Chemical Studies of Minerals Containing Rarer Elements from the Far East District. LXV.[1] Pollucite from Nagatare, Fukuoka Prefecture, Japan

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The chemical analysis of pollucite found in a granite pegmatite at Nagatare, Fukuoka Prefecture, gave SiO_2 46.03, Al_2O_3 17.76, Fe_2O_3 0.02, MnO 0.01, CaO 0.03, Li_2O 0.16, Na_2O 2.08, K_2O 1.81, Rb_2O 0.61, Cs_2O 28.88, and H_2O 2.74; total 100.13%; recalculated as $(Cs,Rb)_{0.573}(Na,K,Li,Mn,Ca)_{0.316}(Al,Fe)_{0.943}Si_{2.071}O_6 \cdot 0.411\ H_2O$ as O=6, thus satisfying the crystallochemical formula advocated by Beger. X-ray single crystal and powder studies have shown it to be cubic, the space group is Ia3d; $a_0=13.674\pm0.005$ Å. It is optically isotropic or very faintly birefringent, with $n=1.520\pm0.002$.

Granite pegmatites exposed at Nagatare, Fukuoka Prefecture, include some rare alkali-bearing minerals, such as lepidolite,[2] petalite,[3] and amblygonite-montebrasite-series minearals,[4] all except the first one being unique occurrences in Japan.

TABLE 1. X-RAY POWDER DATA FOR POLLUCITE FROM NAGATARE, FUKUOKA PREFECTURE

1		2				
d(Å)	I	d(Å)	I	Q_{obs}	Q_{calc}	hkl
5.55	20	5.56	2	0.032	0.032	211
4.818	20	4.83	2	0.043	0.043	222
3.652	80	3.65	30	0.075	0.075	321
3.421	100	3.416	100	0.0857	0.0856	400
		3.225	2	0.0962	0.0963	330, 411
3.048	10	3.058	3	0.1070	0.1070	420
2.907	100	2.913	45	0.1178	0.1177	332
		2.791	1	0.1284	0.1284	422
2.674	20	2.682	7	0.1390	0.1391	510, 431
2.492	20	2.497	4	0.1604	0.1604	521
2.406	80	2.416	24	0.1713	0.1711	440
2.211	60	2.218	17	0.2033	0.2032	611
		2.162	1	0.2139	0.2139	620
2.007	40	2.015	6	0.2462	0.2460	631
1.970	40	1.973	4	0.2569	0.2567	444
1.886	20	1.897	3	0.2780	0.2781	640
1.855	80	1.860	18	0.2890	0.2888	633
		1.827	1	0.2995	0.2995	642
1.731	80	1.736	22	0.3318	0.3316	651
1.705	60	1.709	10	0.3424	0.3423	800
1.679	20	1.683	3	0.3531	0.3530	811
		1.658	2	0.3640	0.3639	644
1.630	20	1.634	3	0.3744	0.3744	653
		1.589	3	0.3957	0.3958	750
		1.548	4	0.4173	0.4172	752
		1.529	7	0.4280	0.4279	840

1. Pollucite. Buckfield, Maine, U.S.A. A.S.T.M. Card No. 15—317. Cu/Ni radiation. Camera method.
2. Pollucite. Nagatare, Fukuoka Prefecture. Cu/Ni radiation. Diffractometer method.

A white mass with a rugged, weathered surface collected by the third author from the dump derived from one of the pegmatites turned out to be the first pollucite in Japan, as has previously been reported.[5] The present paper will report the results of its X-ray, chemical, and optical studies.

Description of the Studied Specimen

The analyzed specimen is a part of a white mass more than 10 cm across and 500 g in weight. It is white in color and semitransluscent, with a vitreous luster. It has no cleavage, and the hardness is 5½—6 by Mohs' scale.

