Memories of
Joseph V. Smith
Prof. Geophysical Sciences
1928 – 2007

The University of Chicago

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Hudnall Mini-Symposium
Honoring and Remembering
Joseph V. Smith
Professor of Geophysical Sciences
1928 – 2007

Saturday, 6 October 2007
Hinds Laboratory, University of Chicago
5734 South Ellis Avenue

Program

2:00 – 2:20 **Gordon Brown**: Applications of synchrotron radiation to Earth materials.

2:20 – 2:40 **Edith Flanigen and Robert Broach**: Joe Smith, a pioneer in zeolite crystallography.

2:40 – 3:00 **Joe Smyth**: Applications of crystallography to studies of Earth's mantle.

3:00 – 3:20 **Ian Parsons**: Feldspars: a phase feast.

3:20 – 3:30 *Break*

3:30 – 3:50 **Adrian Jones**: Searching for primitive carbon in the oldest diamonds.

3:50 – 4:10 **Rick Hervig**: Lithium etc.: Joe Smith's legacy in light element geochemistry.

4:10 – 4:30 **Brian Windley**: Archean anorthosites and their role in development of Earth's crust from 1970 to today.

4:30 – 4:40 *Break*

All presentations in Hinds 101

4:40 – 5:00 **Ian Steele**: Working together with Joe for 35 years.

5:00 – 5:20 **Peter Wyllie**: How Joe and I journeyed from Britain to Penn State to Chicago

5:20 – 6:00 *Reception in Goldsmith Room (Hinds Lab room 176)*

6:00 - 9:00 *Dinner in Swift Hall Common Room*

Sponsored by:
The Center for Advanced Radiation Sources,
Argonne National Laboratory
Department of the Geophysical Sciences, University of Chicago
The Journal of Geology
Physical Sciences Division, University of Chicago

Memories of Joseph V. Smith

A Booklet
Derived from materials that were exhibited on October 6, 2007
In Hinds Lab, 5734 S. Ellis Ave. at a remembrance event organized by
Fred Anderson, Ian Steele, Steve Sutton and Michael Foote

Preface by Fred Anderson

The purpose of this booklet is to help us realize and remember the broad and diverse topics and people that comprised Joe's world. I know that Joe's world and contributions go far beyond what we have displayed. However, the contents of this booklet certainly do reveal a truly exceptional amount of diversity and depth by any standard.

The booklet comprises about 50 pages of text and images. In addition to the booklet we display copies of Joe's 5 books, two crystal structure models and some of his course notes. A pdf file based on the booklet is planned and is to be accessible through the Departmental website. I thank Brenda Smith (Joe's wife), Virginia Smith and Susan Werther (Joe and Brenda's daughters) for supplying me with excellent pictures. I also thank Ian Steele, Howard Zar, Al Duba and numerous others for images, materials etc.

Ian Steele and I put Joe's published works into the following categories:
1) Feldspars, 2)Zeolites, 3)Anorthosites, the Moon and Planetary Crusts, 4) the Earth's mantle, 5)Electron microprobe, ion microprobe, synchrotron X – ray source, 6) Crystallography in theory and practice, and 7) Human welfare and biochemical evolution. I selected 37 articles from Joe's list of about 400 publications to illustrate his diverse interests.

In addition Ian and I decided to include an abbreviated personal history, a list of the students who received Ph D degrees at Chicago under him, a list of one-page biographical statements by the 9 speakers, the title pages of a few of his publications, Joe's preface to his feldspar books, and possibly most mysteriously some copies and selected items from the DOGSheet to which Joe contributed, and a statement by Howard Zar about Joe's interest in geoscience and human welfare.

Finally there are four obituaries from his professional friends and colleagues: Barry Dawson, Peter Wyllie, Romano Rinaldi, and Werner Baur.

JOSEPH V. SMITH

Born	7/30/1928, Derbyshire, England; Naturalized USA citizen
Deceased	4/6/2007, age 78, Boston

Education: Cambridge University

1948	B.A. 1st Class Honors Natural Science Tripos (Chemistry, Mathematics, Mineralogy, Physics),
1951	Ph.D. in Physics/Crystallography, Thesis Advisor: 1948-51, Dr. Helen Megaw.

Professional Career:

1951-4,	Fellow, Geophysical Laboratory, Carnegie Institution of Washington;
1954-6,	Demonstrator, Cambridge University;
1956-60	Asst./Assoc. Professor, Pennsylvania State University;
1960-77,	Professor, Geophysical Sciences, University of Chicago;
1977-,	Louis Block Professor of Physical Sciences;
1989-92,	Director, Center for Advanced Radiation Sources;
1993-,	Coordinator for Scientific Programs.

Outside Appointments (selected):

1965,	Visiting Professor, California Institute of Technology;
1956-2001,	Consultant, Union Carbide Corporation (1956-1982) and UOP;
1983-2001;	Visiting Physicist and Consultant, Brookhaven National Laboratory;
1985-	Research Associate, American Museum of Natural History, New York;
1984,	Consultant, Lawrence Livermore National Laboratory;
1990-1992,	Consultant, Argonne-Materials Science Division

Society Memberships (selected):

American Academy of Arts and Sciences (Fellow);
American Association for the Advancement of Science (Fellow);
American Chemical Society;
American Crystallographic Association;
American Geophysical Union (Fellow; ex-President, Volcanology-Geochemistry-Petrology);
Geochemical Society;
Geological Society of America (Fellow);
Geological Society of London (Honorary Fellow; Murchison Medal);
International Zeolite Association;
Meteoritical Society (Fellow);
Microbeam Analysis Society;
Mineralogical Association of Canada;
Mineralogical Society (London; Honorary Fellow; Hallimond Centenary Lecturer);
Mineralogical Society of America (Fellow; ex-President; Roebling Medal; MSA Award);
National Academy of Sciences (1998, Colloquium on Geology, Mineralogy & Human Welfare; 1999-2003, National Research Council);
Royal Society (London; Fellow)

Selected Services:

1984	Seitz-Eastman Committee on Major Materials Facilities;
1985-7	Steering Committee for 6 GeV Synchrotron;
1986-9	Steering Committee for New Nuclear Reactors;
1987-9	NAS-Board on Earth Sciences; 1988 Special Review Committee for NSLS and HFBR, Brookhaven National Laboratory;
1990	Co-Chair, Geosync-International; not updated after 1990;
1999-	International Geoscience & Human Welfare Project, Organizer;
2000-	Enviro-CAT, Co-Organizer

University of Chicago Geosci Ph. D. Students of Joe Smith

Gilberto Artioli	Structural studies of the water molecules and hydrogen bonding in zeolites
Finley Bishop	Partitioning of Fe2+ and Mg between ilmenite and some ferromagnesian silicates
Sergio Deganello	A thermal study on a member of the olivine structure type ([gamma]Na2BeF4)
William Dytrych	Theoretical and experimental investigations of aluminophosphate molecular sieves
Gerald Gibbs	From Penn State (Joe's first PhD student)
Shaoxu Han	Systematic enumeration of 4-connected 3-dimensional nets in zeolites and related materials : combination of 3-connected 2-dimensional nets with 1-dimensional chains
Richard Hervig	Minor and trace element composition of mantle minerals : Ca-Mg exchange between olivine and orthopyroxene as a geobarometer and the origin of harzburgites
Catherine Leitch	Mineralogy, petrology and origin of the unequilibrated enstatite chondrites
John Louisnathan	The nature of Mg-Al-Si ordering in melilites, (Ca, Na)2 (Mg, Al) (Al, Si)2O7 and the crystal structure of fresnoite, B2(tiO)Si2O7
Timothy McClarnen	Some counting problems in crystallography
Paul Moore	The crystal structures of laueite...
Anthony Perrotta	Some alumino-silicate framework structures
Joseph Smyth	High temperature single-crystal studies on low-calcium pyroxenes
Richard Stenstrom	Some geochemical aspects of diagenetic changes in a shale

If you know of others, please let us know!

