

Memorial of Jun Ito¹
September 25, 1926–June 6, 1978

PAUL B. MOORE

Department of the Geophysical Sciences
University of Chicago
Chicago, Illinois 60637

Jun Ito died at A. M. Billings Hospital (The University of Chicago) after a long and painful illness. A

¹ To receive a bibliography of 87 publications, order Document AM-79-104 from the Business Office, Mineralogical Society of America, 2000 Florida Ave., NW, Washington, DC 20009. Please remit \$1.00 in advance for the microfiche.

0003-004X/79/0506-0672\$02.00

recurrence of the cancer for which he had been operated on in 1972 appeared 18 months prior to his death, and he courageously underwent chemotherapy and continued his methodical activities with single-minded devotion, pursuing his research to the very end. In a memorial service, Professor O. J. Kleppa

(who was Director of the James Franck Institute during Jun Ito's first two years at Chicago) encapsulated most sensitively this tragic event: "As a scientist and as a man he showed us by his example how to work, and how to live, and in the end—how to die."

Indeed, Jun Ito was cut short in the midst of a rich and productive life. Some of his most brilliant achievements were realized within the past decade: complete wet-chemical analyses of unusually complex phases (mcgovernite, kraisslite, wyllieite and hendricksite), crystal growth (protoenstatite, orthoenstatite, idocrase), and study of complex systems (CaO-PbO-ZnO-SiO₂). His splendid achievements in successful crystal growth of seemingly intractable phases deluged him with requests for samples from geophysical laboratories throughout the world. Many of his papers are coauthored with other workers and dealt with their problems, but is it not ironic that in many cases the most demanding and difficult aspect of the project was realized in *his* laboratory? Jun Ito, so scrupulous, so modest, so intent upon his task, kept abreast of the analytic literature and ever improved his techniques. As upon a metaphorical magnificent Cavallé-Coll organ, he had a vast arsenal of techniques and "stops" at his command: general knowledge of the behavior of the elements in aqueous solutions over a range of Eh and pH values, systematic evaluation of major and minor elements present through emission spectrographic analysis, determination of water content from a variety of techniques, deciphering formal valences of first transition series metals, and the quantitative determination of troublesome components such as Li₂O, BeO, B₂O₃, Mn₂O₃, and As₂O₃. Atomic absorption analysis and X-ray diffraction analysis were also important tools in some of his projects.

The war years interrupted Jun Ito's educational career, and during those difficult times he contributed to feeding his family by growing vegetables in a small garden lot. In 1945 his scientific education began at the First Imperial College in Tokyo. During this period he was a skilled rugby player, an activity that gave him great satisfaction. Four years later he went to the University of Tokyo where he obtained a Master's degree in mineralogy in 1953, followed by an Instructorship the following year. While at the University of Tokyo he suffered from serious tuberculosis and had to convalesce for two years. During the early stages of his illness to maintain his strength, Jun did much climbing, including Mt. Fuji, and continued his rugby practice. His father, Tei-ichi (renowned crystallographer and 1968 Roebling Medalist), wanted



Jun to be a mineral chemist in the United States working with Clifford Frondel at Harvard, and this began a very fruitful period of five years (1955-1960). During this time he married Yoko Ohsato, an outstanding opera singer then on tour in the United States with an opera company, and presently teaching voice in Tokyo, who bore him two sons, Kenneth (Ken) and Elliott (Elli) also living in Tokyo. The wedding reception was held in the Frondel home, where festivities included a full house with guests dividing attention between the newlyweds and the finale of the World Series. A long and close contact was to develop between Cliff and Judy Frondel, and Jun. But visa problems forced the Ito family to return to Japan, where Jun continued study and lecturing at the University of Tokyo, obtaining his Doctorate (in mineralogy) in 1962 with a thesis centering on the analytical techniques of the complex tourmaline mineral group.

