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A Mineral Resembling Meerschaum From the Serpentine Range of Hampden County, Mass., With the Descriptions of Interesting Included Crystals.

A. D. Roe

and Baffin's Land, so that the same shore line had run through these three places.

Professor Arndt reported on his investigations into original methods of teaching science.

H. Gale reported on the interesting picture of scientific activity, mingled with a broad culture, found in the delightful "Briefe von Dr. Theo. Billroth."

276th Meeting, November, 1905.

Secretary's minutes lacking.

Paper L, Psychology of the Business Man by Harlow Gale.

277th Meeting, December 5, 1905.

Secretary's minutes lacking.

Paper M, Glacial and Modified Drift of the Mississippi Valley from Lake Itasca to Lake Pepin, by Warren Upham.

Paper N, Meteorological Statistics covering the period from 1895 to 1905 inclusive, furnished from the records kept at Minneapolis should have been announced at this meeting for publication.

[*Paper J.*]

A MINERAL RESEMBLING MEERSCHAUM FROM THE SERPENTINE RANGE OF HAMPDEN COUNTY, MASS., WITH DESCRIPTIONS OF INTERESTING INCLUDED CRYSTALS.

By A. D. Roe.

I.—DESCRIPTIVE.

While prospecting for cabinet specimens in the fruitful mineral field of Hampden and Hampshire counties, Mass., I noticed a substance which the chemist of the Hampden Paint company called meerschaum. On interviewing the chemist, I was shown small pieces found in the disintegrating serpentine material they were using in the manufacture of chrome paints.

On my next excursion to Chester in Hampden county, I accompanied Dr. Lucas, the inventor of the chrome paint pro-

cess and promoter of emery mining in that region, to the exact locality of the paint material. Here I succeeded in unearthing good sized specimens of the so-called meerschaum. From one of these a friend, a meerschaum enthusiast, carved a pipe which polished, colored and was declared to exhibit the mythical properties of sepiolite. Subsequently I secured a lease of the locality and had an excavation made to the depth of a few feet, which satisfied me there was, at that point, no large nor continuous quantity of the substance in question, but I observed indications of the manner of its formation and obtained fine included specimens of rare and interesting minerals to be hereafter described.

This pseudo-meerschaum has a specific gravity of 2.5, is usually of a compact slaty structure, under a strong glass somewhat fibrous, cleaving in two directions, giving smooth, impalpable surfaces, creamy white in color, with a glimmering, waxy luster. It adheres slightly to the tongue, yields readily to the knife, at a hardness of 2.5; it could be easily turned in a lathe but for its slaty structure which causes it to split. (See plate vii, fig. vii.) It breaks with difficulty across its planes of cleavage with a very hackly fracture, but when polished gives the glimmering waxy luster of its cleavage faces. For this mineral I suggest the name hampdenite for reasons to be stated in another paragraph further on.

In composition the hampdenite and hampshirite are almost identical and closely approach some serpentines as is shown in the following table of analyses:

TABLE OF ANALYSES.

	1	2	3	4	5	6	7
SiO_2.....	45.78	42.09	42.83	39.38	42.54	38.60	44.1
Al_2O_3....	.65	.74	.61	1.56	3.78	0.10	
Fe_2O_3....					4.75		
						11.55	
FeO....	8.14	11.05	15.043	13.87	5.57		
MgO....	32.17	33.08	31.76	32.25	30.48	33.62	43.0
Na_2O....	.27	.31	.286				
K_2O.....	.081	.021	.053				
MnO....	1.21	1.78	1.08				
H_2O.....	11.44	10.01	7.16	11.90	13.13	12.82	12.3
Alkalies				.17		3.31	
	99.741	99.036	98.822	99.13	100.25	100.	100

1. Hampdenite, analyzed by E. E. Nicholson, the University of Minnesota.
2. Hampshirite, fibrous coating, E. E. Nicholson, the University of Minnesota.
3. Hampshirite, inside of crystal, E. E. Nicholson, the University of Minnesota.
4. Gray Serpentine, Brewsters, N. Y. Burt, Am. Jour. Sci., 1873, Vol. 6, p. 210.
5. Serpentine, chrysotile, Amelose, R. Brauns, Jahrbuch für Mineralogie, 1887; Beil., Bd. v, 299.
6. Serpentine, grass green, Porthalla, Collins, Quart. Jour. Geol. Soc. London, 1884, vol. 40, p. 467.
7. Serpentine, calculated, Dana, System of Mineralogy, 6th ed. p. 691, 1892.

