PREHNITE FROM COOPERSBURG, PENNSYLVANIA

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WITH MORPHOLOGIC DESCRIPTION *by*
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ABSTRACT

Well-developed prehnite has been found in the Triassic diabase near Coopersburg, Pennsylvania. The crystals are tabular parallel to the base and show the forms *c*{001}, *a*{100}, *m*{110}, *s*{111}, *o*{011}, *b*{010}, *p*{221}, and *t*{012}. The forms, *p* and *t*, are new. Chemical and spectroscopic analyses are presented and the optical properties described.

OCCURRENCE

A new occurrence of prehnite crystals has been found near Coopersburg, Berks County, Pennsylvania. This material merits description because of the excellent development of the prehnite crystals which present two new forms.

The prehnite occurred in a vein-like body cutting Triassic diabase where it was exposed in a quarry. The vein material occupied a steeply-dipping irregular fissure extending 30 or 40 feet across the quarry face. The width of the fissure ranged from a fraction of an inch to about 8 inches. In the wider places the filling was not complete and prehnite crystals had opportunity for free growth. Some of the vein filling, which was virtually all prehnite, was massive but none of it showed the characteristic irregular botryoidal structure typically exhibited by the prehnite found at Paterson, and other New Jersey localities.

Adjacent to the walls and throughout the narrower parts of the vein the prehnite shows the more usual development of crystals radiating from a common center. This manner of growth results in interpenetrating spherical masses of radiating crystals. Where the fissure was wider and the crystals had an opportunity for free growth, terminated tabular crystals project into the open space. These crystals form fan-like aggregates as shown in Fig. 1. Comparing this structure to a wheel, the *a*-axes form the spokes, the *b*-axes are parallel to the axle, and the *c*-axes are tangent to the rim. The crystals show the usual basal cleavage as well as an imperfect breaking parallel to the front pinacoid which is probably a parting (Fig. 2). The average size of the terminated crystals is 2×12×0.4 mm. The color of the prehnite is a delicate light green, somewhat lighter than that from Paterson.

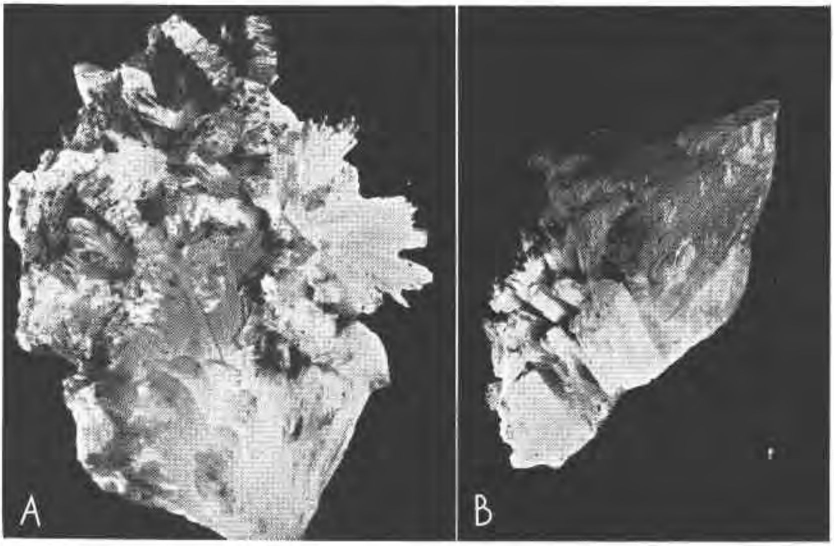


FIG. 1A Group of prehnite crystals showing radial development and terminated individual. $\times 2\frac{1}{2}$

FIG. 1B. Prehnite group showing characteristic development. $\times 2$

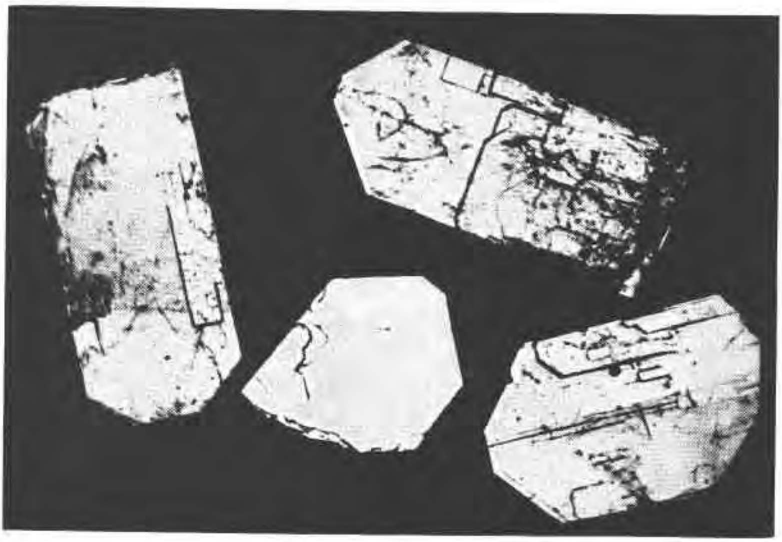


FIG. 2. Individual prehnite crystals showing typical microscopic aspect. Note parasitic crystal growths parallel to the basal pinacoid and lighter bands bordering prism trace caused by birefringence variation of the pyramid. Crossed Nicols, $\times 20$.

Quartz prisms are scattered throughout the prehnite near the walls of the vein. They formed subsequent to the earlier development of prehnite. Iron and manganese stains occur to a small extent throughout the material.