In 1965 he returned to Harvard, where he remained as Research Associate with a brief stay at the National Bureau of Standards until 1974, when the Materials Research Laboratory in the James Franck Institute (The University of Chicago) offered him a post as Senior Research Associate and Professional Chemist. But after Jun returned to the United States, Yoko remained in Tokyo with the children since her talent in teaching voice at a private school and her relative unease in the United States made a more permanent return trip impossible. Their marriage ended in divorce, but Yoko always expressed a fondness for Jun and she didn't remarry. In effect, Jun became more and more a self-made man. During 1971 he married Jean Rogers, a former secretary to Cliff Frondel and Connie Hurlbut, who presently

lives in Chicago with their lively and alertly intelligent son, John Paul.

Jun's Chicago years were equally productive. Growth of single crystals of refractory silicates and aluminates and thorough wet-chemical analyses of new or hitherto inadequately described mineral species attracted his scientific attention. Several papers were incomplete at his death, including studies on boron-rich humites, micas, and amphiboles from the Franklin marble. Jun often commented on the close interactions he had with students at Harvard, something he perhaps missed at Chicago owing to spatial

separation from the other mineralogists. But he attended departmental seminars and interacted with the group on the electron and ion probe analytic facilities through providing wet chemical analyses and a subsequent arsenal of standards. Devoted to his family and always rich with humor and abundant with dedication to his work, the loss of one of the most creative analytic chemists in the world and the very special human warmth, sensitivity, and sensibility left a pronounced gap in the mineralogic community.

The following material did not appear in the original publication.

PUBLICATIONS OF JUN ITO

- 1953 Recueil Mineralogique (I). (1) Epidote de Munam, (2) Epidote de Takeshi. *Mineral. J.* 1, 63-65.
- 1954 Recueil Mineralogique (II). (3) Andalousite de Koshinmen. *Mineral. J.* 1, 126-127.
- (with T. Watanabe) Paigeite (ferroludwigite) from the Kamaishi Iron Mine, Iwate prefecture, Japan. *Mineral. J.* 1, 84-88.
- 1955 Recueil Mineralogique (III). (4) Riebeckite from Sepori in the Fukushin-san district, Korea. *Mineral. J.* 1, 250-254.
- (with H. Minato and Y. Okamoto) On amblygonite from Nagatareyama. *J. Japan. Mineral. Soc.* 2, 263-267 (in Japanese).
- 1956 (with C. Frondel) Boltwoodite, a new uranium silicate. *Science* 124, 931.
- 1957 (with C. Frondel) Geochemistry of germanium in the oxidized zone of the Tsumeb Mine, South-west Africa. *Am. Mineral.* 42, 743-753.
- 1960 (with T. Watanabe and A. Kato) The minerals of Noda-Tamagawa Mine, Iwate Prefecture, Japan. II: pyrochroite ore (Kiminan-Ko) and its origin. *Mineral. J.* 3, 30-41.
- (with C. Frondel and U. B. Marvin) New data on birnessite and hollandite. *Am. Mineral.* 45, 871-875.
- (with C. Frondel and U. B. Marvin) New occurrences of todorokite. *Am. Mineral.* 45, 1167-1173.
- 1961 (with T. Watanabe and A. Kato) Manganpyrosmalite from the Kyurazawa Mine, Tochigi Prefecture. *Mineral. J.* 3, 130-138.
- (with D. J. Milton) Gedrite from Oxford County, Maine. *Am. Mineral.* 46, 734-739.
- A new method of decomposition for refractory minerals and its application for the determination of ferrous iron and alkalies. *Scientific Papers of the College of General Education* (Univ. Tokyo) 11, 48-68.
- (with T. Watanabe and Y. Takeuchi) The minerals of the Noda-Tamagawa Mine, Iwate Prefecture, Japan. III: Yoshimuraite, a new barium-titanium-manganese silicate mineral. *Mineral. J.* 3, 156-167.