Analyses 4 and 6 are quoted from Dana's System of Mineralogy. 6th edition, p. 672, and have not been further verified.

Noting the variation in silica and iron in the first three analyses Prof. Nicholson made a second and third determination of the iron with the result that the inside of the hampdenite which was less exposed to alteration yielded 10.24 percent of FeO which closely approaches No. 2, and the outer portion which was somewhat stained and leached yielded 8.07 percent of FeO. A second determination of the silica using the white material from the inside of the mass gave 42.78 per cent $Si\ O_2$ showing that the larger percentage of silica in No. 1 is probably due to alteration and loss of iron and magnesia. From these results it is evident that from the chemical analyses there would be no reason to make two separate varieties of these two substances, but the texture is so different that the author feels warranted in giving the name hampdenite to the massive splintery material as a distinct variety of serpentine while retaining the name hampshirite to indicate the serpentine pseudomorphs after humite.

The interior of the pseudomorphs is distinct from any serpentine that has come to the author's notice, being compact and massive, with an earthy feel and luster. The composition as determined by Prof. Nicholson is decidedly different from that obtained by Dewey* who obtained $Si\ O_2$ 50.60, Mg O 28.83, $Al_2\ O_3$ 0.15, FeO 2.59, MnO 1.10, H_2O 15.00 = 98.27, which would approximate more nearly the composition of sepiolité than of serpentine.

If the alumina and manganese be considered isomorphous with the iron and the potash and soda isomorphous with magnesia the composition for both hampdenite and hampshirite may be considered as $H_3\ Fe_4\ Mg_{21}\ Si_{18}\ O_{76}$ or 4 FeO, 21 MgO, 18 $Si\ O_2$, 15 $H_2\ O$, which would give a theoretic composition of approximately Fe O, 12; Mg O, 34; $Si\ O_2$, 43; H_2O, 11, which if we consider iron and magnesia to be isomorphous is not far from the theoretic composition of serpentine.

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*Am. Jour. Sci., 1822-1823, vol. 4, 275; vol. 5, 249, vol. 6, 334.

The mineral occurs at the foot of a steep, serpentine declivity in shaly, disintegrating rock, frequently in small masses or nests whose upper surface is convex with shallow smooth corrugations, so that its slaty cleavages sometimes show decided curvature.

In opening up the nests of pseudo-meerschaum or hampdenite, I brought to light a crystal of magnetite two inches across: it was a dodecahedron with striated faces modified by the truncation of half of its solid angles; it was symmetrical in form, having a small twinned attachment on one side. This specimen was transferred to Prof. Chas. U. Shepherd of Amherst College, and it was doubtless destroyed in the burning of his collection. Other similar crystals were obtained, measuring from three-fourths of an inch to over two inches—all modified dodecahedrons, (see plate vii, figs i and ii), but none so perfect as the first one found, most of them being attached to or imbedded in the coarse steatite or serpentine debris on which the nests of pseudo-meerschaum rested.

But a more interesting find than the magnetite was in the crystals believed to be pseudomorphic after humite from one to one and one-half inches in breadth, color brownish-yellow, texture loosely steatitic, hardness 1.5, specific gravity 2.23. They showed but one termination, the lower end being attached to the coarse mass below, as were the magnetite crystals.

These crystals recalled the brief notice of Dana regarding hampshirite as analyzed by Dewey and described in vols. iv, v, and vi, American Journal of Science (first series). This mineral was discovered by Dr. E. Emmons in the town of Middlefield, Hampshire county, Mass., and was named after the county in which it occurred. Professor Dewey visited the Emmons locality, described the crystals and the manner of their occurrence in an unnamed matrix, between heavy masses of serpentine. He declared they could not be pseudomorphs but were true crystals of steatite, and thought it would be difficult to get any more crystals from that locality. He found a few crystals of magnetite in the matrix with the hampshirite. Hermann later declared the crystals Dewey analyzed to be a distinct mineral.

Professor Dewey supposes the material between the masses of serpentine was deposited in a semi-fluid condition

and that afterwards the crystals of iron oxide and hampshirite developed from elements distributed through the soft mass.

The same theory could be applied to the formation of the associated minerals I have described. Iron and chromium, in various combinations, are distributed through the magnesian rocks of the region. Disintegrating and decomposing agencies, constantly operating, cause the elements to mingle and develop new combinations.