Joseph V. Smith
Some published works selected to reveal the scope and range of his research.

Feldspars

Smith, J.V. (1956) The powder patterns and lattice parameters of plagioclase feldspars. I. The soda-rich plagioclases. Min. Mag., 31 47-68.

Smith, J.V. (1972) Critical review of synthesis and occurrence of plagioclase feldspars and a possible phase diagram. J. Geol., 80, 505-525.

Smith. J.V. (1974) *Feldspar Minerals*. Vol. 1. *Crystal Structure and Physical Properties*. pp. 627. Springer Verlag.

Smith, J V. (1974) *Feldspar Minerals*. Vol. 2 . *Chemical and Textural Properties*. pp. 600 Springer Verlag.

Smith, J.V. (1984) Phase relations of plagioclase feldspars. Reviews in Mineralogy, 2, 223-239.

Parsons, I., Lee, M.R., Smith J.V. (1998) Biochemical evolution II: Origin of life in tubular microstructures on weathered feldspar surfaces. Proc. Nat. Acad. Sci., 95, 15173-15176.

Zeolites

Dent, L.S., Smith, J.V. (1958) Crystal structure of chabazite, a molecular sieve. Nature, 181. 1794-1796.

Smith, J.V. (1963) Structural classification of zeolites. Mineralogical Society of America, Special Paper No. 1, 281-290.

Rinaldi, R., Smith, J.V., Jung. G. (1975) Chemistry and paragenesis of faujasite, phillipsite and offretite from Sasbach, Kaiserstuhi, Germany. Neues Jahrb. Miner. Monat., 433-443.

Smith, J.V. (1976) Origin and structure of zeolites. In *Zeolite Chemistry and Catalysis*. Amer. Chem., Soc. Monograph 131 ed. J.A. Rabo, pp. 1 – 79.

Flanigen, EM., Bennett, J.M., Grose, R.W., Cohen, J.P., Patton, R.L., Kirchner, R.M., Smith, J.V. (1978) Silicalite, a new hydrophobic crystalline silica molecular sieve. Nature, 271, 512-516.

Anorthosites, the Moon and Planetary Crusts

Anderson, A.T., Jr., Crewe, A.V., Goldsmith, J.R., Moore, P.B., Newton, R.C., Olsen,E.J., Smith, J.V., **Wyllie, P.J.** (1970) Petrologic history of moon suggested by petrography, mineralogy and crystallography. Science, 167, 587-590.

Steele, I.M., Smith, J.V. (1971) Mineralogy of Apollo 15415 "Genesis rock": source of anorthosite on Moon. Nature, 234, 138-140.

Windley, B.F., Smith, J.V. (1974) The Fiskenaesset complex, West Greenland. Part II. General mineral chemistry from Qeqertarssuatsiaq. Gronlands Geologiske Undersogelse, Bulletin No. 108.

Smith, J.V. (1974) Lunar mineralogy: A heavenly detective story. Presidential Address, Part 1. Am. Min., 59, 231-243.

Windley, B.F., Smith, J.V, (1976) Achaean high grade complexes and modern continental margins. Nature, 260, 671-675.

Steele, I.M., Bishop, F.C., Smith, J.V., Windley, B.F. (1977) The Fiskennesset complex, West Greenland. Part III. Chemistry of silicate and oxide minerals from oxide-bearing rocks, mostly from Qeqertarssuatsiaq. Gronlands Geologiske Undersogelse, Bull. 24.

Smith, J.V. (1977) Mineralogy of the planets: a voyage in space and time. Philos. Trans. R. Soc. London, 286, 433-437.

Smith, J.V. (1980) Planetary crusts: A comparative review. Proc. Conf. Lunar Highland Crust, pp. 441-456.

Steele, I.M., Hutcheon, I.D., Smith, J.V. (1980) Ion microprobe analysis and petrogenetic interpretations of Li, Mg, Ti, K, Sr. Ba in lunar plagioclase. Proc. Lunar Planet. Sci. Conf. 11th, pp. 571-590.

Earth's Mantle

Dawson, J.B., Smith, J.V. (1975) Occurrence of diamond in a mica-garnet lherzolite xenolith for kimberlite. Nature, 254, 580-581.

Smith, J.V., **Hervig, R.L.**, Ackermand, D., Dawson, J.B. (1979) K, Rb and Ba in micas from kimberlite and peridotitic xenoliths, and implications for origin of basaltic rocks. In *Kimberlites, Diatremes and Diamonds: Their Geology, Petrology and Geochemistry*, eds. F.R. Boyd and H.O.A. Meyer, American Geophysical Union, Washington, D.C.. pp. 241-251.

Dawson, J.B., Smith, J.V., **Hervig, R.L.** (1980) Heterogeneity in upper-mantle lherzolites and harzburgites. Phil. Trans. R. Soc. London, 207, 323-331.

Jones, A.P., Smith, J.V., Dawson, J.B. (1982) Mantle metasomatism in 14 veined peridotites from Bultfontein mine, South Africa. J. Geol., 90, 435-453.

Dawson, J.B., Smith, J.V., **Steele, I.M.** (1992) 1966 ash eruption of the carbonatite volcano Oldoinyo Lengai: mineralogy of lapilli and mixing of silicate and carbonate magmas. Min. Mag., 56, 1-16

Electron microprobe, Ion microprobe, Synchrotron X – ray source

Smith, J.V. (1965) X-ray emission microanalysis of rock-forming minerals. I. Experimental techniques. J. Geol., 73, 830-864.

Hutcheon, I.D., **Steele, I.M.**, Smith, J.V., Clayton, R.N. (1978) Ion microprobe, electron microprobe and cathodoluminescence data for Allende inclusions with emphasis on plagioclase chemistry. Proc. Lunar Planet. Sci. Conf. IX, pp. 1345-1368.

Sutton, S.R., Rivers, M.L., Smith, J.V. (1986) Synchrotron X-ray fluorescence: diffraction interference. Anal. Chem., 58, 2167-2171.

Sutton, S.R., Rivers, M.L., Smith, J.V., **Brown, G.E.**, Jr., Jones, K.W. (1998) Synchrotron X ray sources in the earth sciences. Eos (Mineral Physics News), December 27, 1666-1668.

Crystallography in theory and practice

Rinaldi, R., Pluth, J.J., Smith, J.V. (1975) Crystal structure of cavansite dehydrated at 220°C. Acta Cryst., B31, 1598-1602.

Smith, J.V. (1977) Enumeration of 4-connected 3-dimensional nets, and classification of framework silicates. I. Perpendicular linkage from simple hexagonal net. Amer. Min.., 62, 703-709.

Smyth, J.R., Smith, J.V., Artioli, G., Kvick, Å. (1987) Crystal structure of coesite, a high-pressure form of SiO_2, at 15 and 298 K from single-crystal neutron and X-ray diffraction data: test of bonding models. J. Phys. Chem., 91, 988-992.

Human welfare and biochemical evolution

Smith, J.V. (1985) Protection of the human race against natural hazards (asteroids, comets, volcanoes, earthquakes). Geology, 13, 675-678.