PUBLICATIONS (J. Ito)

- 1962 A new method of decomposition for refractory minerals and its application to the determination of ferrous iron and alkalies. *Bull. Chem. Soc. Japan* 35, 225-228.
- 1963 (with T. Watanabe, A. Kato and T. Matsumoto) Jimboite, $Mn_3(BO_3)_2$, a new mineral from the Kaso Mine, Tochigi Prefecture, Japan. *Proc. Japan Acad.* 39, 170-175.
- (with C. Frondel) Manganberzeliite from Franklin, New Jersey. *Am. Mineral.* 48, 663.
- 1965 Synthesis of vanadium silicates: haradaite, goldmanite and roscoelite. *Mineral. J.* 4, 299-316.
- The synthesis of gadolinite. *Proc. Japan Acad.* 42, 404-407.
- (with C. Frondel) Sussexite from Sterling Hill, New Jersey. *Am. Mineral.* 50, 502-503.
- A note on the gadolinite synthesis. *Proc. Japan Acad.* 42, 634-635.
- (with C. Frondel) Composition of palermoite. *Am. Mineral.* 50, 777-779.
- (with C. Frondel) Stilpnomelane and spessartite-grossularite from Franklin, New Jersey. *Am. Mineral.* 50, 498-501.
- (with C. Frondel) Composition of rhodizite. *Tschermaks Mineral. Petrol.*
- 1966 (with C. Frondel) Hendricksite, a new species of mica. *Am. Mineral.* 51, 1107-1123.
- (with C. Frondel) Synthesis of the kentrolite-melanotekite series. *Ark. Mineral. Geol.* 4, 387-390.
- (with C. Frondel) Synthesis of barylite, strontium barylite and lead barylite. *Ark. Mineral. Geol.* 4, 391-394.
- (with C. Frondel and J. G. Hendricks) Barium feldspars from Franklin, New Jersey. *Am. Mineral.* 51, 1388-1393.
- (with C. Frondel) Zincian aegerine-augite and jeffersonite from Franklin, New Jersey. *Am. Mineral.* 51, 1406-1413.
- (with C. Frondel and A. Biedl) New type of ferric iron tourmaline. *Am. Mineral.* 51, 1501.
- 1967 (with C. Frondel) Syntheses of lead silicates: larsenite, barysilite and related phases. *Am. Mineral.* 52, 1077-1084.
- A study of chevkinite and perrierite. *Am. Mineral.* 52, 1094-1104.

PUBLICATIONS (J. Ito)

- (with C. Frondel) Synthetic zirconium and titanium garnets. *Am. Mineral.* 52, 773-781.
- (with C. Frondel) New synthetic hydrogarnets. *Am. Mineral.* 52, 1105-1109.
- Synthesis of calciogadcolinite. *Am. Mineral.* 52, 1523-1527.
- A new yttrium magnesium silicate garnet, $Y_6Mg_5Si_5O_{24}$ and its rare earth and nickel analogues. *Materials Res. Bull.* 2, 1093-1098.
- (with R. W. T. Wilkins) Infrared spectra of some synthetic talcs. *Am. Mineral.* 52, 1649-1661.
- 1968 Synthesis of the berzeliite ($Ca_2NaMg_2As_3O_{12}$)—manganese berzeliite ($Ca_2NaMn_2As_3O_{12}$) series (arsenate garnets). *Am. Mineral.* 53, 316-319.
- Synthesis of some lead calcium zinc silicates. *Am. Mineral.* 53, 231-240.
- (with C. Frondel) Barium-rich phlogopite from Långban, Sweden. *Ark. Mineral. Geol.* 4, 445-447.
- Strontium rare-earth germanate garnets and hydrogarnets. *Materials Res. Bull.* 3, 495-500.
- (with C. Klein) Zincian and manganoan amphiboles from Franklin, New Jersey. *Am. Mineral.* 53, 1264-1275.
- (with C. Frondel) Synthesis of grossular-spessartite series. *Am. Mineral.* 53, 1036-1038.
- (with C. Frondel and A. Montgomery) Scandium content in some aluminum phosphates. *Am. Mineral.* 53, 1223-1231.
- (with C. Frondel) Synthesis of scandium analogues of aegirine, spodumene, andradite and melanotekite. *Am. Mineral.* 52, 1276-1280.
- Silicate apatites and oxyapatites. *Am. Mineral.* 53, 890-907.
- (with C. Frondel) Synthesis of the scandium analogues of beryl. *Am. Mineral.* 53, 943-953.
- Indium silicates and hydrogarnet. *Am. Mineral.* 53, 1663-1673.
- (with H. Johnson) Synthesis and a study of yttrialite. *Am. Mineral.* 53, 1940-1952.
- Synthesis of cerite. *J. Res. Nat. Bur. Stand.* 72A, 355-358.
- 1969 (with S. Peiser) Distorted tetrahedra in copper akermanite. *J. Res. Nat. Bur. Stand.* 73A, 69-74.
- 1970 (with J. Arem) Idocrase, synthesis, crystal chemistry and phase relations. *Am. Mineral.* 55, 880-912.