The locality of these minerals is exactly on the line of Middlefield, Hampshire county, and Chester, Hampden county, beside the highway near where it crosses the Boston and Albany railroad. From this justaposition the name hampdenite seems appropriate to the pseudo-meerschaum which I have described as the matrix of hampshirite and magnetite, and the name hampshirite, the same as has been used by Emmons, Dewey and Herman, to the orthorhombic crystals described and figured in this paper, imbedded with large crystals of magnetite in the mineral, pseudo-meerschaum, herein named hampdenite.

The specimens of hampshirite have been examined by Mr. A. L. Parsons, instructor of mineralogy in the University of Minnesota, and their crystallographic characters are reported in paragraph II below.

II.—MORPHOLOGICAL, by A. L. Parsons.

The material is well adapted for securing measurements, though most of the faces are curved and pitted, particularly the pyramidal. It seems likely that the pseudomorph was formed by the loss of a part of the original material and hydration of that remaining. A list of the probable minerals from which it could be derived comprises enstatite, olivine, and the humite group.

Enstatite is dropped from consideration on account of the non-correspondence of angles. In the case of olivine, it is possible to get forms corresponding to the prismatic faces but the pyramidal faces would not correspond. The humite group exhibits a remarkable similarity of habit and its ordinary association with other minerals is so similar that there seems but little reason to doubt the original mineral was humite or possibly chondrodite. Aside from crystallographic grounds there

is strong reason to expect pseudomorphous humite or chondrodite to occur in this locality and in such association, and equally good reasons why olivine should not yield such pseudomorphs. In the first place in the deposits of magnetite of southeastern New York at Brewster's and in Orange county, chondrodite, humite, and clinohumite are all found and at the Tilly Foster mine in particular all three occur with magnetite and an earthy serpentine or talcose material in addition to other constituents. In Massachusetts, chondrodite is found at Lee, and Tyringham.* It is also found "in the pre-Cambrian limestone at the mouth of Cole's Brook, at the railroad cutting west edge of large bed, in reddish and grayish grains changing into serpentine"† and from the description of this locality it is not more than a mile from the locality from which the material under discussion was obtained, and probably in the same formation. The determination of the Massachusetts mineral has however depended upon other than crystallographic means and as the mineral is granular in all the localities mentioned it is possible that in the western part of the state at least it is to be referred to humite. So far as can be learned, crystallized olivine in good-sized crystals has not been noted in Massachusetts, Connecticut, Vermont, or New York, but it has been found in New Hampshire though not in good crystals.

The angles on Mr. Roe's hampshirite are compared below with those of humite. (See pl. vii.)

TABLE OF CRYSTAL MEASUREMENTS

Angles	Hampshirite	Humite
o_2o_2 (210)	49°—50°	49° 40½′
ce_2 (001 014)	46° 30′—47°	45° 32½′
ce_5 (001 011)	74°	76° 13′
ci_2 (001 103)	55°‡	55° 44′
cr_3 (001 216)	58°	58° 16′

From these measurements it is seen that the crystal approaches one of the types found at Wermland in Sweden*

*Dana, J. D., System of Mineralogy, 6th edition, 1892, p. 1059.
†Emerson, B. K., U. S. Geol. Sur. Bull. 126, 1895, p. 54.
‡Face not shown in figure.
*Sjogren, H., Zeits. fur Kryst. and Min., vii p. 344 et seq. and pl. vii. Also Hintze, C., Handbuch der Mineralogie, vii., p. 379, Fig. 147, 1897. Also Dana, System of Mineralogy, 6th edition, p. 535, 1892.

with the exception that the base (001) is lacking and the brachypinacoid e_2 (014) replaces the form e_4 (012) and the macropinacoid i_3 (101) is replaced by the form i_2 (103). (See plate vii, figs. iii, iv, v, and vi.)

Through the courtesy of Prof. B. K. Emerson, the material described and figured by him† has been at hand for comparison. (See plate vii, fig. vi.) In his description of the material it is to be noted that he orients his crystal in the same way as the present author, and although he mentions five forms he only gives two measurements, one of which appears to be correct and the other incorrect, on account of an imperfection in the crystal which would readily be overlooked without other material at hand for comparison. From a careful examination of Prof. Emerson's specimen, it appears almost impossible to secure measurements that will do more than give an approximation for any faces except the prism which he gives as ∞P (110) and the brachydome which he gives as $2P\infty$ (021). In the case of prism my measurements agree with those of Prof. Emerson, but in the case of the brachydome, my measurements range from 92° to 95° while he gives the angle as ranging from 79° to 81° 30′. This discrepancy is due in all probability to the presence of a pseudocleavage in the fibrous coating of one of the crystals, as by measuring along this cleavage I secured approximately the same angle as Prof. Emerson.

