarized in Table 1. The molecular ratios in best agreement indicate the probable formula to be $3(Sr,Ca)O.8B_2O_3 \cdot 5H_2O$. A possible alternate formula $SrO\cdot 3B_2O_3\cdot 2H_2O$ is obtained if the ratios $SrO=1\times.317$, $B_2O_3=3\times.280$ and $H_2O=2\times.275$ are chosen. Additional analyses on larger amounts of material will be needed to demonstrate positively which formula is correct.

UNIT CELL DIMENSIONS

The unit cell dimensions were given by Switzer[6] as $a_0=6.72$ Å, $b_0=41.26$ Å, $c_0=41.20$ Å. These values, though given as Angstrom units were in reality in *kX* units. However, precision of the measurements is such that the difference is not significant. The best value of β is probably that of Murdoch[7] who gives $\beta = 121° \ 02^1$.

Using the values given above and a unit cell content of 16[$3SrO \cdot 8B_2O_3 \cdot 5H_2O$], the calculated density becomes 2.586. This value compares favorably with the measured value 2.58.[8]

If the alternate formula $SrO \cdot 3B_2O_3 \cdot 2H_2O$ is used and the unit cell content taken as 44[$SrO \cdot 3B_2O_3 \cdot 2H_2O$], the calculated density becomes 2.590.

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[6] *Op. cit.*

[7] Murdoch, Joseph, Crystallography of veatchite: *Am. Mineral.*, **24**, 130–135 (1939).

[8] Murdoch, Joseph, *op. cit.*