TOPAZ AND PHENACITE FROM BALDFACE MOUNTAIN, CHATHAM, NEW HAMPSHIRE

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INTRODUCTION

In the mineralogical collections at Harvard University there are approximately two hundred crystals of topaz and forty crystals of phenacite from South Baldface Mountain, Chatham, New Hampshire. The specimens were collected by E. C. Andrews of Chatham about thirty or forty years ago and purchased from him about 1910. Kunz[1] called attention to this occurrence of topaz and phenacite in 1890 and Eakle[2] published a brief paper on the topaz in 1898. The phenacite has been studied crystallographically by Farrington and Tillotson[3] and also by Schaller.[4]

GEOLOGICAL RELATIONS

The present writer has visited the pocket from which some of the topaz and phenacite are reputed to have come. It is a very irregular ellipsoid in shape, being about five feet along its greatest axis. A detailed study of the mineralogy has not yet been made, but the pegmatite is composed essentially of perthitic feldspar, smoky quartz, and biotite. Apparently many of the topaz and phenacite crystals found by Andrews were detached, lying on the floor of the pocket, or more commonly in the talus of the mountain slopes. The phenacite was implanted on smoky quartz, topaz, or feldspar. The pocket mentioned is located on the east slope of South Baldface Mountain, at about 2900 feet elevation; a number of other pockets are found in the vicinity. The country rock is a medium textured somewhat miarolitic alkaline biotite granite exposed as an oval-shaped stock, the north-south axis of which is a mile and a half long. This stock is satellitic to the late Paleozoic alkaline batholith of the White Mountains.

[1] Kunz, G. F. GEMS AND PRECIOUS STONES OF NORTH AMERICA, p. 100, **1890.**

[2] Eakle, A. S. Topaz Crystals in the Mineralogical Collection of the United States National Museum. *Proc. U. S. National Museum*, pp. 361–369, **1898.**

[3] Farrington, O. C. and Tillotson, E. W., Jr. Notes on Various Minerals in the Museum Collection. *Field Columbian Museum Publications, Geological Series*, Volume **3**, pp. 131–163, 1908.

[4] Schaller, W. T. Phenacite from New Hampshire. *Bulletin* **490**, *U. S. G. S.*, pp. 53–54., 1911. *Zeit. Kryst.*, **48**, p. 554, 1910.

TOPAZ

DESCRIPTION OF THE FORMS. The topaz crystals vary in size from the largest whose dimensions are nine by six centimeters to those less than a centimeter in diameter. They are in general of short or moderate prismatic development, and bounded at one end by a cleavage plane. A number are however doubly terminated, often with extreme distortion of the terminal faces. They are clear and either colorless or faintly pink, sometimes with a bluish border. The ten crystals measured completely yielded the forms of the following table. The letters and axes of Dana's System are used. The angles agreed on the whole very well with those given in Goldschmidt's Winkeltabellen.

TABLE I. FORMS ON TOPAZ FROM SOUTH BALDFACE MOUNTAIN.

c (001)	Often present, either as a narrow facet or occasionally as a broad face.
b (010)	Not rare, but inconspicuous.
m (110), *l* (120)	Always present and one or both dominant in the prism zone.
M (230)	Rare and narrow face.
π (250), *g* (130)	Observed, as narrow facets, but once.
G (065)	Rare and narrow face.
X (043)	Common and sometimes dominant brachydome.
K (085), *J* (053)	Rare and narrow forms.
f (021)	Usually the dominant brachydome and a center of interesting zones.
y (041)	Common, sometimes large.
h (203), *d* (201)	Common faces, often well developed.
δ (405)	Seen but once.
i (223), *u* (111), *o* (221)	All of these pyramids are generally present with variable development.
r (241)	Seen but once.

NEW AND RARE FORMS. The unique feature of the topaz from Baldface Mountain is a series of narrow pyramid faces grouped about the brachydome *f*(021). Their zonal relations are well shown in the gnomonic projection, fig. 1, which contains also the forms of Table 1. The form $\mathfrak{A}$ (1•11•6) lies at the intersection of the zone $[11\bar{2}]$, which contains *f* and *u*, and the zone $[9\bar{3}4]$, which contains *X* and *g*. $\mathfrak{D}$ (2•18•9), $\mathfrak{F}$ (2•24•11), and $\mathfrak{H}$ (2•30•13) all lie in the zone $[92\bar{6}]$ containing *h* and (031) and at the intersections with it of the three zones $[01\bar{2}]$, $[1\bar{1}2]$, and $[2\bar{1}2]$ containing