By orienting the crystal so that 010 becomes 100 it is possible to get all the prismatic and normal faces to correspond to possible olivine forms but with two exceptions they have not yet been found on olivine crystals and it seems unreasonable to refer the source of this material to olivine when most of the faces do not correspond to known forms of olivine. These faces, do, however, closely approximate the forms of humite, the association is like that of humite, and if any other ground were necessary for discarding olivine as the source and substituting humite, it would be found in the size of the crystals which vary from about ¾″ to 2″ in length, the largest under investigation being the latter size, and the average about 1½″. Inasmuch as an olivine crystal two inches long is looked upon as of extraordinary magnitude, the presence of

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†Emerson, B. K., U. S. Geol. Sur. Bull. 126, 1895, p. 92, pl. 1, fig. 4.

a large number of crystals of such great size in this locality, where no trace of olivine has been found, even by microscopic means, would at least seem to indicate some other source than olivine.

III.—HISTORICAL NOTES.

The best specimen of hampshirite found in my explorations consisted of a group of crystals disclosed by cutting away the embedding hampdenite. When I came to Minnesota, this specimen was supposed to be packed for removal with a large collection previously on exhibition in a mineral store in New York City. On reaching my destination in Minnesota and unpacking my specimens, I missed the fine hampshirite and concluded the box containing it had been lost enroute. While revising this paper for publication my attention was called to the Mineralogical Lexicon of Franklin, Hampshire and Hampden counties, Massachusetts,* published by Prof. B. K. Emerson, of Amherst College. This lexicon contains notes on hampshirite which aroused my interest to that degree that I solicited of Professor Emerson the loan of the somewhat unique specimen belonging to the Clarke collection in Smith College. Through his courtesy that specimen was sent me for examination. (See plate vii. fig. vi.) Inspection proves that it is the identical specimen lost by me during my removal to Minnesota. The figure in Bulletin 126† gives a rough idea of the general appearance of this specimen, but fails to bring out fairly the unique appearance of the grouped hampshirite crystals. I took this specimen myself from an excavation in the locality above described; chipped away the embedding hampdenite from the rough block and exposed the crystals as they now appear upon the specimen. The labor devoted to this preparation as well as its peculiar formation gave an impression which leaves me no room to doubt the identity of this individual piece. I take great pleasure in inspecting this specimen and feel indebted to Professor Emerson for his courtesy in loaning it, thereby enabling me to identify beyond doubt my long lost crystal group, and thereby also enabling Professor Emerson to revise

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*Bulletin 126, U. S. Geol. Survey, Washington, 1895.
†Ibid, plate 1, Fig. D.

the unique label which appears in the Smith College collection.*

The hampshirite items appearing in Professor Emerson's lexicon† lead to the presumption that but few specimens of this mineral are extant, scarcely more in number than the distinct opinions as to its nature. In reviewing the literature, it seems that Professor Dewey declared the specimen true crystals of steatite, not a pseudomorph; President Hitchcock believed them to be steatite after quartz; Herman called them a distinct species; Professor Emerson speaks of them as serpentine crystals after olivine.‡ To the foregoing opinions that of Mr. Parsons may be added declaring these crystals to be pseudomorphs after humite, an opinion which he supports by careful crystal measurements.

There is abundant opportunity in the great serpentine formations of Hampshire and Hampden counties to unearth more of the rare and interesting hampshirite. Since I have now pointed out the exact locality which was covered, not for the purpose of concealment, but because the excavation extended into the middle of a traveled highway, it is to be hoped that enthusiastic mineralogists will bring more of these rare crystals to light and Smith College may not be alone in the possession of this unique and interesting mineral.

January 3, 1899.

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* Hampshirite; steatitic pseudomorphs after quartz; Chester, Mass., on the road to Middlefield. Locality exhausted and filled up with rocks to prevent anything more being taken from it. Bailey thinks that this specimen could not be duplicated. From Row's collection; he procured it at the locality for $10.00.

†Ibid, pp. 91, 92, 152.

‡Bul. G. S. A., vol. vi. p. 473.

PLATE VII

Fig. I. Magnetite crystals nearly parallel in growth in a matrix of hampdenite. The dodecahedron and cube are prominent but the surface is rough, and on two sides a great number of minute octahedral facets are shown which suggests that the entire crystal is built up of octahedra.

