

chromites can be expressed as: $(Mg_{51}Fe_{49}^{''}).(Cr_{76}Al_{24}Fe_0^{''})$; $(Mg_{41}Fe_{59}^{''}).(Cr_{73}Al_{22}Fe_5^{''})$; and $(Mg_{74}Fe_{26}^{''}).(Cr_{77}Al_{19}Fe_4^{''})$. The chromite is a magnesia-rich variety and lies within the aluminian chromite field of Stevens' spinel diagram (1944). The cell dimension is less in the chromite with higher Al_2O_3 and lower Cr_2O_3 content, in agreement with Clark and Ally (1932).

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The composition of nekoite.

NEKOITE was discovered at Crestmore, California, by Eakle (1917), who identified it as okenite. Gard and Taylor (1956) showed it to be a distinct species. The only existing analysis, given in Eakle's paper, indicates the formula $CaO.2SiO_2.2H_2O$. The present work shows that this is incorrect; the true formula is probably $3CaO.6SiO_2.8H_2O$.

A new analysis of the type specimen, on which all the previous work has been done, gave SiO_2 55 %, CaO 24 %, H_2O 19.6 ± 0.2 % (total 99 %). CaO and SiO_2 were together determined on about 1.5 mg and H_2O on 5 mg of material. The molar composition calculated from this analysis is $0.47CaO.SiO_2.1.19H_2O$. The $CaO:SiO_2$ ratio agrees reasonably well with Eakle's formula, but $H_2O:SiO_2$ is significantly above the expected value of 1.0. A weight-loss curve was made on 34 mg of another specimen, also from Crestmore, which Dr. A. B. Carpenter had collected in 1959. This gave a total loss of 22.1 ± 0.1 %, which fits the formula $0.5CaO.SiO_2.1.39H_2O$. Loss of water begins at about $40^\circ C$ and is partly reversible.

The X-ray study by Gard and Taylor showed the contents of the triclinic cell to be $3CaO.6SiO_2.xH_2O$. The present results suggest that x is probably 8 ($H_2O:SiO_2 = 1.33$). The type specimen has probably

suffered slight dehydration, while the new specimen possibly contains a little unbound water or CO_2 .

Comparison of observed and calculated specific gravities supports the new formula $3\text{CaO}\cdot 6\text{SiO}_2\cdot 8\text{H}_2\text{O}$. Eakle reported a specific gravity of 2.206. We have made new determinations, by the suspension method, and find 2.24 ± 0.01 for the type specimen and 2.23 ± 0.01 for the new specimen. The values calculated for either specimen from the cell dimensions are 2.14 for the old formula and 2.26 for the new formula. Heller and Taylor (1956) quote a calculated value of 2.28 for the old formula, but this is wrong.

We are studying the crystal structure and the products and mechanism of dehydration. We thank the U.S. National Museum for the loan of the type specimen (USNM 95637), and Dr. A. B. Carpenter of Harvard University for a generous portion of the new specimen (Com 203).

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BOOK REVIEW

WOOLFSON (M. M.). *Direct Methods in Crystallography*. Oxford (Clarendon Press—Monographs on the Physics and Chemistry of Materials), 1961, 144 pp. Price 30s.

To determine the arrangement of atoms within the unit cell of a crystal one requires to find a set of structure factors F_{hkl} , one for each order of diffraction (hkl); from these, a map showing the atom positions can readily be calculated. In general F_{hkl} is a complex quantity, and one can only measure F_{hkl}^2 from the intensity of the hkl diffracted X-ray beam; the phase angle for each F_{hkl} remains to be determined. The problem is much simplified if the crystal structure (or that projection of it that is being examined) has a centre of symmetry, when all phase angles are 0° or 180° ; in this case one has only to decide whether to take the positive or the negative square root of F_{hkl}^2 . Even so there are too many structure factors involved for direct guesswork.