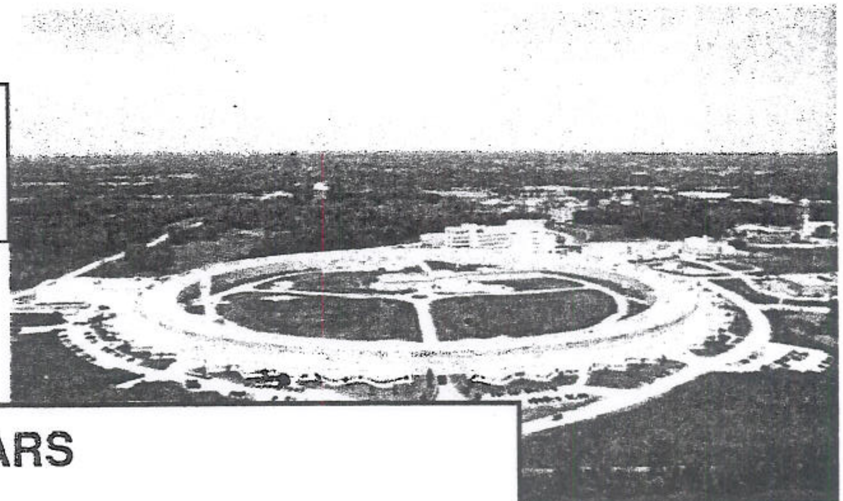
Smith, J.V. (1998) Biochemical evolution. I. Polymerization on internal, organophilic silica surfaces of dealuminated zeolites and feldspars. Proc. Nat. Acad. Sci., 95, 3370-3375.

Parsons, I., Lee, M.R., Smith J.V. (1998) Biochemical evolution II: Origin of life in tubular microstructures on weathered feldspar surfaces. Proc. Nat. Acad. Sci., 95, 15173-15176.

Smith, J.V. (1999) Geology, mineralogy, and human welfare. Proc. Natl. Acad. Sci., 96, 3348-3349.

Smith, J.V. (2000) Natural Hazards: Geology, engineering, agriculture, and Sociopolitical/humanitarian considerations for the twenty-first century. Inter. Geol. Rev., 42, 617-656.

Advanced Photon Source at Argonne National Laboratory



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CAT DIRECTOR: Joseph V. Smith
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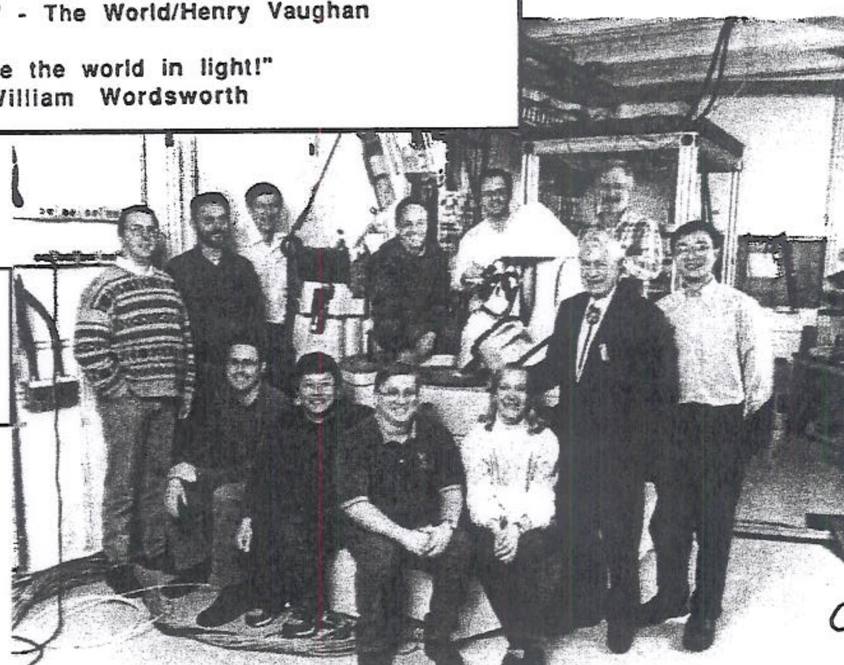
5734 South Ellis Avenue
Chicago, Illinois 60637

March 15, 1991: phone 312-702-8110, fax 312-702-0157,
E-mail ARPANET: SMITH@GEOVAX.UCHICAGO.EDU

"Mehr licht" - Goethe's last words

"I saw eternity the other night/Like a great ring
of pure and endless light" - The World/Henry Vaughan

"Rise up, and bathe the world in light!"
The Excursion/William Wordsworth



Joe with the GeoSoilEnviroCARS Staff at APS

Brief Bio for speaker Gordon E. Brown, Jr.: D.W. Kirby Professor, School of Earth Sciences, Stanford University

Gordon E. Brown, Jr. is the D.W. Kirby Professor in the School of Earth Sciences at Stanford University, and he is also Professor of Photon Science at the Stanford Linear Accelerator Center. In addition, Brown serves as Director of the Stanford Environmental Molecular Science Institute and has also served as Chair of the Geology Department at Stanford (1986-1992), Chair of the Stanford Synchrotron Radiation Laboratory Faculty (1998-2007), and Co-Director of the Stanford Center for Materials Research (1987-1989). Brown did his Ph.D. work with Jerry Gibbs at Virginia Tech in mineralogy and crystallography (1966-1970), post-doc'd at SUNY Stony Brook with Charlie Prewitt and Jim Papike (1970-1971), was Assistant Professor of Geological and Geophysical Sciences at Princeton University (1971-1973), and has been on the faculty in the School of Earth Sciences at Stanford University since August 1973. Brown was the first earth science user of a synchrotron radiation source (the Stanford Synchrotron Radiation Project) in the mid 1970's where he carried out the first x-ray spectroscopic studies of the local structural environment of iron in silicate glasses. The current research of Brown and his students involves molecular-scale studies of environmental contaminants in both natural and synthetic systems, including those containing microorganisms. He and his students use a variety of synchrotron radiation methods, coupled with other experimental and theoretical methods, to study the chemical and biological processes that sequester and/or transform contaminant species, particularly at mineral-aqueous solution interfaces. Brown's research also focuses on defining the local environments of trace elements in silicate glasses and melts and structure-property relationships in silicate melts. He is the recipient of the Roebling Medal of the Mineralogical Society of America for his lifelong work in mineralogy, the Clair C. Patterson Medal of the Geochemical Society for his work in environmental geochemistry, the Hawley Medal of the Mineralogical Association of Canada for his work with Francois Farges and others on molybdenum complexation and transport in silicate liquids, and a Docteur Honoris Causa degree from the University of Paris VII and is a fellow of a number of scientific societies. He is deeply indebted to Joe Smith, his academic grandfather, for Joe's remarkable vision of scientific user facilities in the 1980's that led to the founding of GSECARS, the leading synchrotron radiation facility in the world for research on earth and environmental materials.

Brief Bio for speaker Edith M. Flanigen: Union Carbide Senior Research Fellow (retired), Consultant, UOP, Des Plaines, IL

Dr. Edith M. Flanigen

Dr. Edith M. Flanigen earned a Bachelor of Arts Degree in Chemistry from D'Youville College in Buffalo in 1950, and a Master's Degree in Inorganic-Physical Chemistry from Syracuse University in 1952. She joined the Research Staff of Union Carbide Corporation in Tonawanda, NY in 1952 and served as a Research Scientist with Union Carbide until 1988, when she transferred to UOP, a joint venture of Union Carbide and AlliedSignal. She retired in 1994 as a Union Carbide Senior Research Fellow and a UOP Fellow, and has continued as a consultant to UOP R & D since that time.

