A NEW OCCURRENCE OF STEVENSITE, A MAGNESIUM-BEARING ALTERATION PRODUCT OF PECTOLITE

M. L. CLENN
Erie, Pennsylvania

IN THE old Hartshorn quarry, in Springfield Township, Essex County, New Jersey, Mr. Louis Reamer of Short Hills, N. J., discovered a single vein of a peculiar mineral, called by the quarrymen "magnesium" (=talc?) and submitted samples of it to the writer for identification. It proved to be essentially identical with the hitherto imperfectly known *stevensite*, the nature of which is discussed in this article. The quarry lies some 16 miles southwest from the better known mineral localities around Paterson, but is in the same rock, the basalt of First Watchung Mountain. The rock is, if anything, more altered than that at Paterson, and the mineralogical association is somewhat different from that at the latter place. The most unusual feature is the abundance of a secondary feldspar, in aggregates of sheaf-like and "cocks-comb" crystals, which shows the optical properties of anorthoclase.[1] There are also numerous small quartz crystals, usually iron-stained; drusy prehnite in small pockets; many calcite crystals; a little pectolite and datolite; and several zeolites. Of the latter natrolite, stilbite and heulandite were the only ones noted by the writer, no trace of apophyllite, chabazite, or laumontite, so common at other similar localities, being observed.

Some of the pectolite found at the quarry is of the usual type, silky radiations of fine needles, but the greater part of it shows marked evidence of alteration, the color becoming more and more pinkish and the luster more and more waxy toward the outer ends of the radiations. The properties of the most altered material are as follows:

Color, white to pink (colored by manganese); luster waxy; translucent; structure compact, though with occasional shrinkage cracks; brittle; fracture hackly; feel smooth; hardness 2.5; specific gravity varying from 2.15 to 2.20; optical properties:[2] chiefly isotropic and amorphous, and showing very few feebly

[1] As determined by Dr. Edgar T. Wherry.
[2] Also determined by Dr. Wherry.

doubly-refracting areas (metacolloidal, cryptocrystalline); index of refraction about 1.50, but varying slightly from one fragment to another, owing to differences in water content.

Qualitative tests: Before the blowpipe fuses at 3 to a white enamel; in a dark room shows beautiful bluish green luminescence. In closed tube decrepitates, gives off neutral water, and becomes gray. In HCl dissolves, forming granular SiO_2, and the solution yields reactions for Mg. In H_2O some pieces crumble and give off air bubbles with a crackling sound.

Chemical composition: The analyses recorded below were made on material from which a little calcite had been removed by hand-picking.

TABLE I. COMPOSITIONS OF MAGNESIUM-BEARING PECTOLITES

	1	2	3	4	5	6	7	8
H_2O	2.70	5.26	4.09	5.28	5.53	6.76	8.45	9.04
Na_2O	9.31	9.06	8.57	6.50	6.89	5.59	3.73	....
K_2O	....	....	....	0.85	0.21	....	....	....
CaO	33.68	32.80	32.21	28.64	24.72	22.59	1.61	....
MgO	....	....	1.43	5.12	5.76	9.81	27.66	30.37
MnO	....	....	....	....	....	0.13	0.03	....
FeO	....	....	tr.	1.33	....	....	....	....
$Al_2O_3+Fe_2O_3$	....	....	0.58	....	0.67	1.18	0.37	....
SiO_2	54.31	52.88	53.94	52.20	56.22	53.84	58.03	60.59
	100.00	100.00	100.82	99.92	100.00	99.90	99.88	100.00

To bring out the variations in the percentages of the constituents the above analyses are arranged, not in the usual order, with new ones first, but in such manner that the new ones fall in columns 6 and 7, thus:

1. Theoretical composition of ordinary pectolite, $HNaCa_2(SiO_3)_3$.
2. Theoretical composition of a monohydrate of the preceding, $HNaCa_2(SiO_3)_3+H_2O$.
3. Analysis of massive pectolite, Point Barrow, Alaska.[3]
4. Analysis of "walkerite" from Corstophine Hill, Scotland.[4]
5. Analysis of "magnesiumpektolith" from Burg, Herborn, Germany.[5]
6. Analysis by the writer of partially altered pectolite from the Hartshorn quarry.
7. Analysis by the writer of highly altered pectolite, same locality.
8. Theoretical composition of the pure magnesium mineral, "stevensite," the monohydrate of talc, $H_2Mg_3(SiO_3)_4+H_2O$.

The mineral of No. 6 retained the pectolite structure, but showed impregnation by waxy material; while that of No. 7 was the purest waxy mineral obtainable, and appeared to be

[3] F. W. Clarke, *Am. J. Sci.* [3], **28**, 20, 1884.

[4] Heddle, *Mineralog. Mag.*, **4**, 121, 1880.

[5] E. Reuning, *Centr. Min. Geol.*, **1907**, 739.

essentially homogeneous, altho a few fibers of unaltered pectolite no doubt remained, giving rise to the Na_2O and CaO content found. Analyses were made on material dried at 110°.

From these analyses, which represent pectolites which have undergone successively greater alteration by magnesium-bearing solutions, it appears that:

1. Magnesium replaces both calcium and sodium.
2. As the magnesium content increases the water, and in some cases the silica also, increases.

The end product toward which the material here analyzed is evidently tending is therefore a mineral with the ratios of talc but containing an additional molecule of water, of which the theoretical composition is shown in the last column of Table I. Its amorphous, colloidal character readily accounts for this extra water as the colloid forms of almost every substance contain more water than the corresponding crystalline ones. This end product may be regarded as a mineral species because it has certain characteristic physical properties, as described above; it appears homogeneous under the microscope; and the composition indicated for it seems reasonable.

The name stevensite, given to "talc pseudomorphous after pectolite" by A. R. Leeds in 1889,[6] seems appropriate for it; materials thus labeled in various collections agreeing with it in properties.

As to its origin, rain water probably first extracted magnesium from the basalt rock as bicarbonate, and the resulting solution reacted with pectolite somewhat as follows:

$$\underset{\text{Pectolite}}{4HNaCa_2(SiO_3)_3} + \underset{\substack{\text{magnesium}\\\text{bicarbonate}}}{9MgH_2(CO_3)_2} + \underset{\text{water}}{3H_2O} =$$

$$\underset{\text{stevensite}}{3[H_2Mg_3(SiO_3)_4.H_2O]} + \underbrace{\underset{\substack{\text{calcium}\\\text{bicarbonate}}}{8CaH_2(CO_3)_2} + \underset{\substack{\text{sodium}\\\text{carbonate}}}{2Na_2CO_3}}_{\text{removed in solution}}.$$

[6] *Nat. Leisure Hour*, **12**, 31, 1889; thru Chester, *Dict. Names Minerals*, Ed. 1, 257, 1896.