ORDER-DISORDER IN KALSILITE

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Kalsilite, the stable form of $KAlSiO_4$ at ordinary temperatures (Tuttle and Smith, in preparation), was first recognized by Holmes (1942) in volcanic rocks from S. W. Uganda. Bannister and Hey (1942), from single-crystal x-ray photographs, found that it contained $2KAlSiO_4$ in a hexagonal cell with a 5.17 Å and c 8.67 Å and space-group $P6_32$. Claringbull and Bannister (1948) established that the structure type of kalsilite is $H2_8$ (Gottfried, 1940) but kalsilite can truly belong to this structure type only if the Si and Al atoms are disordered, as was implicitly recognized in the paper. If the Si and Al atoms are ordered, they cannot lie in the same set of positions as is required by the $H2_8$ structure and the true unit-cell must be either larger or less symmetrical. Unfortunately the intensity differences between the ordered and disordered structures would be small and crystals of kalsilite previously found have been too small to provide x-ray photographs of sufficient intensity to test whether the Si and Al atoms are ordered.

Recently larger crystals have become available from a lava flow at Kabfumu, Nyiragongo area in North Kivu, Belgian Congo, which has been studied by the second author. The kalsilite occurs as the dominant phase in a kalsilite-nepheline microperthite of a texture similar to that described by Sahama (1953). Careful study of this material by single-crystal x-ray methods has revealed very weak, diffuse reflections in addition to the strong, sharp reflections expected for kalsilite and nepheline. The diffuse reflections originate from the kalsilite and show that a new unit-cell must be taken at 30° to the usual 5 Å cell, thus increasing the a repeat distance by $\sqrt{3}$. The c-axis is unchanged and the symmetry remains hexagonal. The space-group appears to be $P6_32$ but little reliance can be placed on it for only the following diffuse reflections have been observed: $(12\bar{3}0)$, $(13\bar{4}0)$, $(24\bar{6}0)$, $(15\bar{6}0)$, $(23\bar{5}1)$ and $(12\bar{3}2)$.

Careful comparison of the photographs obtained for several crystals from the Kabfumu lava revealed variations in the intensity of the diffuse reflections. After heating a crystal at 600° C. for 3 days, the diffuse reflections disappeared giving a kalsilite whose true a repeat was 5.15 Å. Although final proof must await structure-factor calculations it may be concluded that the diffuse reflections are caused by the ordering of Si and Al atoms. Variation in the intensity of the reflections indicates the existence of partial order, thus showing that the kalsilite of the Kabfumu lava has not reached equilibrium.

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So far no other specimens have been investigated, that contain crystals large enough to permit the detection of such weak reflections. As the reflections are too weak for observance on powder photographs, it has not been possible to establish the frequency of occurrence of the two types of kalsilite.

Kalsilite joins the feldspar group of minerals in showing order-disorder of the Al and Si atoms and it is to be expected that further investigation of other minerals that carry Al and Si in four-fold coordination, such as nepheline, will reveal the occurrence of order-disorder. The prefixes *d-* and *o-* are suggested for the characterization of the disordered (*a* 5.15 Å) and ordered (*a* 8.9 Å) forms of kalsilite.

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IDENTITY OF NOCERITE AND FLUOBORITE

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During an extensive investigation of the silicates and fluorides of calcium and magnesium performed in this Institute, we had the occasion to attempt the synthesis of a compound of the composition $Mg_3Ca_3O_2F_8$, which has been ascribed to the mineral nocerite. In the literature this rare mineral is described from only one occurrence in Nocera, Italy. It is found in volcanic tuffs, in geodes with abundant fluorite, and highly metamorphic inclusions of limestones which are locally dolomitic. Nocerite was described in these typical "piperno" tuffs for the first time by A. Scacchi (1), and repeatedly examined by other mineralogists (cf. Dana's "System of Mineralogy," 7th edition, vol. II. 1944, 1951, pp. 85 f.) Nocerite is hexagonal and is optically negative, with the refractive indices $\omega(Na) = 1.5098$, and $\epsilon(Na) = 1.4855$ (cf. F. Zambonini (2)); or $\omega = 1.512$; $\epsilon = 1.487$ (cf. E. S. Larsen (3)).

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