Dr. Flanigen has attained international prominence for her work in the fields of silicate chemistry and the chemistry of zeolites and molecular sieve materials. Her accomplishments include synthesizing new molecular sieve materials for application as adsorbents and catalysts; inventing the hydrothermal emerald synthesis process; and pioneering the use of mid-range infrared spectroscopy for interpreting zeolite structures. She led the Union Carbide Research Group that discovered new generations of molecular sieve materials in the late 70's and 80's, including families of aluminophosphates, silicoaluminophosphates, and other novel molecular sieves. She has authored or co-authored over 36 publications and has been granted 108 U.S. patents.

In 1983 Dr. Flanigen received a Doctor of Science, *Honoris Causa,* degree from D'Youville College. Her other honors and awards include: the Francis P. Garvan- John M. Olin Medal of the American Chemical Society, 1993; the Perkin Medal of the Society of Chemical Industry, American Section, 1992; the Chemical Pioneer Award of the American Institute of Chemists, 1991; and Election to the National Academy of Engineering of the United States, 1991.

Dr. Flanigen had a long association and collaboration with Joe Smith who served as a consultant to the Union Carbide zeolite and molecular sieve research group from 1956 to 2001, first at Tonawanda, NY, and later at Tarrytown, NY and with UOP in Des Plaines, Il. Joe's collaboration with the Union Carbide and UOP group was most enjoyable and productive and included many joint research projects and publications.

Brief Bio for speaker Richard L. Hervig: Professor, Earth and Space Exploration, Arizona State University

Richard Hervig is a Professor in the School of Earth and Space Exploration at Arizona State University. He attended the University of Chicago from 1975 to 1980 as a graduate student and subsequent postdoctoral research associate advised by Joe Smith. His research involved applying sensitive electron probe analyses to mantle minerals and using these samples to calibrate the prototype secondary ion mass spectrometer (SIMS) that Joe and others had obtained. After a brief sojourn in government-funded studies of nuclear waste disposal, he moved to Arizona State University to conduct research in thermodynamic properties of silicate glass with Alexandra Navrotsky (a University of Chicago graduate). In 1984, he was transferred to the new SIMS lab at ASU and since then has been involved with research in developing and applying new microbeam techniques to problems in geo- and cosmo-chemistry. In addition to trace element analysis, Hervig developed techniques for oxygen, boron, and lithium isotope microanalysis in samples from extraterrestrial and terrestrial samples, including materials formed in igneous, metamorphic, and sedimentary environments. Hervig has been made a Fellow of the Mineralogical Society of America and elected to the Kaiserlich Konigsliche Böhmische Physikalische Gesellschaft for his research in ion-solid interactions, a direct result of his PhD research with Joe Smith. He sits on national (NSF Proposal Review Panel; EAR Instrumentation and Facilities) and international (NERC Edinburgh Ion Microprobe Steering Committee) panels related to SIMS and other micro-analytical research. His students and post-doctoral research associates (one subset of Joe Smith's intellectual "grandchildren") have positions at the University of Western Ontario, UCLA, US Geological Survey, and Microsoft.

Brief Bio for speaker Adrian P. Jones: Reader in Petrology, University College of London, UK

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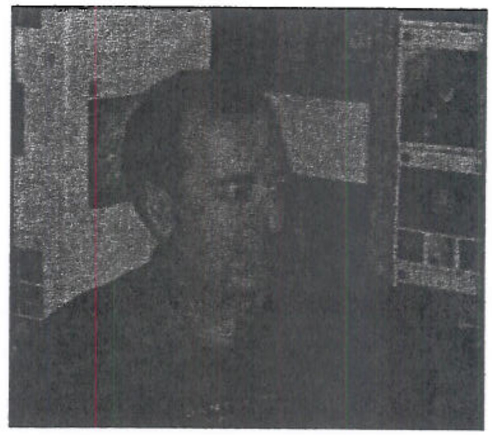
Dr Adrian P. Jones



Reader in Petrology

Graduate Tutor

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Tel: 020 7679 2415

Research Interests

The Haskel Laboratory uses high pressure solid state multianvil presses to quantify materials and melting behaviour in the Earths mantle, and the transport of materials to sites of volcanic eruptions. We are particularly interested in the deep carbon cycle, - where C is stored and how it is entrained back to the surface in C-rich magmas like carbonatites and kimberlites (see ESF Eurocarb). Diamond provides the deepest known terrestrial samples and may have survived from the early stages of the Earth's history, including impact accretion and a magma ocean; it therefore provides a unique way to directly access a significant part of the Earths carbon inventory. We are part of the Mineral Ice and Rock Physics Laboratory, and share the same facilities with colleagues working on deformation. Systematic analysis of products from HP experiments is compared with natural diamond through microscopic analytical techniques both in the Earth Sciences and Chemistry Departments, including electron microprobe, laser ICPMS, IR and Raman spectroscopy and Xray diffraction.

The highest experimental pressures are achieved through shock during hypervelocity impacts, and these allow access to processes which include the ancient bombardment history of the early Earth. Materials behaviour during high shock pressure can be related to static experimental data through equations of state, when allowance is made for the unique loading and unloading conditions of impact experiments. A combined modelling and experimental approach links naturally to planetary geology and astrobiology. We collaborate with several experimental gun facilities, and our understanding of terrestrial materials has enabled us to parameterise the response of the lithosphere to large impact cratering, including potential for triggering volcanic activity.

Brief Bio for speaker Ian Parsons: Emeritus Professor of Mineralogy, University of Edinburgh, UK

Ian Parsons, Emeritus Professor of Mineralogy, Grant Institute of Earth Science, The University of Edinburgh, UK

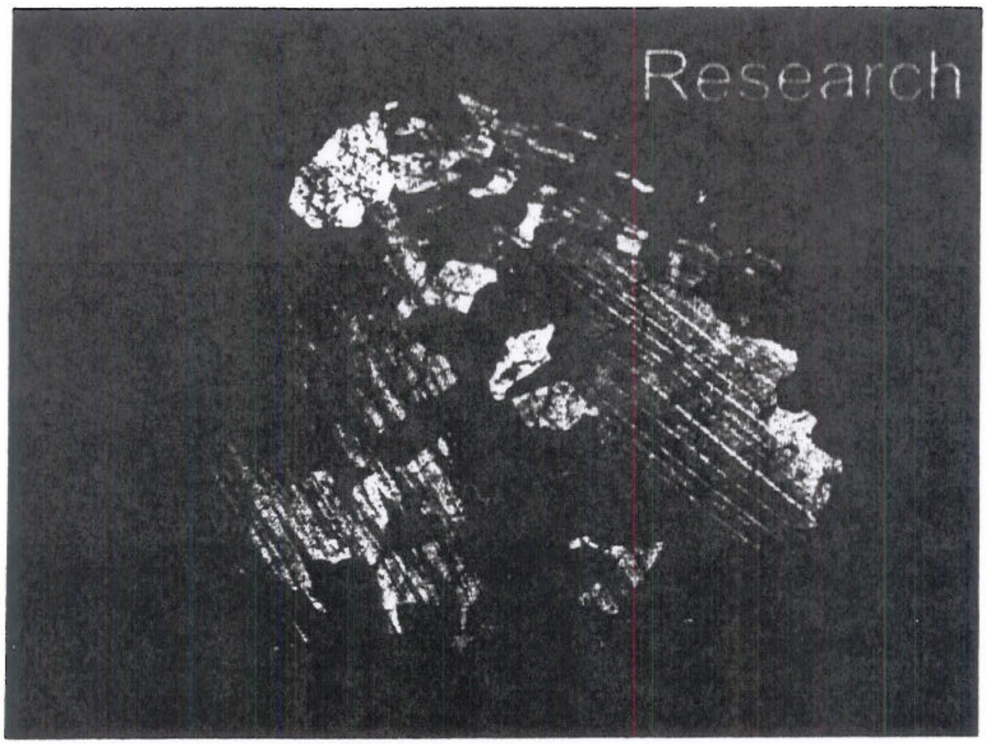
As a PhD student at Durham, supervised by Henry Emeleus, I was sent in 1960 to NW Scotland to work on a small syenite intrusion which is the type locality of the monomineralic alkali feldspar rock 'perthosite'. I had to find out about feldspars. Henry had collaborated with Joe Smith on a single crystal X-ray study of high temperature alkali feldspars using a method devised by Joe and WS MacKenzie ('Mac') at the Geophysical Lab. I learned the technique and discovered that optically featureless 'single-crystal' cleavage fragments could contain as many as three feldspar phases in nine different orientations. I wanted to know how this complexity arose and what it meant in terms of rock history. After a year as a post-doc in Mac's lab in Manchester I landed a lectureship in Aberdeen where I set up a small experimental system with Tuttle bombs. This provided the first properly reversed determination of the alkali feldspar solvus, at 1 kbar and led to a life-long collaboration with Bill Brown at the CRPG in Nancy, starting with the thermodynamics of ternary two-feldspar geothermometers which underpins all modern computerized versions.

