

45. On Kamaishilite, $\text{Ca}_2\text{Al}_2\text{SiO}_6(\text{OH})_2$, a New Mineral
Dimorphous (Tetragonal) with Bicchulite from
the Kamaishi Mine, Japan

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(Communicated by Seitarô TSUBOI, M. J. A., Sept. 12, 1981)

Introduction. Bicchulite $\text{Ca}_2\text{Al}_2\text{SiO}_6(\text{OH})_2$, a hydrated gehlenite, was first found in Fuka, Okayama Prefecture, Japan and Carneal, County Antrim, Ireland by C. Henmi *et al.* (1973).

Kamaishilite, dimorphous with bicchulite, was found by the present authors and approved as a new mineral by the Commission on New Minerals and Mineral Names of the International Mineralogical Association (15th September 1980). The mineral was named after its locality, the Kamaishi mine. The present paper reports the occurrence, optical properties, chemical composition and X-ray diffraction (Debye-Scherrer) data of the mineral.

Occurrence of kamaishilite. Kamaishilite is found in a vesuvianite skarn formed in a marble exposed at the 350 m level adit of Shinyama ore deposit of the Kamaishi mine, Iwate Prefecture, Japan

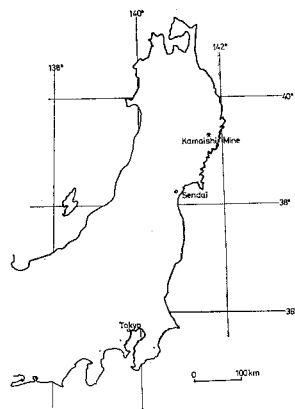


Fig. 1. Position of the Kamaishi mine.

(Figs. 1 and 2). The vesuvianite skarn is dyke shaped and about 10 cm in width (Fig. 3). The skarn is composed mainly of vesuvianite, kamaishilite, and titaniferous 'hydrograndite'. Small amount of perovskite, calcite, magnetite, and chalcopyrite are also present. Kamaishilite occurs in close association with titaniferous 'hydro-

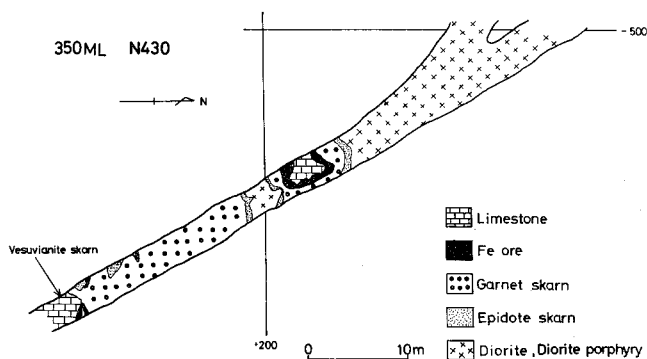


Fig. 2. Sketch map of Shinyama 350 m level adit of the mine showing the occurrence of kamaishilite-bearing vesuvianite skarn.

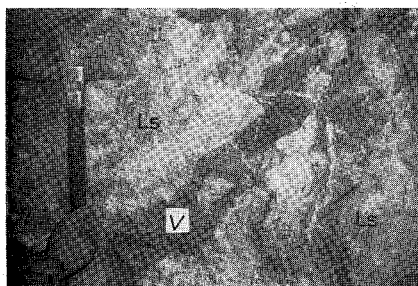


Fig. 3

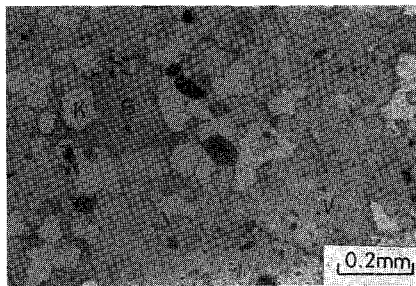


Fig. 4

Figs. 3-4. 3: Photography showing the occurrence of kamaishilite-bearing vesuvianite skarn (V) and limestone (LS). 4: Microphotography (polarizer only) of kamaishilite-bearing vesuvianite skarn. K: Kamaishilite. G: Hydrograndite. V: Vesuvianite. P: Perovskite.

grandite', and fills interstices of vesuvianite grains (Fig. 4). This texture permits us to consider kamaishilite as an alteration product of vesuvianite.

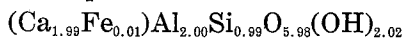
Optical properties. Kamaishilite occurs as grains of about 0.1 mm in diameter (Fig. 4). It is colourless and transparent. No cleavage is observed. X-ray powder diffraction pattern reveals a tetragonal symmetry of the mineral, but optically it is nearly isotropic. No conoscopic interference figure is observed. The refractive index determined by immersion method $n=1.629$ is close to that of bicchulite from Carneal ($n=1.625$) and of synthetic bicchulite obtained by Carlson (1974) ($n=1.628$).

Chemical composition. The chemical composition of kamaishilite determined by electron probe microanalyser is given in Table I. No other elements than those tabulated were detected. $H_2O(+)=6.1\%$

Table I. Chemical composition of kamaishilite from the Kamaishi mine, Iwate Prefecture, Japan

SiO ₂	20.03
Al ₂ O ₃	34.15
Feo	0.21
MgO	0.02
CaO	37.42
H ₂ O	6.1
Total	97.93

and H₂O(-)=0.2% were obtained by wet chemical analysis. This composition gives the empirical formula:



calculated on the basis of O=8.00. The mineral is considered to be dimorphous with bicchulite.