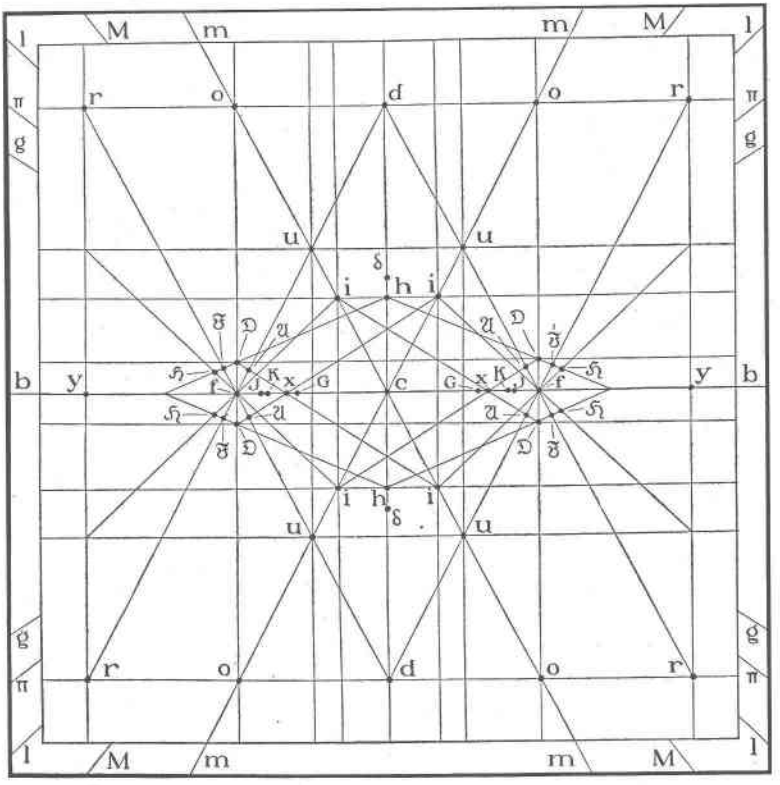

Figure 1. Gnomonic Projection of Topaz from Baldface Mtn.

respectively the forms *f* and *o*, *f* and *m*, and *f* and *l*. Although these forms have complex indices, the fact that they are true forms is demonstrated not only by the definite zonal relations but also by the number of times they were observed and the constancy of the angles. The form $\mathfrak{D}(2\cdot18\cdot9)$ was noted sixteen times; in ten of these cases the edges were so rounded that a blurred and continuous signal resulted, but in six cases the signal was sufficiently good for accurate measurement and the readings are noted in the accompanying table. The close agreement of the measured and calculated values emphasizes the legitimacy of the form. The form $\mathfrak{A}$ $(1\cdot11\cdot6)$ is nearly as well developed; in four of the ten occurrences the signal was sufficiently sharp for purposes of calculation. The forms $\mathfrak{F}(2\cdot24\cdot11)$ and $\mathfrak{H}(2\cdot30\cdot13)$ are not so

definite; both were found six times, but in only one case for each form was the face free from rounding. Nevertheless, the observed and calculated angles are close. The appearance of these narrow faces grouped about $f(021)$ is shown in figure 4. The form $\mathfrak{A}(1 \cdot 11 \cdot 6)$ has been reported as uncertain by Bücking[5] from the Fichtelgebirges and also by Rosicky;[6] the other three forms have not been reported.

TABLE 2. ANGLES OF NEW AND RARE FORMS ON TOPAZ FROM BALDFACE MTN.

Letter	Miller Indices	Calculated		Measured	
		ϕ	ρ	ϕ	ρ
$\mathfrak{A}$	(1.11.6)	9° 45′	41° 26′	9° 09′ $^{+8}_{-9}$	41° 35′ $^{+5'}_{-11}$
$\mathfrak{D}$	(2.18.9)	11 52	44 17	12 01 $^{+22}_{-27}$	44 24 $^{+8}_{-13}$
$\mathfrak{F}$	(2.24.11)	8 58	46 29	9 30	46 45
$\mathfrak{H}$	(2.30.13)	7 11	48 00	7 36	48 10

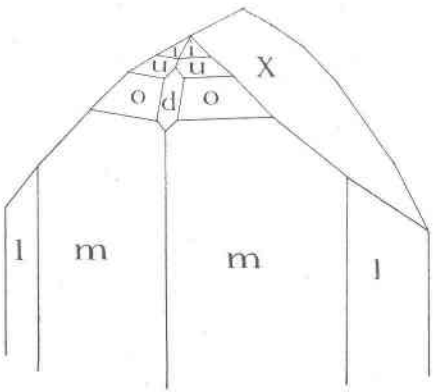

Figure 2. Topaz. Typical Baldface Habit.

[5] Bücking, H. Neues Vorkommen von Kalfeldspat, Turmalin, Apatit, und Topas im Granit des Fichtelgebirges. *Ber. Sneckenbergische Naturfor. Gesel. Frankfort*, p. 148, **1890.**

[6] Rosický, *Abh. Böhm. Ak.*, p. 23, **1916.**

HABIT. The topaz crystals fall generally into two types of habit. The most common, illustrated by figure 2, is of rhombic section, rather short prismatic, with the base very subordinate, *m* dominant in the prism zone, and *f* the dominant brachydome. Frequently *l* rather than *m* is dominant in the prism zone. Sometimes *X* is the most prominent brachydome, as in the doubly terminated crystal in figure 3. The second habit, which has an equant section with a broad basal plane, is seen on but few crystals. Figure 4 is of this habit, but more modified than usual.