Joe's brilliant interpretation of the diffraction patterns told us the geometrical relationships of exsolution textures and twins in alkali feldspars. When TEM methods became routine the spatial relationships and their evolution could be unravelled. Bill and I pioneered the use of TEM in a petrological context, working mainly on alkali feldspars from the spectacular Klokken layered syenite intrusion in S Greenland which I mapped for the Geological Survey of Greenland (GGU) in 1971. Feldspars have led me from the granulite facies to diagenesis, weathering and with Joe and Martin Lee, to a proposal that tubular networks near weathered feldspar surfaces would be ideal reactors for the origin of life. Around 1985 Joe asked Bill and myself to work with him on a 2nd Edition of his 1974 masterwork, Feldspar Minerals, published by Springer. Joe and Bill condensed the two volumes of the 1974 edition into one, which appeared in 1988, and the three of us set out on a new volume 2 covering phase equilibria and occurrence in rocks. Bill and I wrote the phase equilibrium chapters, but Bill became Director of the CRPG, I became Head of Department in Edinburgh and Joe became much involved with CARS. Sadly, volume 2 will never appear. Joe catalysed four NATO ASI's on feldspars, organised by Tom Barth in Oslo, Mac in Manchester, Bill in Rennes and myself in Edinburgh. A symposium 'Feldspars 2007' at the recent Frontiers meeting in Cambridge was the spiritual successor of these Institutes and was dedicated to Joe.

I have worked on many projects in the Gardar alkaline province in South Greenland, and continue to be involved with the alkaline rocks of NW Scotland. The map in my 1963 thesis has just been published as part of a new BGS map of Assynt, in the Moine Thrust Zone. My greatest adventure (1980) was to help GGU map the Kap Washington volcanics in Peary Land at 83°30′ N and to contribute to the world's most northerly geological maps. From 2002-4 I was President of the IMA and am about to finish a rewarding three years as one of the founder editors of *Elements* magazine.

Brief Bio for speaker Joe Smyth: Professor of Geological Sciences University of Colorado

Joseph R. Smyth, Professor of Geological Sciences, University of Colorado, Boulder, CO. I was J.V. Smith's PhD students completing in 1970 with a high temperature crystallographic study of pyroxenes. I have followed Joe's example of using crystallographic experimental methods to explore the processes of the Earth's interior. My work has greatly benefited from the availability of synchrotron X-ray sources. I have been investigating the incorporation of water as hydroxyl in the nominally anhydrous minerals of the Earth's interior. Water is incorporated in all of the major phases of the upper mantle and transition zone in quantities sufficient to affect seismic velocities and phase transition depths.



Ultra-Deep Nodule.

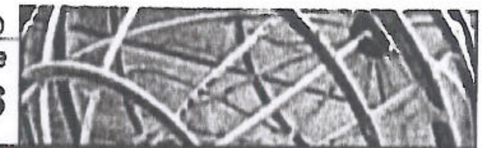
The image is a crossed-polars thin section photo of a garnet pyroxenite nodule from the Bellsbank Kimberlite, South Africa. The high-birefringence (colored) mineral is clinopyroxene; the low birefringence (gray) mineral is orthopyroxene; and the extinct (black) mineral is garnet. The two-pyroxene-garnet intergrowth texture indicates that the entire nodule originally crystallized as a single phase. The only possible single-phase of this composition would be a majoritic garnet at pressures above 17 GPa or 500 km depth.

Interestingly the nodule also contains sulfide blebs containing the mineral djerfisherite, a potassium nickel iron sulfide, which confirms the chalcophile nature of K at high pressure, consistent with K as the heat-generating element in the core

I last modified this site on September 7, 2007.

Brief Bio for speaker Ian Steele:
Senior Research Associate
University of Chicago

The UNIVERSITY of CHICAGO
The Department of the
Geophysical Sciences



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Ian Steele
Senior Research Associate

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Publications

I've been at the University some 26 years and during this time have been involved in a wide range of studies. Broadly speaking, I apply mineralogy and crystallography, sensu lato, to answer basic questions dealing with natural and synthetic materials. Nearly all these studies have involved the application of instrumental techniques.

Beginning with the returned lunar sample program in 1971, extraterrestrial materials have been a continuing interest. The main theme of this work has been to use minor and trace elements in minerals to deduce information about their history. Particular emphasis has been placed on olivine and feldspar. Analysis techniques have included electron, ion and X-ray microprobes and funding is received from NASA.

For the last ten years I have worked with several companies which manufacture lead acid batteries which find application in a wide range of products including portable appliances, automobiles, and submarines. Recent legislative incentives have spurred research into their application for electric vehicles and as a result I have been funded by the Advanced Lead Acid Battery Consortium to conduct novel experiments to document changes within battery materials (synthetic minerals) as a function of charging techniques. I have organized a group consisting of battery manufacturers, scientists at Argonne National Laboratory, The University of Chicago, and CSIRO (Australia) to provide a wide range of expertise. Basically this involves construction of experimental batteries and continuous monitoring using in-situ neutron diffraction over the lifetime of the battery. Parallel studies will evaluate changes in batteries used in test vehicles in Canada using very high resolution SEM and TEM instruments.

Basic crystallography continues with the structure solution of a number of important phases mostly related to battery materials. These all contain lead which forms a fascinating range of compounds, many containing sulfate, carbonate, phosphate, silicate and hydroxide units. We have solved both tribasic and tetrabasic lead sulfate structures and are now working on other minor battery phases including hydrocerussite and plumbonacrite. Because synthetic phases are notoriously fine-grained, a project has been initiated examining the natural formed lead compounds at Leadhills-Wanlockhead, Scotland. Fine examples of hydrocerussite and other lead carbonate species have been obtained. Some of these lead compounds have tremendous commercial use; for example, basic lead carbonates are used to stabilize PVC (poly vinyl chloride) against degradation by UV radiation and the expanded use of plastics in high visibility products require improved stabilization. This requires a better understanding of how these lead compounds "work" and possibly more important "don't work". Crystal structural studies form the basis of this project.