PUBLICATIONS (J. Ito)

- (with L. Merker, G. Engel and H. Wondratschek) Lead ions and empty halide sites in apatites. *Am. Mineral.* 55, 1435-1437.
- (with N. H. Mao, J. F. Hays, J. Drake and F. Birch) Composition and elastic constants of hortonolite dunite. *J. Geophys. Res.* 75, 4071-4075.
- (with C. Frondel, C. Klein and J. Drake) Mineralogy and composition of Lunar fines and selected rocks. *Science* 167, 681-683.
- (with C. Frondel, C. Klein and J. Drake) Mineralogical and chemical studies of Apollo 11 Lunar fines and selected rocks. *Proc. Apollo 11 Lunar Science Conf.* 1, 445-474.
- 1971 (with J. Arem) Chevkinite and perrierite: synthesis, crystal growth and polymorphism. *Am. Mineral.* 56, 307-319.
- Synthesis of scandium pseudobrookite, Sc_2TiO_5 . *Am. Mineral.* 56, 1105-1108.
- (with J. Arem) Idocrase, synthesis, phase relations and crystal chemistry. *Proc. IMA-IAGOD Meetings, 70 IMA Vol. Mineral. Soc. Japan Special Paper* 1, 63-66.
- (with C. Frondel and C. Klein) Mineralogical and chemical data on Apollo 12 fines. *Proc. Second Lunar Science Conf.* 1, 719-726.
- 1972 Rhodonite-pyroxmangite peritectic along the join MnSiO_3 - MgSiO_3 in air. *Am. Mineral.* 57, 865-876.
- Synthesis and crystal chemistry of hydropyroxenoids. *Mineral. J.* 7, 68-88.
- 1973 (with A. Duba and J. C. Jamieson) The effect of ferric iron on the electrical conductivity of olivine. *Earth Planet. Lett.* 18, 279-284.
- (with P. B. Moore) Wylieite, $\text{Na}_2\text{Fe}_2^{2+}\text{Al}(\text{PO}_4)_3$, a new species. *Mineral. Rec.* 4, 131-136.
- (with Y. Takeuchi and N. Haga) The crystal structure of monoclinic $\text{CaAl}_2\text{Si}_2\text{O}_8$: a case of monoclinic structure closely simulating orthorhombic symmetry. *Zeitschr. Kristallogr.* 137, 380-398.
- (with T. Grove) High pressure displacive transformation in synthetic feldspars. *Trans. Am. Geophys. Union* 54, No. 4, 499.
- (with A. Mariano and P. Ring) Cathodoluminescence of plagioclase feldspars. *Geol. Soc. Am. Abs. (Dallas)*, 726.
- 1974 (with S. Hafner) Synthesis and study of gadolinites. *Am. Mineral.* 59, 700-708.