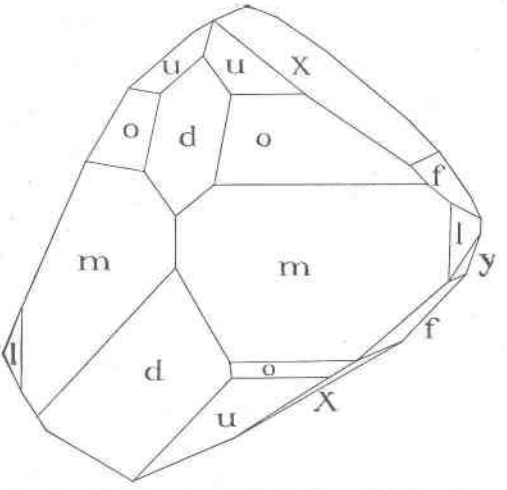

Figure 3. Doubly Terminated Topaz from Baldface Mountain.

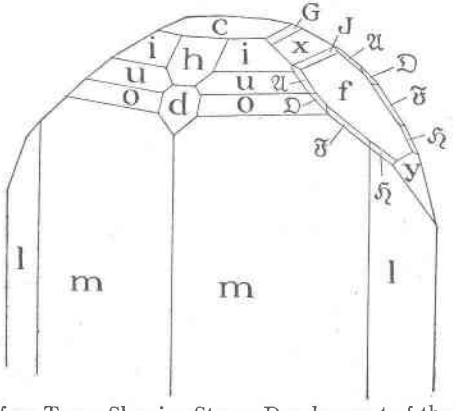

Figure 4. Baldface Topaz Showing Strong Development of the Base and the Rare Pyramids around the Brachydome *f*.

ETCHING. The prisms are often striated parallel to the c-axis. Etching of all common forms is noted. In some forms the brachydomes are more affected, in other crystals the pyramids are most strongly attacked. In general the etch figures on the orthodomes and pyramids are more closely spaced and smaller than those on the brachydomes, the resulting surface in the former case simulating ground glass.

PHENACITE

The Baldface phenacite is always lenticular due to the dominance of the positive unit rhombohedron and the slight development of the prisms. Six of the forty phenacite crystals were measured on the two-circle goniometer; on two of these crystals both terminations were measured. Five other crystals were set up for partial study. The prisms $a(11\bar{2}0)$ and $m(10\bar{1}0)$ when present occur as narrow faces; the prism $k(41\bar{5}0)$ is very rare. The positive unit rhombohedron $r(10\bar{1}1)$ is always conspicuous and usually the dominant form; the negative rhombohedron $d(01\bar{1}2)$ is usually prominent, occasionally surpassing in development the positive unit rhombohedron. The negative rhombohedron $\mu(02\bar{2}1)$ is often present as a narrow face between d and m.

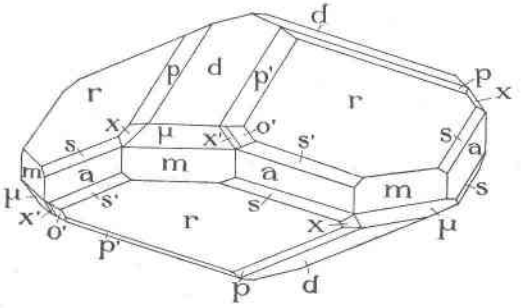

Figure 5. Phenacite from Baldface Mountain.

The complementary second order rhombohedrons p $(11\bar{2}3\ r)$ and $p_1(21\bar{1}3\ l)$ are often prominent, occurring as rectangular faces between r and d. The second order rhombohedron o_1 $(42\bar{2}3\ l)$ occurs as a small face and has been found only four times, twice on each of two crystals. The crystals are arbitrarily set up so as to throw this form onto the left hand boundary of the positive quadrant. The complementary form $o(22\bar{4}3\ r)$ has not been found. The

third order rhombohedrons are always inconspicuous. The complementary forms $s(21\bar{3}1\ r)$ and $s_1\ (3\bar{1}\bar{2}1\ l)$ are found as narrow faces in the positive quadrant between r and a. $x(\bar{1}3\bar{2}2\ r)$ and $x_1\ (12\bar{3}2\ l)$ are in the negative quadrant and inconspicuous. The third order rhombohedron $v_1\ (3\bar{1}\bar{2}4\ l)$, which occurs in the left hand portion of the positive quadrant, was found but once, on one of the crystals showing $o_1\ (4\bar{2}\bar{2}3\ l)$. The complementary from $v(21\bar{3}4\ r)$ has not been observed by the present writer, but Schaller[4] has reported it, and also one other form, $\delta(14\bar{5}6\ l)$, not found on these crystals. The typical lenticular habit and the tetartohedral rhombohedral symmetry are shown in the accompanying figure 5. Etching of the Baldface phenacite is common.