The completion of the third generation synchrotron at Argonne National Laboratory provides a nearby intense source of focused X-rays. I am part of a group (Consortium for Advanced Radiation Sources) designing an x-ray microprobe incorporating both a EDS and WDS spectrometer. My particular scientific studies using this instrument will involve trace element analyses of mineral phases useful for mining and mineral exploration. Heavy mineral separates, mainly garnet, chromite, and ilmenite, are useful for diamond exploration and particular concentrations of minor elements suggest that diamonds may have co-existed with these phases and point to mining potential. Likewise, gold concentrations in sulfides is of particular interest in benefaction methods. Both these applications require a low level, small area analysis technique such as the X-ray fluorescence microprobe.

Other interests include mineralogy of archeological artifacts in cooperation with anthropologists and

Brief Bio for speaker Brian Windley: Professor of Geology, University of Leichester, UK

Brian Windley, Emeritus Professor of Geology, Department of Geology, The University of Leicester, UK. My main interest is the plate tectonic evolution of collisional and accretionary orogens throughout Earth history, such as the Himalayas, the Mozambique belt in Madagascar, the Central Asian orogenic belt in Mongolia, the Tien Shan, Kun Lun and Altai orogens in China, and the Archaean crustal evolution of West Greenland. The Geological Society of London kindly awarded me the Bigsby (1977) and Murchison (1985) medals. As a result of comparing in 1970 the calcic anorthosites on the Moon and the early Earth, Joe Smith invited me to Chicago throughout the 1970s to study with him on his ARL electron microprobe the mineral chemistry of silicates, oxides and sulphides through the 3.0 Ga, layered, anorthositic Fiskenaesset complex in West Greenland. Our seven papers between 1974 and 1981 (some with Ian Steele, Finlay Bishop and Bob Newton) laid the foundations for future investigations of the Archaean anorthosites and tectonic evolution of West Greenland, which are still in press today.

Brief Bio for speaker Peter Wyllie: Professor of Geology, Emeritus, California Institute of Technology

Peter Wyllie, Professor of Geology Emeritus, Division of Geological and Planetary Sciences, California Institute of Technology. I have also taught at the University of St, Andrews, the University of Leeds, the Pennsylvania State University, and the University of Chicago, with terms as Department Chairman at Chicago and Caltech. My wife (Romy) and I followed the Smiths from Britain to Penn State (1956) to Chicago (1960 and 1965). We spent 18 enjoyable and productive years with DoGs at the University of Chicago (1965-1983), where our children grew through the Laboratory School, before we moved to Caltech. In addition to going to the Moon together, Joe and I agreed to be editors for the "Smith and Wyllie Intermediate Geology Series", with Wiley & Sons, which started with Joe's book on "Crystallography". Joe committed to "Mineralogy" and I to "Petrology and Petrography", but we were both too busy to complete these books and the Series faded away.

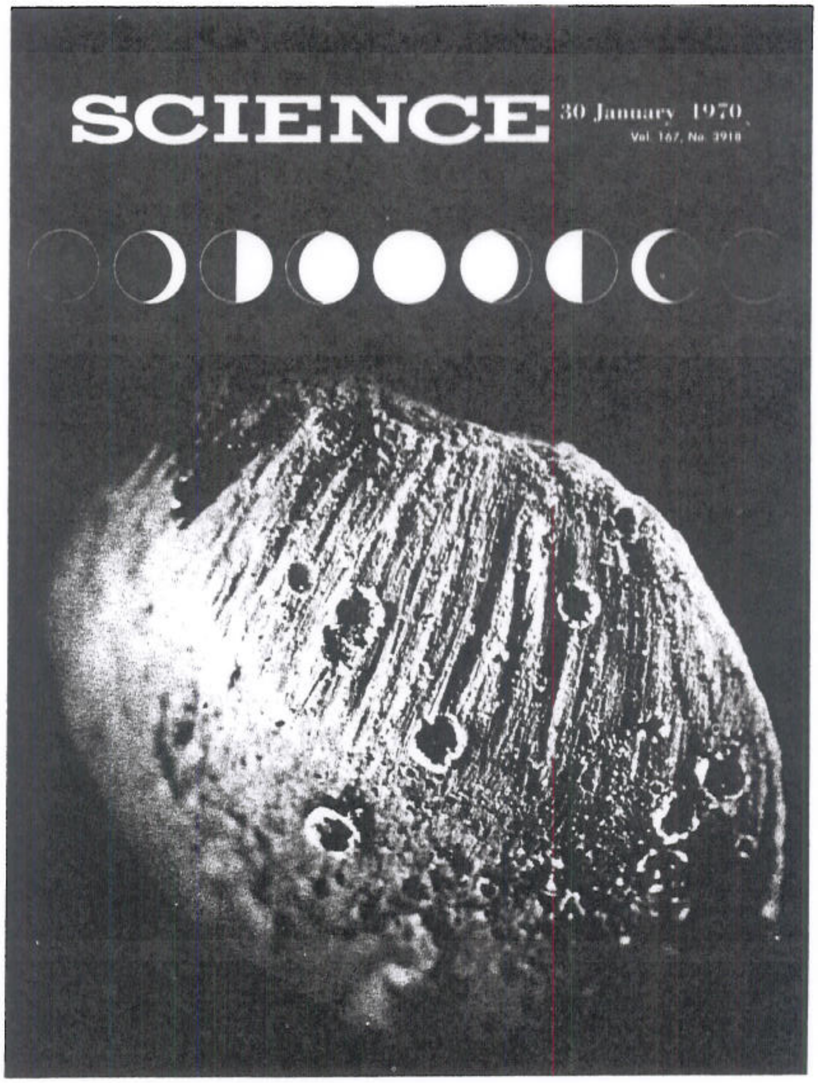
My field geology started with 2 years behind a dog sledge in Greenland (1952-54) learning about rocks and ice and climate. Next I completed a Ph.D. in petrology (University of St. Andrews), and migrated into experimental petrology at Penn State.. The experimental determination of phase relationships for complex rock systems and for related simple synthetic systems places constraints on the processes involved in the origin of rocks, and supplements other approaches. Research topics have included the origin of granitic batholiths, andesites, kimberlites, carbonatites, and associated ore deposits, evaluated from the phase relationships of minerals and rocks at high pressures and temperatures.

I have served as President of the Mineralogical Society of America, The International Mineralogical Association, and the International Union of Geodesy and Geophysics. I am a Fellow, Foreign Fellow or Member of the National Science Academies of the USA, Britain (The Royal Society), Europe (Europea), Russia, India, and China, as well as several Societies of Geology, Mineralogy and Geophysics. Honors include the Polar Medal, MSA Award, Wollaston Medal, A-G-Werner Medal, Leopold von Buch Medal and the Roebling Medal. My books (based on courses taught in Chicago) *The Dynamic Earth* (1971) and *The Way the Earth Works* (1976) are among the textbooks that brought the plate tectonic theory into classrooms.