X-ray diffraction data. X-ray powder diffraction pattern of kamaishilite is reproduced in Fig. 5. Eight principal parts of the pattern are enlarged and given in Fig. 6. These parts correspond to angular domains where the eight principal diffraction peaks of bicchulite occur. The figure shows the splitting of the diffraction peaks

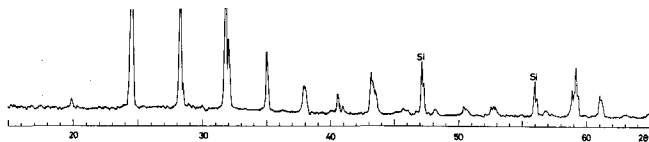


Fig. 5. X-ray powder diffraction pattern (for Cu K α_1 : $\lambda=1.54050 \text{ \AA}$) of kamaishilite.

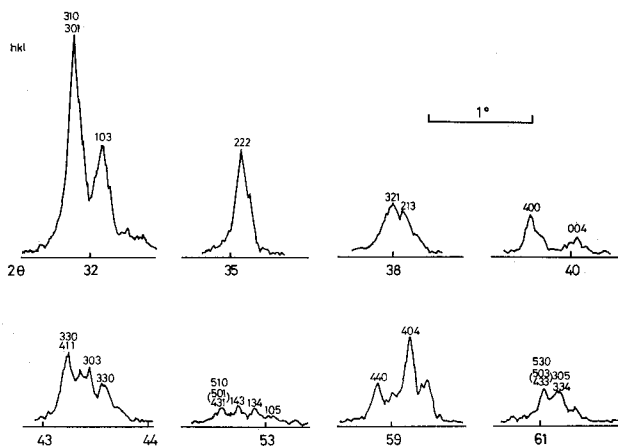


Fig. 6. Details of principal powder diffraction lines of kamaishilite.

Table II. X-ray powder diffraction data of kamaishilite and bicchulite

1				2			3		4	
hkl	d(Å)	I	d(cal)	hkl	d(Å)	I	d(Å)	I	d(Å)	I
200	4.426	6	4.425				4.44	10	4.41	3
002	4.389	2	4.385	200						
211	3.607	100	3.608	211	3.60	90	3.60	100	3.600	78
112			3.591							
220	3.118	15	3.129	220	3.12	10	3.11	10	3.120	7
202			3.115							
310	2.799	85	2.799	310	2.786	100	2.787	100	2.790	100
301			2.796							
103	2.777	40	2.776							
222	2.547	40	2.547	222	2.547	30	2.545	20	2.547	34
321	2.361	20	2.364	321	2.354	35	2.38	b	2.358	25
213	2.351	20	2.351							
400	2.213	15	2.213	400	2.205	20	2.21	b	2.205	13
004	2.193	6	2.193							
330	2.085	30	2.086							
411			2.085							
303	2.076	20	2.077	(330)	2.079	40	2.081	30	2.080	40
330	2.070	15	2.069	(411)						
420	1.977	2	1.979	420	1.984	10	1.97	b	1.974	
402			1.975							
204			1.965							
332	1.883	3	1.884	332	1.890	10	1.880	5	1.882	4
323	1.879	4	1.880							
422	1.804	6	1.804	422	1.801	15	1.804	10	1.802	9
224	1.795	3	1.796							
510	1.735	5	1.736							
(431)			1.735							
143	1.730	6	1.730	(510)	1.732	10	1.727	10	1.731	12
134	1.725	6	1.726	(431)						
105	1.721	2	1.721							
521	1.615	3	1.615	521					1.612	6
152			1.614							
125			1.604							
440	1.564	20	1.565	440	1.559	50	1.558	40	1.560	41
404	1.557	35	1.557							
530	1.514	15	1.518							
(503)			1.514							
(433)	1.511	15	1.514	(530)	1.514	25	1.513	30	1.513	19
305			1.511							
334			1.508							
a=8.850Å, c=8.770Å			a=8.829Å			a=8.82Å		a=8.8254Å		

1: Kamaishilite from the Kamaishi mine. 2: Bicchulite from Fuka (Henmi C. *et al.* (1973)). 3: Bicchulite from Carneal (Henmi C. *et al.* (1973)). 4: Synthetic bicchulite (Gupta A.K., and Chatterjee N.D. (1978)).

of bicchulite into several lines in kamaishilite. This situation suggests lower symmetry of kamaishilite than cubic bicchulite. No splitting of 222 peak of bicchulite in kamaishilite and splitting of 400 of bicchulite into two lines with an intensity ratio of 2:1 in kamaishilite and that of 222 of bicchulite into two peaks with intensity ratio of 1:2 in the latter permit us to consider the tetragonal symmetry of the new mineral. The indexing of the diffraction pattern was performed with this assumption. The results are given in Table II. All the given (hkl) indices satisfy the extinction rule for a body centered tetragonal unit cell with $a=8.850 \text{ \AA}$, $c=8.770 \text{ \AA}$ and $z=4$. Comparison of these parameters with that of bicchulite ($a=8.82\text{--}8.83 \text{ \AA}$) indicates a slight expansion of kamaishilite in the direction along a and contraction along c . c/a for the mineral is 0.9910.

Acknowledgements. The authors wish to express here their gratitude to Dr. A. Kato of National Science Museum, Dr. H. Shimazaki and Mr. K. Kawamura of the University of Tokyo for their kind and valuable discussions. They are grateful to mining geologists of the Kamaishi mine for help offered during the field work and sampling in this study.

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