

cores consisting of greywackes, argillites and related rocks from a generating station proposed site nearby, was also negative.

However, the long-term test with mortar bars containing these materials showed distinct expansion and formation of silica gel, indicating susceptibility to alkali-silica reaction in concrete, although the maximum acceptable limits for expansion, according to the Ontario Hydro and the ASTM Standard Specifications for Concrete Aggregates, were not reached.

The alkali-silica reaction, with conspicuously developed silica gel, was identified also in an old deteriorated concrete dam, 30 miles distant, in which local gravel and sand were used as aggregates. In drill cores, large pieces of a relatively uniform varved argillite from the foundation rock were found in the concrete. Mortar bars made with these argillites interlaminated with greywackes showed expansion equivalent to the maximum permissible limit. The test confirmed that argillites and varieties of greywackes grading to argillites are alkali-reactive.

To our knowledge this is the first indication that argillites are alkali-reactive although they are closely related to phyllites and slates, some of which are known to be reactive.

MORE PRECESSION GONIOMETRY

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The precession x -ray diffraction camera has been used as a goniometer to identify neighbouring twins in staurolite. It can also be applied, in combination with the stereographic net, to the solution of problems of crystal orientation: (1) Orienting a crystal when the two arcs of the goniometer head are not horizontal and vertical. (2) Ascertaining the relative orientations of intergrown crystalline species. (3) Determining the various orientations of quartz grains in a petrographic thin section. In each case the necessary information is obtained from one ordinary adjustment photograph, taken with a small precession angle ($\mu = 10^\circ$) and unfiltered radiation.

A CHEMICAL AND X-RAY STUDY OF OMPHACITIC PYROXENES

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The cell constants of analysed omphacites, mainly from eclogitic rocks of Austria, Italy, Switzerland, U.S.S.R., France, Newfoundland, Norway, and the U.S.A. have been determined using x -ray powder diffraction techniques and a least squares programme written for an IBM 7040 computer. Of a total of fourteen samples, five represent new analyses determined by wet chemical, x -ray fluorescence, and electron microprobe techniques. The remaining analyses are from the literature. Cell constants for four samples have also been taken from the literature.

The complex chemistry of these pyroxenes makes representation in terms of their theoretical end-member molecules difficult. Attempts have been made to correlate their cell sizes and chemistry using the methods proposed by Yoder & Tilley (1962), Niggli (1946), Eskola (1921), Smulikowski (1960), Church (1967), and Huchenzholz (1965). None of these methods are entirely satisfactory in that they do not conveniently represent all possible end-members.

Cell parameter determinations indicate there is a wide range of values depending on composition ($a = 9.45\text{--}9.70 \text{ \AA}$, $b = 8.78\text{--}8.89 \text{ \AA}$, $c = 5.16\text{--}5.27 \text{ \AA}$, $\beta = 106.5\text{--}106.9^\circ$) The feasibility of determining the approximate compositions of omphacites from a knowledge of their cell constants is discussed.

CLEAVELANDITE AND THE SIGNS OF THE OPTIC DIRECTIONS

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Type cleavelandite from Chesterfield, Massachusetts is a relatively-pure variety of albite characterized by its occurrence in granitic pegmatites (especially in hydrothermal units) in masses of *warped* or curved generally coarse (010) lamellae, some of which form albite twins. Crystal faces and cleavages [except (010)] are not commonly evident. Platy albite lacking these qualities should not be designated as cleavelandite. By assigning signs to the optic directions and using the values of the Köhler angles among these, one can differentiate readily between twinning types in the albites.

CRYSTAL CHEMISTRY AND GEOCHEMISTRY OF SCANDIUM

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A dominant theme in the geochemistry of scandium, originally stated by Goldschmidt and Peters in 1931, has been the supposed diadochy of Sc^3 with Fe^2 and Mg. It was based on the ionic radius, 0.83 \AA , attributed to Sc^3 . Recent refinements of the structures of Sc_2O_3 , $\text{Sc}_2\text{Si}_2\text{O}_7$, LaScO_3 and other Sc compounds have shown, however, that the radius of Sc^3 in 6-coordination is much smaller averaging near 0.73 \AA .

Studies by the authors of the crystal chemistry of synthetic Sc compounds indicate that the trace-element geochemistry of this element is based on a diadochic relation to Al, and in particular, to Fe^3 . Our syntheses include the Sc analogue of beryl, $\text{Be}_3\text{Sc}_2\text{Si}_6\text{O}_{18}$, together with solid solutions involving substitution of Sc^3 by Fe^3 , Cr^3 , V^3 , Mn^3 and Ga; the Sc analogues of andradite, $\text{Ca}_3\text{Sc}_2\text{Si}_3\text{O}_{12}$, aegirine, $\text{NaScSi}_2\text{O}_6$, and kentrolite, $\text{Pb}_2\text{Sc}_2\text{Si}_2\text{O}_9$, with serial substitution of Sc^3 by Fe^3 ; and the Sc analogues of spodumene, $\text{LiScSi}_2\text{O}_6$, and hydrogarnet, $\text{Sr}_3\text{Sc}_2(\text{OH})_{12}$. Further instances of the experimental substitution of Sc^3 and Fe^3 are cited from the recent literature. Most Sc compounds are isostructural with compounds of Al and Fe^3 , and there are no close crystallochemical relations to Fe^2 or Mg. The geochemical enrichment of Sc in ferromagnesian silicates such as garnet, micas, allanite, pyroxenes is now interpreted as connected not with (Fe^2 , Mg) but with the 6-coordinated (Al, Fe^3) positions. Attention also is drawn to the enrichment of Sc in Al and Fe^3 minerals, including phosphates, formed in the groundwater circulation.

STANFIELDITE, A NEW PHOSPHATE MINERAL IN STONY-IRON METEORITES

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The formula for this mineral from the Estherville mesosiderite is $\text{Mg}_3\text{Ca}_4\text{Fe}_2(\text{PO}_4)_6$. Weissenberg photographs indicate monoclinic, symmetry with $a = 17.16$, $b = 10.00$, $c = 22.88 \text{ \AA}$, $\beta = 100.25^\circ$. Probable space groups are Pc or P2/c. Associated minerals