Reprinted from
30 January 1970, Volume 167, pp. 587-590

SCIENCE

Apollo 11 Lunar Science Conference



Petrologic History of Moon Suggested by Petrography, Mineralogy, and Crystallography

A. T. Anderson, Jr., A. V. Crewe, J. R. Goldsmith, P. B. Moore, J. C. Newton, E. J. Olsen, J. V. Smith and P. J. Wylie

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Journal of Geology 1965 v. 73, 830-864

X-RAY-EMISSION MICROANALYSIS OF ROCK-FORMING MINERALS

I. EXPERIMENTAL TECHNIQUES[1]

J. V. SMITH[2]

ABSTRACT

In order to provide a basis for calibration of X-ray-emission analyses, existing theories and expe... measurements on the generation, absorption, and fluorescence of X-rays produced by electron bomba... of mixed targets are reviewed and compared with new measurements for a variety of targets, prim... common silicates. Theoretically, the efficiency of X-ray generation should depend strongly on the ... atomic number of a mixed target, and its variation is commonly described by a so-called atomic ... factor. Using hard radiation for which the absorption is trivial, measurements have shown that the ... factor $(1 + h)$ varies too little with mean atomic number. A new empirical factor, $[4.7 + 0.9 \ln (V_o$ ... $\ln \langle Z \rangle] \langle Z/A \rangle R^{-1}$, fits the data to within 2 per cent, except for V_o close to V_K (V_o is incident elect... celerating voltage in kilovolts, V_K is ionization voltage for K electrons, $\langle Z \rangle$ is mean atomic num... target weighted according to mass concentration, $\langle Z/A \rangle$ is a similar average for ratio of atomic num... atomic weight, R is Green's backscatter coefficient to express proportion of potential ionization ... retained in target). For soft radiation, empirical absorption curves have been derived for simple and ... oxides on the assumption that the above efficiency-of-generation factor is valid. These curves differ ... from those suggested by measurements on single-element targets, and it is recommended that th... curves be used for analyses in which the same experimental conditions are used. It is concluded that ... of major elements in common minerals can be carried out to a relative accuracy of 1-5 per cent by ... choice of standards and experimental conditions; such conditions are described.

GENERAL INTRODUCTION

Bombardment of matter by a focused electron beam, coupled with measurement of the energy and number of emitted X-ray quanta, permits fine-scale chemical analysis. The technique, colloquially known as electron-microprobe analysis, is of fundamental importance in mineralogy and petrology because tedious and often-incomplete mineral separations can be avoided and because the high spatial resolution (approximately 1–5 μ for primary excitation) permits detailed study of zoned minerals and tiny inclusions. For coarser rocks the technique is valuable principally because of its high speed and reasonable, relative[3] accuracy (1–5 per cent). Because the analyses are made with reference to a standard, rather than being on an absolute basis as are the gravimetric methods of analytical chemistry, it is necessary to assemble suites of suitable standards. Because it is imp... ticable to prepare standards cover... possible samples, it is necessary to d... formulas for interpolation. The conv... of electron kinetic energy into X-ray ... tal energy and the subsequent inter... of the X-rays with the sample befor... into the detection system form a ... of complex, interrelated processes wh... understood only to a first approxim... Numerous attempts, both theoretic... experimental, have been made over th... half-century, especially during the ... years, to understand the process... develop appropriate formulas. Seri... agreements between some of the pro... formulas have cast doubt on their ... bility, and for this reason I decided ... to embark on a detailed comparison of ... tron-microprobe analyses with tho... tained by other techniques. Thro... kindness of many scientists, ... mentioned elsewhere, I assembled ... suites of samples, both weighed ... and analyzed natural. Comparison ... yses has revealed excellent correla... tween electron-probe and other ... (principally gravimetric chemical ...

[1] Manuscript received May 28, 1965.

[2] Department of Geophysical Sciences, University of Chicago, Chicago, Illinois 60637.

[3] Relative accuracy is expressed as a percentage of an element, while absolute accuracy is expressed as the percentage of the whole sample.

Joseph V. Smith

Feldspar Minerals

In Three Volumes

With Editorial Assistance of Brenda F. Smith

1 Crystal Structure and Physical Properties

With 252 Figures

Springer-Verlag Berlin Heidelberg New York 1974

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Joseph V. Smith

Feldspar Minerals

In Three Volumes

With Editorial Assistance of Brenda F. Smith

2 Chemical and Textural Properties

Dedicated to

With 211 Figures

Helen D. Megaw and W. H. Taylor
for thesis supervision

Wm. Scott MacKenzie
for collaboration and advice since 1952

Julian R. Goldsmith and Fritz Laves
whose brilliant research at the
University of Chicago
encouraged me to go there

Paul H. Ribbe and David B. Stewart
for collaboration and advice since 1965.

Springer-Verlag New York Heidelberg Berlin 1974

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Preface

During the past two centuries, crystallography, mineralogy and petrology have evolved from simple compilations of data to powerful disciplines based on interlocking networks of laws, hypotheses and rules-of-thumb. While many data still consist of isolated facts which defy synthesis, a gratifying portion can be organized according to physical and chemical principles. Unfortunately the separation of physical sciences into sub-divisions, especially at the teaching level, makes it difficult to integrate the different approaches to minerals. This separation is worsened by the increasing technical demands of chemical and physical theories, by the number and complexity of experimental methods, by the sheer mass of facts in an observational discipline such as mineralogy or petrology, and by the explosion of papers. This book concentrates on those aspects of the genesis and properties of feldspar minerals which can be related to physical and chemical principles.

My main aim is frankly pedagogic: I wish to show how chemical and physical principles can be combined with geologic observation to produce an enhanced level of understanding of the genesis of minerals. The feldspars which demonstrate almost all of the general principles provide the most suitable example.

As I began to organize this book, it became obvious that a fundamental decision was necessary concerning the level of treatment. At one extreme, I could write to the feldspar specialists and assume a knowledge of the latest crystallographic, thermodynamic and petrologic techniques. At the other, I could attempt to develop the book on the assumption that the reader had only an elementary knowledge of the basic disciplines and would require a detailed explanation of the latest advances. Obviously I could not reproduce all the basic theoretical studies, but I have deliberately provided surveys of the basic ideas with listings of valuable text books and review articles. Furthermore I have deliberately emphasized uncertainties in theoretical understanding to reduce the danger of a reader accepting uncritically some of the claims in the literature. Probably most readers will find some sections too elementary because of their specialized knowledge in those areas, while other sections will appear somewhat obtuse without study of ancillary textbooks and articles. If so, I will have achieved my aim. Education in earth sciences should be a life-time process requiring continual expansion into new subjects.

The literature on feldspars is so massive and chaotic, and contains so many errors of fact and interpretation, that I have attempted to critically evaluate all important papers distilling from them material likely to have permanent value. Hopefully the treatment is sufficiently complete that even feldspar specialists will rarely need to consult the primary literature before 1973.

Controversial matter is especially emphasized in order to stimulate new research and to warn non-specialists. I have deliberately stated my opinions trying to separate them carefully from an objective evaluation of the available experimental data and theories.

It proved impossible to write this book without assuming knowledge of some aspect of feldspar behavior which it was not expedient to explain at that time. Thus in the section on crystal structure, some chemical properties and phase relations are assumed. Fortunately many readers will have a sufficient working knowledge of feldspar minerals to tide them over until a particular subject is treated in detail: many will have read the feldspar section in Vol. 4 of "Rock Forming Minerals" by W. A. DEER, R. A. HOWIE, and J. ZUSSMAN. To supplement this prior understanding, I have introduced the book with a summary of the important features of feldspar minerals plus a review of the nomenclature. Readers would also profit from the excellent introductions by F. LAVES in the McGraw Hill Encyclopedia of Science and Technology and by W. S. MACKENZIE in Encyclopedia Britannica.

The book "The feldspars-phase relations, optical properties, and geological distribution" by A. S. MARFUNIN (translated in 1966 from the original Russian version of 1962) provided a valuable summary of his own important work and of the work of many Russian mineralogists. Since I cannot read Russian fluently, I would have been severely handicapped without this book. Taking advantage of this monograph, I have not attempted to compile a definitive reference list to Russian and Ukrainian works.

