polytypism in the dioctahedral micas may be explained.

Zussman reviewed the present state of crystal-chemical knowledge of pyroxenes and amphiboles. Although the fundamental structural models of both silicate classes are well known, the distinctions and variations between subclasses are not, because there have been few three-dimensional structural analyses of minerals in these groups. The distribution of iron and magnesium has been studied in only two cases, cummingtonite and hypersthene. Knowledge of alkali and calcium distributions and of the limits of solid solution between alkali and calcic amphiboles is completely lacking. It was also pointed out that complete understanding of the complex polymorphism of enstatite will be achieved only by x-ray studies of these phases at high temperature. The discussion of amphibole structures was primarily concerned with the distribution of cations other than silicon over the four available sites. C. T. Prewitt (Dupont Company) presented evidence that the tetrahedral sites as well as the A site may have to be considered as possible locations for these cations in certain amphiboles.

The problem of distribution of cations of varying size and its possible influence on silicate chain configuration in pyroxenes and the related pyroxenoids was the focus of much discussion. Joan Clark (U.S. Geological Survey) considered the lower-than-normal symmetry of omphacite and the possible existence of "domain" structures with regions having different cation distributions and possibly different space groups. Burnham suggested a likely pyroxenoid-type structure for a triclinic polymorph of ferrosilite, by analogy with pyroxmangite and rhodonite. D. A. Stephenson (University of Chicago) gave some results of high-temperature x-ray studies of enstatite by which a displacive transformation of clinoenstatite to a triclinic form has been discovered. Smith emphasized the necessity of studying structures at the temperatures where the crystals form, for the structures of the quenched products may be quite different. Liebau, in considering an extension of the concept of building chains, sheets, and frameworks from single and double tetrahedral units, pointed out that when certain cations not usually found in geologic environments are available, silicate structures containing chains built up from triple, quadruple, even quintuple tetrahedral units may be formed.

W. M. Meier (Technikum, Winterthur) developed an elegant classification of zeolites based on the simplest polytetrahedral building blocks from which the entire structure can be generated. In a comprehensive review he discussed the nature of exchangeable cation sites and the role of aluminum in these structures. There is evidence that alumina tetrahedra may be replaced by $(OH)_4$ tetrahedra under certain conditions. The distinction between feldspathoids and zeolites was found to be unjustifiable on structural grounds, for the various types of zeolite structures are at least as different from one another as they are from the feldspathoids. Discussion centered on the extreme difficulty of determining the positions of the exchangeable cations since most sites are only partially occupied. It was estimated that there are at least forty known zeolites whose structures have not been determined.

K. Fischer (Saarbrücken) introduced the closing session, on refinement of silicate structures. He discussed the importance of proper background measurement when using counter techniques and pointed out the severe criteria that must be satisfied by monochromators if they are to be used effectively. With respect to refinement results, he emphasized the importance of selecting an appropriate weighting scheme and the influence of anomalous dispersion and absorption corrections on thermal models. Finally, he demonstrated that by judicious selection of refinement procedures it is possible to determine Si-Al atomic distributions in disordered sites by the least-squares technique.

The problem of weighting appeared during discussion to be the least understood; Cruickshank aided considerably by citing the several criteria that must be met by a "correct" weighting scheme. Additional discussion focused on the problem of structure refinement in space groups of lower-than-apparent symmetry—for example, testing an ostensibly centric structure in the corresponding noncentric space group. The problems encountered in such a procedure were well documented. It was suggested that significance tests of the standard crystallographic R factor could indicate the validity of such refinements. The final discussion dealt with presentation of atomic thermal parameters and the question of the most appropriate procedure for correcting bond distances and angles for the effects of thermal motion. It was reemphasized that thermal data should be presented in terms of physically meaningful quantities, such as the magnitude and orientation of thermal ellipsoids, in addition to the anisotropic temperature-factor tensors.

Among the most significant results of the conference were the numerous possibilities for new directions and emphasis in silicate research indicated by the interaction of petrologic, chemical, and crystallographic approaches. Such stimulating interdisciplinary exchanges are possible only in small meetings such as this, and it is to be hoped that the success of the conference will lead to future meetings of a similar nature.

