ADDITIONAL NOTES ON LAUMONTITE AND THOMSONITE FROM TABLE MOUNTAIN, COLORADO

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INTRODUCTION

Table Mountain, a conspicuous geological feature near Golden, Colorado, has long been known as a locality for zeolites. Cross and Hillebrand,[2] Patton,[3] Clarke and Steiger[4] have described these minerals in detail and since then several other articles have appeared on the zeolites from this locality, but the various authors have added no new analyses of laumontite. Hey[5] recently published two analyses of thomsonite but aside from these no recent analyses of the Table Mountain thomsonite have been reported.

On a recent visit (by E. P. H.) to the quarry located on the western rim and well to the southern end of North Table Mountain, considerable quarrying was done in the hope of exposing some suitable mineral specimens. A number of different zeolites were exposed and among them a golden-brown sandy laumontite which almost completely fills some of the vesicular cavities in the basalt. All the zeolites obtained by the author's quarrying activities were inferior mineral specimens, but the Colorado School of Mines which operated this quarry several years ago kindly donated to the U. S. National Museum a suite of good specimens of the different zeolites from this locality.

LAUMONTITE

The specimen studied came from the Colorado School of Mines and had been exposed to the air in their collections for several years without any special precautions to prevent dehydration. Because of its apparent freshness and unusual golden-brown color this material seemed worthy of an investigation to determine if it were a normal laumontite. A very narrow reddish-brown reaction ring confined within the altered basalt follows the contact of the vesicu-

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

[2] *Amer. Jour. Sci.*, **23,** p. 452, 1882; **24,** p. 129, 1882; and *U. S. Geol. Surv., Bull,* **20,** p. 13, 1885.

[3] *Geol. Soc. Amer. Bull.*, **11,** p. 461, 1900.

[4] *U. S. Geol. Surv., Bull.* **207,** p. 34, 1902.

[5] *Mineral. Magazine,* **33,** p. 54, 1932.

lar cavity, largely filled with the zeolites, and shows that the solutions introducing the zeolites have had some effect upon the basalt.

A sharply defined veinlet of brown thomsonite, about one quarter of an inch wide, separates a band of light brown compact laumontite of about equal thickness from the loosely bonded golden-brown laumontite in the center of the cavity. This thomsonite veinlet is discontinuous in several places and the compact laumontite fills the gap and grades gradually out into the golden-brown laumontite in the center. Little or no alteration has taken place within this thomsonite veinlet. There are, however, small segregations of brown iron oxide confined to the thomsonite along its contact with the golden-brown laumontite.

The golden-brown laumontite which fills the central portion of this cavity is quite uniform in texture and almost free from other zeolites. A few isolated spherulites of thomsonite are present, mostly limited to regions close to the thomsonite veinlet. As you proceed farther into the laumontite and away from the thomsonite veinlet, the more altered the spherulites become. The alteration product of the thomsonite is a soft white powder which in most cases preserves the original form of the spherulite. During the alteration there has been a decrease in volume as many of these white powdery spherulites are now hollow shells. Minor cracks in the golden-brown laumontite have been filled with a later generation of colorless laumontite.

The laumontite has a very uniform golden-brown color and bright luster, without the slightest suggestion of any alteration or apparent dehydration, thus differing from most laumontites. The texture is granular, the individual grains being slightly elongated with a few rather poorly developed faces in the prismatic zone. No terminal faces were seen.

The following optical determinations[6] were made on the same sample of the golden-brown laumontite whose analysis is given in Column 1 of Table II.

$\alpha = 1.504, \beta = 1.514, \gamma = 1.516$, Optically $(-)$, $2V = 25°–35°$, dispersion $\rho < v$. Extinction highly inclined, $c \wedge Z = 30°–36°$.

The indices of this laumontite are considerably lower than those given by Larsen[7] but are consistent with the values reported by

[6] Optical determinations made by J. J. Glass.

[7] *U. S. Geol. Surv., Bull.* **679**, p. 245, 1921.

him[8] for the material from Wolf Creek Station, Montana, analyzed by Shannon, and for that described by McClellan[9] from the Cascade Mountains, Oregon, also analyzed by Shannon.

TABLE I. COMPARISON OF OPTICAL INDICES OF LAUMONTITE

	1	2	3	4
α	1.504	1.513	1.505	1.505
β	1.514	1.525	1.515	—
γ	1.516	1.524	1.517	1.513
$\gamma-\alpha$	0.012	0.011	0.012	0.008

(1) Table Mt., Colo.
(2) Locality not reported. *Op. cit.*
(3) Wolf Creek Station, Mont. *Op. cit.*
(4) Cascade Mountains, Oreg. *Op. cit.*

The birefringence of numbers 1, 2, 3, are all consistent even though the indices of no. 2 are considerably higher than the others.

