VEATCHITE, A NEW CALCIUM BORATE FROM LANG, CALIFORNIA

George Switzer, *Harvard University, Cambridge, Mass.*

Abstract

Veatchite, $Ca_2B_6O_{11} \cdot 2H_2O$, is a new mineral from Lang, California. It is monoclinic, with lattice constants $a_0 = 6.72$Å, $b_0 = 41.26$Å, $c_0 = 41.20$Å, $\beta = 67°$. Perfect {010} and imperfect {001} cleavages; H=2, G=2.69. Biaxial, positive; $Z{:}c[001] = -38°$, $Y = b[010]$; indices (Na): $nX = 1.551$, $nY = 1.553$, $nZ = 1.621$, all ±0.002; 2V=37°. Occurs in white cross-fibre veins in limestone and howlite.

Introduction

The mineral here described was found by Mr. William H. Nisson, of Petaluma, California, at the old colemanite mine at Lang, Los Angeles County, California, in September 1936. Veatchite, as the new species will be named, occurs in white cross-fibre veins up to 6 mm. across, with dark grey clay, cutting massive white limestone and howlite. The new species is apparently rare, since only a few small specimens have been found.

Morphology

No terminated crystals of veatchite were found. The vein fibres are rather coarse (up to 1 mm. across) and exhibit two cleavages. The better cleavage is *b*{010}. The other cleavage is at an angle of 67° (±1°) to the length of the fibres and is taken as *c*{001}. The symmetry is thus probably monoclinic. The perfect *b*{010} cleavage produces very thin plates tabular parallel to *b*{010} and elongated parallel to the length of the fibres, terminated at either end by the imperfect basal cleavage. The fibres form subparallel aggregates, and it is only by cleaving down to a very thin plate that a single individual can be obtained.

Physical Properties

The cleavage of veatchite is perfect and easy parallel to *b*{010}, and imperfect parallel to *c*{001}. The hardness is 2. The specific gravity determined by suspension in bromoform is 2.69. It is clear and colorless with a silky luster.

Optical Properties

	n(Na)		
X	1.551	±0.002	Positive
$Y = b[010]$	1.553		$2V = 37°(\pm 2°)$
$Z{:}c[001] = -38°$	1.621		Dispersion $r > v$, perc.

X-RAY MEASUREMENTS

Rotation photographs were taken on cleavage fragments with both $c[001]$ and $a[100]$ as axes of rotation. A Weissenberg photograph was taken with $c[001]$ as the rotation axis, the zero and first layer lines appearing on the same picture because of the extremely long translation distance along the c axis. These photographs gave a monoclinic unit cell with the dimensions:

$$a_0=6.72\text{ Å},\ b_0=41.26\text{ Å},\ c_0=41.20\text{ Å},\ \beta=67° \text{ (from morphology)}$$

$$\text{Axial ratio: } a_0{:}b_0{:}c_0=0.163{:}1{:}0.998.$$

Using the unit cell dimensions given above and a density of 2.69, the molecular weight of the unit cell becomes 17,126.

The space group was not determinable because of the uncertainty of indexing all of the spots due to the large dimensions of the unit cell in the directions c and b.

COMPOSITION

Table 1 gives the chemical analysis and the atomic content of the unit cell using the molecular weight 17,126.

TABLE 1. ANALYSIS OF VEATCHITE AND CONTENT OF UNIT CELL

	1.	2.	3.	4.		5.	6.	
CaO	31.08	31.20	$0.5563=2\times 0.2782$	Ca	95.4	96	CaO	31.41
B_2O_3	59.03	59.26	$0.8510=3\times 0.2873$	B	291.4	288	B_2O_3	58.51
H_2O	9.50	9.54	$0.5300=2\times 0.2651$	O	623.3	624	H_2O	10.08
Insol.	0.62			H	181.6	192		
	100.23	100.00						100.00

1. Analysis by F. A. Gonyer.
2. Analysis calculated to 100%.
3. Molecular ratios.
4. Atomic content of the unit cell.
5. Theoretical unit cell content for $48(Ca_2B_6O_{11}\cdot 2H_2O)$.
6. Calculated composition for $Ca_2B_6O_{11}\cdot 2H_2O$.

The calculated density using the theoretical unit cell content is 2.665.

Pyrognostics. Before the blowpipe, on charcoal, veatchite fuses at 1.5 with intumescence to an opaque white bead. It gives the characteristic greenish yellow boron flame. In the closed tube it yields a moderate amount of water, which gives a strong acid reaction.

THE SYSTEM $R_2B_6O_{11}\cdot nH_2O'$

The formula $Ca_2B_6O_{11}\cdot 2H_2O$ for veatchite places it in the same chemical system with five other calcium and magnesium borates. Table 2 tabulates some of the properties of this system in order of increasing degree of hydration.

TABLE 2

Name	Composition	Density	Mean Ref. Index	Crystal System	Cleavage
Veatchite	$Ca_2B_6O_{11}\cdot 2H_2O$	2.69	1.586	Mono.	{010} per. {001} imp.
Colemanite	$Ca_2B_6O_{11}\cdot 5H_2O$	2.42	1·600	Mono.	{010} per. {001} dis.
Hydroboracite	$CaMgB_6O_{11}\cdot 6H_2O$	2.17	1.548	Mono.	{010} per. {001} per.
Meyerhofferite	$Ca_2B_6O_{11}\cdot 7H_2O$	2.12	1.530	Tri.	{010} per.
Inyoite	$Ca_2B_6O_{11}\cdot 13H_2O$	1.87	1.510	Mono.	{001} per.
Inderite[1]	$Mg_2B_6O_{11}\cdot 15H_2O$	1.80	1.490		

It is noteworthy in the above table that the specific gravity becomes less with increasing degree of hydration; that there is a more or less systematic change in the mean index of refraction; and that all the members of the system have at least one perfect cleavage, usually *b*{010}.

OCCURRENCE

The minerals of the system $R_2B_6O_{11}\cdot nH_2O$ occur intimately associated in deposits of a similar nature in several California localities, along with other borates, usually ulexite ($NaCaB_5O_9\cdot 8H_2O$) and howlite ($H_5Ca_2B_5SiO_{14}$). Colemanite is always the most abundant mineral. Such deposits are found at Lang, Borate, several localities in Ventura County, and in the Ryan and Mt. Blanco districts near Death Valley. They are all interbedded with lake bed deposits of Tertiary age.[2]

The exact mode of occurrence of veatchite at Lang is not known. Although the specimens show veatchite veins cutting limestone and howlite, they were found as part of a small boulder lying in the wash, and none of the material has yet been found in place.

Name. It seems fitting to name this new borate *veatchite* after Dr. John A. Veatch, who was the first to detect the presence of borates in the mineral waters of California, on January 8, 1856, as related in a letter from Dr. Veatch to Henry G. Hanks, in the California State Mining Bureau, Third Annual Report of the State Mineralogist (1883).

ACKNOWLEDGMENTS

The writer wishes to acknowledge the interest shown, and assistance given, in the preparation of this paper by Professor Charles Palache, Dr. Harry Berman, Mr. W. E. Richmond and Mr. F. A. Gonyer of Harvard University.

---

[1] Godlevsky, M. N., Mineralogical Investigation of the Inder borate deposit: *Mem. Soc. Russ. Mineral., 2d Ser.*, vol. **66**, No. 2, pp. 315–344, 1937.

[2] Foshag, W. F. The origin of colemanite deposits: *Econ. Geol.*, vol. **16**, p. 203, 1921.