The conference was organized by a committee consisting of C. W. Burnham (Geophysical Laboratory), C. T. Prewitt (E. I. du Pont de Nemours and Co.), M. Ross and D. E. Appleman (U.S. Geological Survey), and T. Zoltai, director (University of Minnesota). It was sponsored by the Department of Geology and Geophysics, University of Minnesota, and was supported by a grant from the National Science Foundation.

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Calorimetry

Techniques and achievements in the field of calorimetry were the main topics of discussion at the 20th Calorimetry Conference, held in Ames, Iowa, 11–13 August 1965. Participants came from all sections of the United States and many foreign countries.

This year's meeting honored Daniel R. Stull (Dow Chemical Company) as its choice for the Huffman memorial lecture. Hugh Huffman, important for his research on the thermodynamic properties of amino acids, was the chief organizer of these conferences until the time of his death in 1950. At that time Stull assumed the responsibility.

The subject of Stull's address was the evaluation of thermodynamic data and the preparation of authoritative tables of properties. For many species of interest "one or more of the necessary facts are imperfectly known or even completely unknown." Preparing

a table of selected values "is like trying to assemble a jigsaw puzzle with part of the pieces missing and with some of the pieces swollen or shrunken from their true shapes."

A twin recording calorimeter is used at the University of Muenster, Germany, to measure heat capacities of electrolytes and organic compounds near room temperature (Th. Ackerman). The University of Lund, Sweden, was well represented by Stig Sunner and Ingemar Wadsö. Sunner described a high-precision calorimeter developed there and its application to direct measurements of heats of vaporization of water and of octane and other organic compounds. Wadsö discussed improvements in their reaction calorimeter.

Heats of fusion of iron, nickel, and silicon have been measured, with an accuracy previously unattainable, with a high-temperature drop calorimeter of excellent precision which has been developed at Irsid, France (M. Odette).

From England, J. S. L. Leach (Imperial College, London) and John N. Pratt (University of Birmingham) described liquid-tin-solution-calorimeters. P. Paraskevoudakis described an x-ray radiant-energy calorimeter used at the Puerto Rico Nuclear Center.

George Cataland (National Bureau of Standards) reported on a provisional temperature scale from 2° to 20°K. This research was prompted, in part, by a request from the Calorimetry Conference. Germanium-resistance thermometers were described by G. Ahlers (Bell Telephone Laboratories) and silicon-resistance thermometers by William V. Johnston (North American Aviation). Albert Benjaminson (Dymech Division, Hewlett-Packard) described a digital quartz thermometer in which the temperatures from −40° to 230°C are presented in digital form with precision as high as 0.0001 degree. Quartz crystals are frequently cut for electronic applications on planes for which the frequency of vibration is nearly constant with temperature. For the quartz digital thermometer the cut is made to give a maximum sensitivity of frequency to temperature.

Darrel W. Osborne reported that standard copper samples are available at Argonne National Laboratory for measurements of heat capacity below 25°K. The samples are cylindrical with an outside diameter of 3.17 cm. Borrowers may machine them but should return the samples to Argonne after testing them. G. Ahlers (Bell Telephone Laboratories) reported on measurements of several copper samples from 1.2° to 20°K.

Several participants discussed automatic adiabatic controls, automation of readings, and other improvements in the designs of calorimeters. A. Navrotsky (University of Chicago) described a new high-temperature solution calorimeter which uses oxide solvents for the purpose of determining heats of formation of oxides such as $MgAl_2O_4$.

For two sessions the meeting divided itself into small groups, where problems were discussed in specialized fields of interest to the members of the group. Among the topics were: solution calorimetry, bomb calorimetry, automation of measurements, thermometry, and low-temperature calorimetry. These groups permitted discussion of trends in calorimetry and needs of the future.

In his banquet speech Frank H. Spedding recounted how Iowa State University fulfilled its wartime assignment of producing large quantities of uranium. He interspersed his story with many humorous incidents as they actually happened.

