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PTILOLITE FROM UTAH

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INTRODUCTION

A pink radial mineral from Coyote, Garfield County, Utah, was received for identification some years ago from Hoyt S. Gale, at that time a member of the United States Geological Survey. Mr. Gale had received the specimen from Professor George T. Henry of Marysvale, Utah. While resembling a zeolite in appearance, its properties were not those of zeolites, and a chemical analysis suggested either mordenite or ptilolite. A study of the mordenite-ptilolite group was thereupon undertaken and, as described in the following paper, it was found that these two minerals are very closely related and have been mistaken for each other in the past, but are distinct with individual properties. According to the conclusion reached, the pink mineral from Utah is ptilolite.

The specimen has the character of an amygdaloidal filling in basalt and measures about 7 by 4 by 3 centimeters. The greater part of the specimen is composed of radial groups or imperfect half-spherulites of pink needles about a centimeter long. The centers of these half-spherulites lie close to the surface of the specimen; the space between the two layers of half-spherulites is filled with coarsely cleavable calcite.

DESCRIPTION OF CRYSTALS

The ends of the pink needle-like crystals are completely imbedded in the calcite. On dissolving the carbonate with acid, the radiating needles of ptilolite are exposed, many of them showing terminal faces. Some of the individual prismatic crystals are of equal thickness and others are somewhat flattened, resembling a yard stick in shape. They show a good cleavage in the prism zone and the individual pieces are more of a prismatic columnar shape than a finely fibrous one. The crystals exhibit a tendency to split into several fibers at the attached end. The thickness of the larger individual crystals averages about 0.06 millimeters, though many

of them are almost hair-like. The color is pink, similar to the reddish color of many heulandites though not so intense. Scattered through the pink fibrous cores are streaks where the ptilolite is colorless, yellowish, or pale greenish. The luster of the larger prisms is vitreous, that of the radiating fibrous masses, satiny.

Although many of the crystals freed from the calcite matrix are terminated, such faces are very minute and uneven and though brilliant, yield a mass of very poor and indistinct reflections on the goniometer. The prism zone is strongly striated, vertically, many of the crystals giving an almost continuous band of reflections, with a maximum brightness for the position of the faces.

The crystal forms present are: $c(001)$, $b(010)$, $a(100)$, $m(110)$, and $o(101)$. All of these forms have been previously noted, $c(001)$ by Cross and Eakins,[1] Colomba, and Grattarola, and $o(101)$ by Grattarola, D'Achiardi, and Bøggild; the latter also found the pyramid $p(111)$.

The axial ratio given by Bøggild, namely $a:b:c=0.8785:1:0.3606$, is adopted, even though his prism angle ($a \wedge m=41°\ 18'$) is based on measurements of flokite, which as shown in the following paper, is identical with mordenite and not with ptilolite. The prism angle of the two species is apparently very similar and as the angle given is the only one available it is here used.

The measurements on the crystals of ptilolite from Utah are shown below.

MEASUREMENTS OF PTILOLITE FROM UTAH

Form	Measured		Calculated	
	ϕ	ρ	ϕ	ρ
	° ′	° ′	° ′	° ′
$c(001)$	.. ..	4±	.. ..	0 00
$b(010)$	0 14	90 00	0 00	90 00
$a(100)$	89 59	90 00	90 00	90 00
$m(110)$	47 50	90 00	48 42	90 00
$o(101)$	90 04	22 35	90 00	22 49
$p(111)$	.. ..	.. ..	48 42	29 15

The faces of $c(001)$ are very minute specks, giving no reflections. No crystal was observed on which both $c(001)$ and $o(101)$ are present.

[1] For references, see literature cited in the following paper.

The three forms of the prism zone vary in size, even on the same crystal. The two pinacoids, in general, seem to be larger than the prism faces. All three forms are strongly striated vertically.

The macrodome $o(101)$ is the only termination on several of the crystals and seems to be characteristic of the termination of ptilolite. The faces are somewhat elongated parallel to the b-axis.

Optical Properties

The minute crystals all show strictly parallel extinction on all faces in the prism zone. A faint birefringence could be readily detected on the larger crystals if purposely placed as little as 2 degrees out of parallelism with the cross-hairs of the microscope. Ptilolite is definitely orthorhombic. The elongation of the crystals is negative. The optical orientation could not be determined further than that the axial plane is parallel to the elongation. The refractive indices are: α (parallel elongation) $= 1.473$, $\beta = 1.475$, γ (normal elongation) $= 1.478$.

Chemical Composition

The minute crystals of ptilolite fuse quietly and fairly readily to an opaque white enamel. Aggregates of crystals, when fused, show a slight intumescence. The mineral is insoluble in hydrochloric acid, even on boiling.

The analysis of the mineral, freed from calcite, shows it to have the following composition.

Analysis and Ratios of Ptilolite from Coyote, Garfield County, Utah

	Analysis	Ratios		
SiO_2	67.35	1.1206	10.04	or 10
Al_2O_3	11.49	.1126	1.01	or 1
CaO	3.87	.0690		
K_2O	0.11	.0012 .1126	1.01	or 1
Na_2O	2.63	.0424		
H_2O-	5.13	.7750	6.94	or 7
H_2O+	8.82			
	99.40			

The ratios of the analysis, grouping CaO, K_2O, and Na_2O, together, show that the formula of the mineral is $10\ SiO_2 \cdot Al_2O_3 \cdot (Ca, K_2, Na_2)\ O \cdot 7\ H_2O$.