NOTES AND NEWS

OCCURRENCE OF SODIC SCAPOLITE AT FALLS OF FRENCH CREEK, PENNSYLVANIA

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Most occurrences of calcic scapolites have been found in limestones, in zones altered by igneous intrusions. Most of these occurrences were originally classified as wernerite, a name used rather loosely to indicate a scapolite high in meionite content, or near the calcic end of the series. These occurrences have been regarded, on field evidence, as originating in the deep seated zone of metamorphism. The associated minerals of contemporaneous origin as listed by Dana—pyroxenes, amphiboles, garnets, etc.—are minerals characteristic of that zone.

Occurrences of sodic scapolites, however, as reported, are usually found in veins or cavities in basic igneous rocks. The field evidence at these localities and the minerals associated with the scapolite, suggest an origin at shallower depths and under lower thermal conditions than would apply to calcic members of the group.

I have recently had the privilege of examining an occurrence of scapolite in the quarry of the French Creek Granite Co. at Falls of French Creek, Pa. In composition this is sufficiently near the sodic end of the series to be classified with the marialites. This scapolite occurs in veins cutting across a diabase sill which was intruded in Triassic time. The associated minerals are: prehnite, zeolites (chiefly heulandite), sphene, epidote, chlorite, and apatite. The field evidence at this locality and the minerals associated with the scapolite would indicate that the vein developed in the lower belt of the upper zone of metamorphism. The intimate association of prehnite and heulandite with the scapolite, places the three minerals together with respect to the physical conditions under which they have formed.

ORIGIN OF THE FRENCH CREEK SCAPOLITE

Many of the Triassic diabase intrusions in this district, particularly the larger bodies, are cut across their trend by veins of albitic feldspar. Such veins may be seen exposed in the quarry at Monocacy, about eight miles northwest of Falls of French Creek quarry, and in the same sill. As there have been no later igneous injections in the district, and as these albitic veins are definitely associated with the diabase, it is a reasonable assumption that the filling of the veins was derived from residual liquors given off by the cooling basaltic magma. Further evi-

dence of this is furnished by the action of the vein liquors on the wall-rock. Diabase wall-rock shows only uralitization with some increase in sulphide content, but where the veins extend beyond the diabase into acid rocks, the walls have been actively attacked, potash feldspar has been replaced and quartz dissolved.

In chemical composition these veins are higher in silica and soda, and show higher ignition losses than the diabases containing them. In mineral composition the principal constituents are albite (or a sodic plagioclase) and quartz with a variable amount of calcite and small amounts of sphene, epidote, chlorite, and apatite. Some veins contain in addition, prehnite and zeolites.

The scapolite veins at French Creek occupy the same relative position with respect to the diabase as do the albitic veins to the diabase at other localities in the district. The accessory minerals are the same in the two types of veins. The reaction on the diabase wall-rock is the same. In chemical composition the two sets of veins are similar, except for the relatively large chlorine content in the veins at French Creek. (Compare columns 2, 3, and 4 with 5 in table of analyses.)

The scapolite vein is lower in silica and higher in soda than the albitic veins, but the high percentage of chlorine in this vein would seem to be the principal factor in determining the development of scapolite rather than albite at French Creek.

Description of the Scapolite

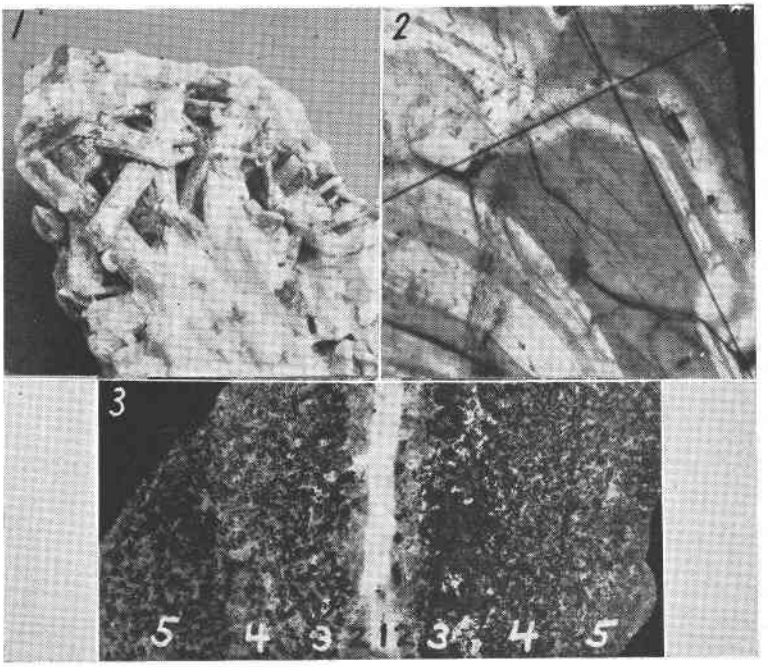
The scapolite here described is not the same type of scapolite as that mentioned from French Creek in Dana's *Textbook of Mineralogy*. The latter is listed as wernerite and is said to occur in cavities in hessonite at the mines adjacent to the quarry property.