At the business meeting O. J. Kleppa was elected to the position of chairman-elect and program chairman for the next conference. The following new directors were also elected: G. T. Furukawa (National Bureau of Standards), B. C. Gerstein (Iowa State University), and B. J. Zwolinski (Texas A. and M. University). Ralph Hultgren (University of California, Berkeley) will replace W. N. Hubbard (Argonne National Laboratory) as the chairman of the Calorimetry Conference.

An innovation at the conference was the display of commercial calorimetry equipment. It is now becoming possible to purchase calorimeters and parts of calorimeters. Formerly such equipment had to be designed and constructed by the experimenter.

The proceedings are not published; abstracts of the papers were distributed at the meeting.

The 21st Calorimetry Conference will be held at the University of Colorado, Boulder, Colorado, 22–24 June 1966. Information about program and attendance can be obtained from the program chairman, O. J. Kleppa, Institute for the Study of Metals, University of Chicago, Chicago, Illinois.

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Forthcoming Events

November

24–29. American College of **Apothecaries**, Inc., Miami Beach, Fla. (R. E. Abrams, Hamilton Court Hotel, 39th and Chestnut St., Philadelphia, Pa. 19104)

25. Central Assoc. of **Science and Mathematics Teachers**, Chicago, Ill. (A. M. Hach, 1220 Wells St., Ann Arbor, Mich.)

25–27. National Council for **Geographic Education**, New York, N.Y. (T. G. Gault, The Council, Indiana State College, Indiana, Pa.)

25–27. **Reinforced Plastics**, 4th intern. conf., British Plastics Federation, London, England. (The Federation, 47–48 Piccadilly, London, W.1)

26–27. **Interactions of Space Vehicles with an Ionized Atmosphere**, 2nd symp., Univ. of Miami, Coral Gables, Fla. (A. R. Hochstim, Inst. for Defense Analyses, 400 Army-Navy Drive, Arlington, Va.)

26–27. American Inst. of **Ultrasonics in Medicine**, 1st Pan American meeting, Lima, Peru. (C. Bustamante Ruiz, Dept. of Physical Medicine and Rehabilitation, Hospital Obrero, Lima)

28–3. **Radiological** Soc. of North America, Chicago, Ill. (M. D. Frazer, 713 Genesee St., Syracuse, N.Y.)

28–4. **Odontological** Federation of Central America and Panama, San Jose, Costa Rica. (R. Pauly S., Univ. of Costa Rica, San Jose)

28–4. **Odontological** Soc. of Chile, 5th intern. congr., Santiago. (J. Pequeño, San Antonio 510, Santiago)

29–30. Biochemical and Pharmacological Aspects of **Basal Ganglia Disease**, symp., Columbia Univ. College of Physicians and Surgeons, New York, N.Y. (M. D. Yahr, New York Neurological Inst., 710 W. 168 St., New York 10032)

29–2. **Entomological** Soc. of America, New Orleans, La. (R. H. Nelson, ESA, 4603 Calvert Rd., College Park, Md., 20740)

29–3. **Metallurgy**, 1st operating conf., Pittsburgh, Pa. (Metallurgical Soc. of American Inst. of Mechanical Engineers, 345 E. 47 St., New York 10017)

29–3. **Phytopharmacology**, intern. conf., Amsterdam, Netherlands. (California Chemical S.A. Française, 19, avenue George V, Paris 8e)

29–4. **Space Technology and Science**, 6th intern. symp., Tokyo, Japan. (D. Mori, Inst. of Space and Aeronautical Science, Univ. of Tokyo, 856 Koma-ba-machi, Meguro-ku, Tokyo)

29–8. **Rehabilitation of Persons with Dulled Sensory Perception**, intern conf., Braunschweig, Germany. (Sonnenberg Intern. Center, P.O. Box 460, 33 Braunschweig)

30–2. **Computers**, fall conf., Las Vegas, Nev. (R. Sheehy, Bunker-Ramo Co., 8433 Fallbrook Ave., Canoga Park, Calif.)

December

1–3. **Ultrasonics**, symp., Boston, Mass. (J. H. Rowen, Bell Telephone Laboratories, Murray Hill, N.J. 07971)

1–3. American **Water Resources** Assoc., first annual, Univ. of Chicago, Chicago, Ill. (AWRA, P.O. Box 434, Urbana, Ill.)