The normal diabase near Coopersburg is composed of labradorite, augite, magnetite and sphene. Adjacent to the prehnite vein this mineral assemblage has been altered to a massive greenish-gray rock composed of uralite, quartz, and epidote with a little residuary sphene. It is interesting to note the complete absence of labradorite in the altered rock.

Analyses

Comparative spectroscopic analyses of prehnite from Coopersburg and from Paterson, New Jersey, are listed in Table 1.

It is very probable that the elements present in minor amounts are due in greater part, at least, to minute physically-contained impurities

Table 1. Spectroscopic Analyses of Prehnite from Coopersburg, Pa., and Paterson, N. J.

Element	Coopersburg	Paterson
Si	principal	principal
Ca	principal	principal
Al	principal	principal
Fe	appreciable (−)	appreciable (+)
Mg	small	small
Mn	trace	minute trace
Cu	very minute trace	very minute trace

A chemical analysis[1] of the Coopersburg prehnite is listed in Table 2, which is in excellent agreement with the accepted composition.

Table 2. Average of Two Analyses

SiO_2	42.38
Al_2O_3	24.41
CaO	27.90
H_2O	4.10
Fe_2O_3	1.20
	99.99

[1] J. R. Wiegner, *Analyst.*

Optical Description

The optic plane is parallel to (010); $X=a$. $(+)2V=64°$ measured. Tabular, elongation negative. $\alpha=1.612\pm.002$, $\beta=1.618\pm.002$, $\gamma=1{,}642\pm.002$. Birefringence, 0.030. Colorless in section.

According to Winchell (1933),[2] optic anomalies in prehnite are not uncommon. The optic angle is subject to marked variation, interference colors and dispersion may be abnormal, and incomplete extinction may occur. Microscopic striations and twinning lamellae have been noted, and it is believed that where these are submicroscopic, anomalous properties result.

In the Coopersburg prehnite, the measured optic angle, $(+)2V=64°$, is about 10° greater than the optic angle calculated from the indices of refraction. The abnormal azure-blue and leather-brown interference colors described by Iddings (1906) are present in some sections. Sections perpendicular to the optic axes exhibit incomplete extinction.

Individual crystals show striations on the basal plane which are parallel to the prism and front pinacoid. These lack the extinction properties typical of twinning striations and are thought to be due to oscillatory growth. Some crystals (Fig. 2) by their birefringence show the presence of tiny pyramid faces. Small parasitic crystals have grown parallel to the basal plane on many of the larger crystals. Many of the parasitic crystals exhibit only pinacoid forms (Fig. 2).

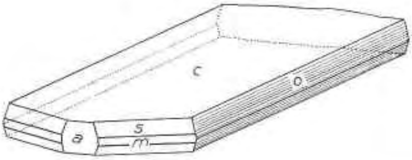
Thin sections of the massive material located closer to the vein walls show abundant twinning. The two types most commonly encountered are: (1) Two sets of fine twinning lamellae parallel to the traces of the prism faces intergrown to form a grid, and (2) two sets of fine twinning lamellae parallel to the traces of the front and side pinacoids. The latter type is somewhat coarser and commonly shows discontinuous bands that resemble a blocky type of microcline twinning.

Previous workers explain the anomalous optical properties of prehnite by assuming submicroscopic twinning. Study of the Coopersburg prehnite has not served to prove or disprove this assumption.

Morphologic Description

From a casual inspection of the prehnite one would think that there was abundant material for crystal measurements. However, a close examination shows that the pyramid faces on most of the crystals do not give suitable reflections. Out of 25 of the most promising crystals examined, only 6 were suitable for goniometric measurement. All of the crystals are similar in habit, being tabular parallel to the base as shown in Fig. 3.

[2] References are listed at the end of the article.



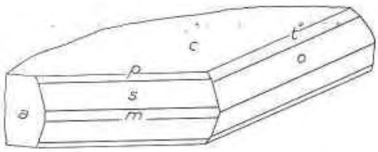


FIG. 3. Characteristic development of prehnite.
FIG. 4. Portion of prehnite crystal showing the two new forms, *p* and *t*.

The forms common to all the crystals are *c*{001}, *a*{100}, *m*{110}, *s*{111}, and *o*{011}. The brachypinacoid *b*{010} was found on only two crystals, but the tendency for *b* to form, gives *o* a striated appearance. On most of the crystals *s* is deeply etched, and on only 6 crystals were the faces of this form of sufficient quality to give reflections for measurement. The other common forms, however, presented brilliant faces on most crystals.

Two new forms were noted as line faces as shown in Fig. 4; *p*{221} on two crystals and *t*{012} on one crystal. The position of these forms is given by the following two-circle goniometer measurements.

Forms	*Mean*		*Range*		*No. of Faces*
	ϕ	ρ	ϕ	ρ	
p 211	49°59′	69°07′	49°55′–50°01′	68°55′–69°19′	3
t 012	0°00′	59°44′	—	59°27—60°01′	2

At least six different axial ratios have been given for prehnite by as many writers. Goldschmidt (1890) gave the ratio as $a:b:c=0.840:1:3.376$, but later (1897) he recorded $a:b:c=0.8405:1:1.1207$. Dana (1892) gave $a:b:c=0.840:1:0.5626$. These last two ratios have persisted to the present day. Gossner and Mussgnug (1931) in an *x*-ray study of prehnite found the dimensions of the unit cell to be: $a_0=4.65$, $b_0=5.52$, $c_0=18.53$, giving a ratio of $a_0:b_0:c_0=0.842:1:3.357$. Using this ratio, which agrees closely with Goldschmidt's original, the Miller indices of the forms on the crystals at hand are considerably simplified, and this latter ratio has therefore been used in assigning indices to the forms found.

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