TABLE II. ANALYSES AND RATIOS OF LAUMONTITES FROM TABLE MT., COLORADO

	1	2	3
	Golden-brown	Yellow Crystals	White crystals
SiO_2	50.82	51.43	52.07
Al_2O_3	20.06	21.52	21.30
Fe_2O_3	2.18	0.94	—
CaO	12.14	11.88	11.24
MgO	0.02	—	—
K_2O	0.22	0.35	0.42
Na_2O	0.31	0.19	0.48
H_2O	14.87	13.81	14.58
V	None	N.D.	N.D.
Total	99.97	100.12	100.09
RO	1.00	1.00	1.00
R_2O_3	1.01	0.96	0.98
SiO_2	3.76	3.90	4.11
H_2O	3.68	3.50	3.81

(1) E. P. Henderson, analyst.
(2, 3) W. F. Hillebrand, analyst.

The uniform bright golden-brown color and the freedom from any alteration indicates that the 2.18 percent ferric iron is present

[8] *Amer. Min.*, **6**, p. 6, 1921.
[9] *Amer. Min.*, **11**, p. 287, 1926.

isomorphously with the alumina. Qualitative tests showed no vanadium present. The molecular ratio between $R_2O_3(Al_2O_3+Fe_2O_3)$ and RO ($CaO+K_2O+Na_2O$) is 1.01:1.00. Winchell[10] selected a series of analyses of laumontite in which the ratio between Al_2O_3 and $CaO+Na_2O$ was 1:1, and if these same analyses are averaged for their molecular ratios the following proportions are obtained:

$$RO:R_2O_3:SiO_2:H_2O = 1.00:1.01:4.05:3.65.$$

When the molecular ratios of this golden brown laumontite are compared with the averages given, there is close agreement, except for the SiO_2. The silica ratio of this golden-brown laumontite is 7.16% lower than the averaged ratios.

Thomsonite

The best of the closely packed small brown spherulites of thomsonite, associated with the brown laumontite, were selected for analysis with the object of confirming the identity of the mineral rather than of describing an unusual variety of thomsonite.

Table III. Analyses and Molecular Ratios of Thomsonite from Table Mt., Colorado

	1	2	3
SiO_2	38.55	40.3	40.73
Al_2O_3	29.08	28.5	29.93
Fe_2O_3	1.89	—	—
CaO	12.14	11.2	12.17
Na_2O	4.38	5.7	4.66
K_2O	0.44	—	—
H_2O	14.02	14.1	12.55
MgO	0.04	—	—
	100.77	99.8	100.04
RO	1.00	1.00	1.00
R_2O_3	1.01	0.97	1.00
SiO_2	2.19	2.32	2.31
H_2O	2.66	2.70	2.38

(1) E. P. Henderson, analyst.
(2, 3) M. H. Hey, analyst, *Op. cit.*

[10] *Amer. Min.*, **10**, p. 112, 1925.

The material selected, by hand picking, for the analysis was not entirely free from impurities as it was impossible to remove all of the adhering laumontite and brown iron oxide. However, the percentages of these impurities in the sample analyzed are very small.

The optical properties[11] determined upon the analyzed material, Column 1, Table III, are as follows: $\alpha = 1.518$, $\beta = 1.521$, $\gamma = 1.531$. Optically +, $2V = 54°$ (measured), dispersion $\rho > v$. Orientation, $a = X, b = Z, c = Y$.

A small portion of the thomsonite showed a larger axial angle, $2V = 72°$ (measured). Also a portion, obtained from the hand picked sample, had somewhat lower indices of refraction, namely $\alpha = 1.513$, $\beta = 1.519$, $\gamma = 1.527$. No intermediate values were obtained.

The purpose of this paper is to place on record two new analyses and accompanying optical data. No additional relationships between the different zeolites at this locality were noted.

[11] Determined by J. J. Glass.

NOTES AND NEWS

NOMINATIONS FOR OFFICERS OF THE MINERALOGICAL SOCIETY OF AMERICA FOR 1934

The Council has nominated the following for officers of the Mineralogical Society of America for the year 1934:

PRESIDENT: John E. Wolff, Pasadena, California.

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TREASURER: Waldemar T. Schaller, U. S. Geological Survey, Washington, D. C.

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EDITOR: Walter F. Hunt, University of Michigan, Ann Arbor, Michigan.

COUNCILOR (1934–1937): Edward P. Henderson, U. S. National Museum, Washington, D. C.

The fourteenth annual meeting of the Society will be held December 27–29, 1933, at the University of Chicago, Chicago, Illinois. It is planned to publish in the December issue of the Journal a *preliminary* list of titles of papers to be presented before the Society at its annual meeting. In order to appear on the advance program, titles of papers should be in the hands of the Secretary *pro tem.* by *November 10.*

ALBERT B. PECK (Ann Arbor, Mich.), *Secretary, pro tem.*

* Due to the sudden death of Dr. Van Horn on Aug. 1, 1933, the Council has not had an opportunity, at the time this issue goes to press, to recommend his successor. The Council's recommendation for this and other offices of the Society will be printed on the official ballot and mailed to all fellows and members about Nov. 1, 1933.