PUBLICATIONS (J. Ito)

- (with R. Gopal, C. Calvo and W. Sabine) Crystal structure of synthetic Mg-whitlockite. *Canad. J. Chem.* 52, 1155-1164.
- (with H. D. Grundy) The refinement of the crystal structure of synthetic nonstoichiometric Sr-feldspar. *Am. Mineral.* 59, 1319-1326.
- (with T. Watanabe, A. Kato, T. Yoshimura and H. Momoi) Haradaite, $\text{Sr}_2\text{V}_2\text{O}_7(\text{Si}_4\text{O}_{12})$, a new mineral from the Noda Tamagawa Mine, Iwate Prefecture, and Yamato Mine, Kagoshima Prefecture, Japan. (Abstract). *Internat. Mineral. Assoc., 9th General Meeting*, p. 97.
- 1975 (with C. Frondel) Zinc rich chlorite from Franklin, N. J. with a note on chlorite nomenclature. *Neues Jahrb. Mineral. Abhandl.* 123, 111-115.
- (with I. K. Goetz and G. L. Hovis) Unit-cell parameters of composition and Al-Si distribution for C 2/m barium-potassium feldspars. *Trans. Am. Geophys. Union* 56, 462.
- 1976 High temperature solvent growth of orthoenstatite, MgSiO_3 , in air. *Geophys. Res. Lett.* 2, No. 12, 533-536.
- Crystal synthesis of a new cesium aluminosilicate, $\text{CsAlSi}_5\text{O}_{12}$. *Am. Mineral.* 60, 170-171.
- Single crystal growth of orthoenstatite, MgSiO_3 , mantle component. *Trans. Am. Geophys. Union* 57, No. 2, p. 85.
- (with I. M. Steele) Experimental studies of $\text{Li}^+ + \text{Sc}^{3+}$ coupled substitution in the Mg-silicates: olivine, clinopyroxene, orthopyroxene, protoenstatite and a new high-temperature phase with $c = 27\text{\AA}$ (Abstract). *Geol. Soc. Am. Annual Meeting (Denver)*, p. 937.
- (with C. Frondel, R. M. Honea and A. M. Weeks) Mineralogy of the zippeite group. *Canad. Mineral.* 14, 429-436.
- 1977 (with F. Hawthorne) Synthesis and crystal structure refinement of transition metal orthopyroxene. 1. Orthoenstatite and Mg, Mn and Co orthopyroxene. *Canad. Mineral.* 15, 321-338.
- (with J. R. Smyth) The crystal structure of synthetic protopyroxene $(\text{Li}_{0.3}\text{Sc}_{0.3})\text{Mg}_{1.4}\text{Si}_2\text{O}_6$. *Trans. Geophys. Union* 58, p. 6312.
- (with D. J. Weidner and H. Wang) Elasticity of enstatite. *Trans. Geophys. Union* 58, p. 491.
- (with Y. Takeuchi and Y. Kudo) High temperature derivative structure of pyroxene. *Proc. Japan Acad. Sci.* 53, Ser. B., No. 2, 60-63.
- Crystal synthesis of a new olivine, LiScSiO_4 . *Am. Mineral.* 62, 356-361.
- (with J. R. Smyth) The synthesis and crystal structure of protopyroxene $\text{Li}_{0.3}\text{Sc}_{0.3}\text{Mg}_{1.4}\text{Si}_2\text{O}_6$. *Am. Mineral.* 62, 1252-1257.

PUBLICATIONS (J. Ito)

1978 (with P. B. Moore) Kidwellite, a new species. *Mineral. Mag.* 42, 137-140.

(with P. B. Moore) I. Whiteite, a new species. II. New data on xanthoxenite. III. Salmonsite discredited. *Mineral. Mag.* 42, 309-323.

(with P. B. Moore) Kraisslite, a new platy arsenosilicate from Sterling Hill, New Jersey. *Am. Mineral.* 63, 938-940.

End of supplemental material.