The scapolite from the quarry of the French Creek Granite Co. is colorless and glassy when fresh, becoming a chalky-white on exposure. The crystals are long prismatic. The largest found measure 40 mm. by 5 mm. The ratio of length to width in a number of crystals measured, ranged between 8–1 and 5–1. This is a greater elongation than is found in calcic scapolites. (Fig. 1).

Many crystals show zonal growth. This zoning may be repeated several times in a single crystal (Fig. 2). In sections of zoned crystals a core showing a gray birefringence color may be bordered by zones showing a straw-yellow color; a difference in birefringence of about .003. Examination of the indices in sections shows that there is very little difference in the indices of the ϵ ray in the various zones. Practically all the difference in birefringence is due to variation in the indices of the ω ray. According to A. N. Winchell (*Am. Mineral.*, **9**, p. 108), the variation of the

ω ray of scapolite is a straight-line function of the ratio of Ma molecules to Me molecules in the mineral. The application of this principal to these zoned crystals indicates that the available soda and lime fluctuated as the scapolite crystals grew, and that the percentage of lime tended to increase as the reactions by which the scapolite was formed, progressed. This may possibly have resulted from a slow attack of the vein liquors upon the calcic plagioclase, labradorite, of the diabase walls.

When the percentage of lime became high enough, prehnite formed instead of calcic scapolite. Crystals of scapolite having calcic borders are often capped by prehnite and intergrown with prehnite along their borders. There is no evidence that any change in physical conditions



1. Marialite crystals in vug. Falls of French Creek, Pa., ×2 dia.

2. Oblique section of sodic scapolite showing zoning. Crossed nicols, × about 100 dia. Crosshairs at 45°.

3. Cross section of vein showing effect of vein liquors on wall-rock. Natural size. (1) scapolite vein; 60–80% scapolite, 20–40% prehnite and zeolites, etc. (2) scapolite and amphibole with prehnite and zeolites, etc.; scapolite in excess. (3) amphibole and scapolite; amphibole in large excess; sulphides in this zone. (4) uralite and plagioclase. (5) unaltered diabase. The accessory minerals sphene and apatite are found in all zones but are most abundant in (2) and (3).

occurred between the formation of the scapolite and the formation of the prehnite. The change in available chemical elements is clearly registered in the zoned scapolite crystals, and this would appear the only factor determining which of the two minerals would form. The percentage composition at which scapolite ceases to form and prehnite begins, under the conditions prevailing in these veins at French Creek, is about 70 Ma, 30 Me.

The indices of the French Creek scapolite, measured on broken grains, were found to be $\epsilon = 1.542-$, $\omega = 1.549$ to 1.552. All zones are optically negative.

Using Winchell's diagram, which is based only on the two principal molecules, $NaCl \cdot 3NaAlSi_3O_8$, and $CaCO_3 \cdot 3CaAl_2Si_2O_8$, these indices would indicate that the zones of this scapolite range between 77 and 74 per cent in Ma content, with some calcic borders a little lower.

Calculated from chemical analysis the composition would be approximately Ma 68, Me 22, KMe and minor molecules 10.

CHEMICAL ANALYSIS

	1 French Creek Scapolite	2 Scapolite Vein	3 Albitic Vein Monocacy	4 Albitic Vein Safe Harbor	5 French Creek Diabase
SiO_2	57.01*	57.30	77.02	66.80	51.96
Al_2O_3	23.85*	23.15	14.05	18.00	15.20
Na_2O	8.42	7.49*	3.35	2.74	1.70
K_2O	1.24	1.10*	.35	.42	.50
CaO	5.00	5.40*	—	—	11.50
Cl	2.72*	2.45	tr.	tr.	—
Ign.	1.75*	3.06	—	—	.30
FeO	—	—	—	—	8.10
Fe_2O_3	—	—	—	—	.97
MgO	—	—	—	—	8.67
TiO_2	—	—	—	—	1.05

* Calculated from composition of vein (col. 2) determined in sections by grid measurement to be 90% scapolite and 10% heulandite.

1. Analysis of separated crystals of scapolite. Includes all zones.

2. Analysis of scapolite vein, 90% scapolite and 10% heulandite.

3. Analysis of albitic vein from quarry in diabase at Monocacy, Pa. This quarry is about eight miles northwest of the French Creek quarry, but is in the same sill.

4. Small albitic vein in diabase from quarry at Safe Harbor, Pa. Vein composed of oligoclase with about 10% chlorite.

5. Analysis of French Creek diabase.

Analyses 1, 2, 3 and 4 by John Herman Laboratories, Los Angeles. Analysis 5 furnished by French Creek Granite Company.

Conditions at Quarry

The quarry of the French Creek Granite Company has been in operation about sixty or seventy years. Engaged originally in the quarrying of paving block and curbing, it has during the last thirty-five years been quarrying stone for monumental purposes. The quarry is noted for large blocks of stone of uniform texture without jointing. The stone is a medium-grained diabase of dark color and is very uniform in texture. The scapolite veins are narrow, mostly under two inches in width. Several of these veins are exposed at present, some extending entirely across the quarry. Abundant material is available.

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