The associated minerals found in the mass include pale blue albite, and light and deep purple-colored lepidolites and petalite. Besides them, there are minute soft, white veinlets composed of earthy hydromica (?) with quartz. Under a microscope, pollucite is colorless and isotropic between crossed Nicols, except for a few grains which have a faint birefringence. The refractive index, as measured by the immersion method, is 1.520 ±0.002. The birefringence could not be masured by that method, but it is less than 0.002.

TABLE 2. CHEMICAL ANALYSIS OF POLLUCITE FROM NAGATARE, FUKUOKA PREFECTURE

	wt%	Molecular quotient	Metal number	Oxygen number	Metal number as O=6
SiO_2	46.03	0.7661	0.7661	1.5322	2.0708
Al_2O_3	17.76	0.1742	0.3483	0.5226	0.9417
Fe_2O_3	0.02	0.0001	0.0002	0.0003	0.0008
MnO	0.01	0.0001	0.0001	0.0001	0.0003
CaO	0.03	0.0005	0.0005	0.0005	0.0014
Li_2O	0.16	0.0054	0.0108	0.0054	0.0292
Na_2O	2.08	0.0336	0.0672	0.0336	0.1816
K_2O	1.81	0.0192	0.0384	0.0192	0.1038
Rb_2O	0.61	0.0033	0.0066	0.0033	0.0178
Cs_2O	28.88	0.1025	0.2050	0.1025	0.5541
H_2O	2.74	0.1521			0.4111
Total	100.13				

Analyst: K. NAGASHIMA

1) Part LXIV: K. Nagashima, K. Nakao, H. Wakita, and A. Kato, This Bulletin, **44**, 867 (1971).
2) H. Shibata, *J. Geological Soc. Japan.* **41**, 582 (1936).
3) Y. Okamoto, *Kobutsu to Chishitsu*, **3**, 1 (1950).
4) J. Ito, H. Minato, and Y. Okamoto, *J. Mineralogical. Soc. Japan*, **2**, 263 (1955).
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X-ray Studies

We used the X-ray single-crystal and powder methods to check the space group and the unit-cell constant. In its precession photographs of zero, first, and second layers, there was no diffraction spectrum violating the extinction rule of Ia3d. The X-ray powder data obtained by the diffractometer method are given in Table 1. The unit-cell constant calculated from them is 13.674± 0.005 Å, well coincident with the known value.[6]

Chemical Analysis

The chemical analysis was carried out adopting the following procedures: Cs_2O, Rb_2O, and Li_2O——atomic absorption analysis; Na_2O, K_2O——flame photometry; SiO_2, Al_2O_3, CaO, H_2O——gravimetry; Fe_2O_3, MnO——spectrophotometry. The results are shown in Table 2. The empirical formula based on O=6 is $(Cs_{0.554}Rb_{0.018})_{0.572}(Na_{0.182}K_{0.104}Li_{0.029}Mn_{0.003}Ca_{0.001})_{0.316}(Al_{0.942}Fe_{0.001})_{0.943}Si_{2.071}O_6 \cdot 0.411\ H_2O$, well satisfying the ideal formula. The adoption of the crystallochemical formula proposed by Beger,[6] $Cs_xNa_yAl_{x+y}Si_{48-x+y}O_{96} \cdot (16-x)H_2O$, where $2y \geq 16-x \geq y$, gives the following results:

empirical formula: $(Cs, Rb)_{9.150}(Na, K, Li, Mn, Ca)_{5.061}Al_{15.080}Si_{33.133}O_{96} \cdot 6.578\ H_2O$

crystallochemical formula: $(Cs, Rb)_{9.150}(Na, K, Li, Mn, Ca)_{5.061}Al_{14.211}Si_{33.789}O_{96} \cdot 6.850\ H_2O$

There is a minor excess of tetrahedrally-co-ordinated ions and a deficiency of water, both being within the limits of analytical error.

6) R. M. Berger, *Z. Krist.*, **192**, 280 (1969).