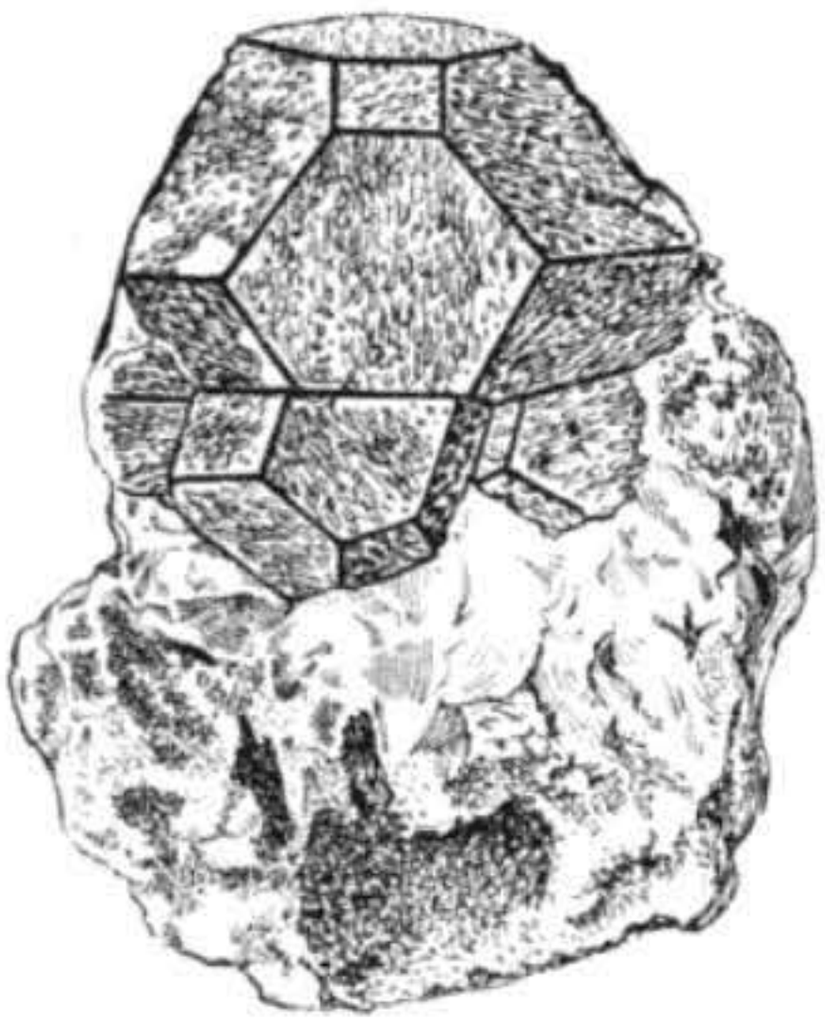
Fig. II. Magnetite and hampshirite in hampdenite. The magnetite shows a similar development of faces to Fig. I., but the octahedron is more prominently developed than in the preceding case and gives a striated appearance to the crystal and at one place gives a nearly smooth octahedral face beveling the solid angle of the dodecahedron. In both figures I and II the typical appearance of hampdenite is well shown.

Fig. III. Cast of a hampshirite pseudomorph after humite.

Figs. IV and V. Hampshirite pseudomorphs after humite showing typical development. Fig. V shows the best detached crystal known to the author.

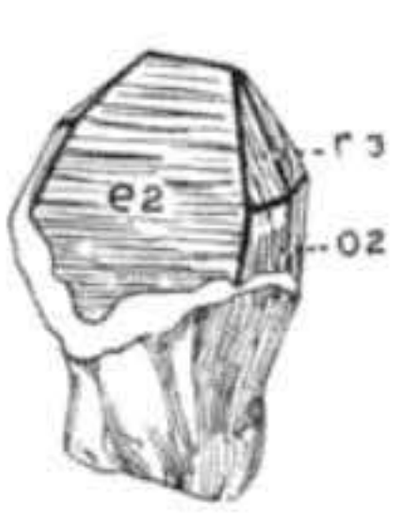
Fig. VI. Group of Hampshirite pseudomorphs after humite in hampdenite loaned by Prof. B. K. Emerson from the Smith College collection. This is the specimen referred to on page 274.

Fig. VII. Hampdenite showing smooth fibrous fracture.
Reduced one-half.



I

II



III

IV

V

VI

VII