The monograph "Feldspars" by the late T. F. W. BARTH, issued in 1969, provides an uneven treatment, some parts excellent, some parts incomplete, and some parts uncritically accepting factual errors and mistaken interpretation. Nevertheless many readers would profit by reading it.

The section "Feldspat-Familie" by H. U. BAMBAUER (1966, in „Optische Bestimmungen der gesteinsbildenden Minerale" by W. E. TRÖGER) offers an excellent review of the optical properties and occurrence of feldspars.

The present treatise aims to be more comprehensive and critical than the above volumes, but at the expense of greater length.

Unquestionably the hardest problem has been the nightmare of nomenclature. Even if all uncertainties had been resolved in the physical and chemical properties which should underlie any system of nomenclature, there would remain two problems: first, a system of nomenclature must take into account the different needs of field geologists and crystal physicists to mention only two types of specialist; second, historical usage often tied to personal preference (dare I say pride and prejudice?) provides overlapping auras around the existing terms. But we cannot begin anew: few would welcome a new set of terms completely free of historical association. The problem of nomenclature is especially bothersome for the novice who is unaware of the personal nuances: the old hand knows that when Dr. X uses the term *T*, he is following in the tradition of laboratory *L* which favors hypothesis *H*; in addition he knows that orthoclase to the field geologist implies a looser definition than orthoclase to the structural crystallographer, just as metamorphic to the crystallographer calls into mind a smaller range of associations than to the geologist. Accordingly I believe that a system of nomenclature should be

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sufficiently flexible to be used by all the specialists, that the level of usage should be implied by context (i.e. what was orthoclase to the field man using only a microscope might turn out to be low sanidine plus microcline to the X-ray specialist), and that a minimum of dislocation with historical usage be sought. In 1973, there was no agreed system of nomenclature of feldspars; I discussed the present system with many feldspar specialists and find that none will agree with all aspects. Since many objections are mutually conflicting it is necessary to put forward unilaterally the present system. Of course, I hope that criticism will not be too severe, but I have spent too many days arguing about nomenclature to have any illusions. Throughout the book I endeavor to point out alternative nomenclatures together with their historical provenances, and I apologize for the implied criticisms of other systems.

Many readers will wish to learn the appropriate techniques for the study of feldspars. Although the theoretical bases of the techniques are mentioned in this book, and the most important data are given in tables and graphs, no attempt was made to expound the mechanical details. Modern equipment is so complex that the day-to-day operation can be learnt only by actual use, preferably under the guidance of a skilled practitioner.

Initially I hoped to publish the treatise in a single volume, but the mass of material enforced publication in several volumes. Furthermore the labor has become so immense that a few years must elapse before publication of the last volume. Each section has been written to be intelligible in itself, but full comprehension may require turning to another section.

My wife and I have assembled as comprehensive a bibliography as was reasonably feasible, and we have profited by comparison with the handbook "A Bibliography of the Feldspars" issued by D. R. Waldbaum in 1969. Each chapter of the treatise has its own bibliography to permit independence between the different parts of the book.

The text of Chapters 1–20 was prepared for publication in June 1973, and additions were made in December 1973. I plan to review incoming material for future publication either as addenda or in a revised edition. To minimize the bibliographic work, I would be grateful if authors would send me a reprint or preprint of papers mentioning feldspars: in addition, I would be grateful for glossy prints of interesting photographs or diagrams. Of course, corrections to the present text would be gratefully received.

The treatise begins deliberately with the crystal structure, and proceeds to physical properties and experimental techniques. The chemical properties and experimental techniques form a third part. Growth, diffusion, defects and intergrowths are the subject of the fourth part, providing an introduction to the problems of understanding the genesis of feldspars. The fifth part deals with the thermodynamic properties and phase relations, both under idealized conditions of stable equilibrium and under realistic experimental conditions. All these five parts provide a prolonged introduction to the sixth part which deals with the petrology and occurrence of the feldspars. There is some overlap between the parts but the whole is conceived as a symphony on feldspars, rather more Mahleresque than Mozartian in texture.

Chicago, February 1974 Joseph V. Smith

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Geometrical and Structural Crystallography

Joseph V. Smith
Louis Block Professor of Physical Sciences
University of Chicago

1807 175 YEARS OF PUBLISHING 1982
John Wiley & Sons
New York *Chichester* *Brisbane* *Toronto* *Singapore*

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J.V. Smith with a smile on his face, as represented in the DOGSheet

The DOGSheet was a 1960's publication of DOGS students, including humor, poetry, social events, films, athletic activities, and an occasional bit of science. J.V. (Big Joe) is represented often in these pages as recounted by Al Duba, editor (for life).....

There were 11 volumes of the DOGSheet containing 113 issues from 2 Oct 67 through 3 June 1970; with two special issues, in 1971 and 1983. Big Joe appears at least 30 times, more than Big Julie (J. Goldsmith). In the issue of October 1983, which featured quotable quotes by faculty from the 11 volumes, Big Joe had the most--5--barely nosing out Goldsmith and Ziegler, who had 4 each. Big Joe, Brenda, and their daughters participated in many DOGS events, thus JV's family members are mentioned in at least 4 issues. Brenda and Big Joe allowed us to use their family room for gatherings (he even provided a keg of beer sometimes). A favorite issue is of 3 Feb 70, in which the first entry in an oddly named poetry contest included....

"The Plaint of the Moon Orphan," by Brenda F. Smith'

"Oh, Mother dear, the orphan cries,
"Is Father coming soon?"
"Hush now, my love,"
His dam replies,
"He's coping with the moon!"
There follow three additional verses, detailing JV's research, ending with a prescient hope that Apollo 13 might not bring any additional moon rocks back and Father might return to the family circle, come late fall. This ties in well with Al's favorite Big Joe quote from the 28 Oct 69 issue:
"I said 'To hell with it (working on the moon research from 9-11 on Saturday mornings), volleyball is more important!'"

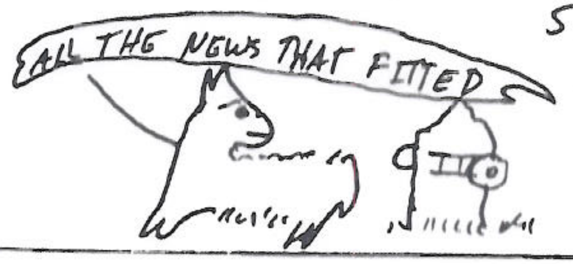
These quotes and more smiles from Joe can be found in the attached pages.

Howard Zar

Reprinted From

The Dirty Old Gossip Sheet of the DOGS

DOGS WEE



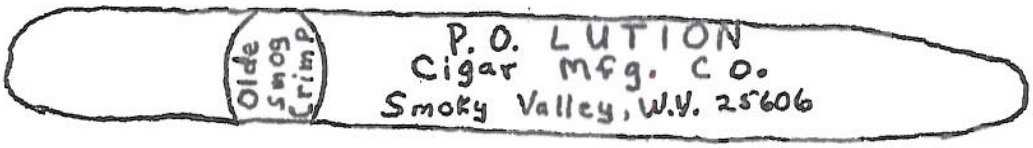
VOL 15 No. 1 Fri, Oct 28, 1983 JCJ Memorial Issue

Jamieson	Jan 69	"If you don't like the answer, change the problem."
	Feb 69	"That's nothing, we've studied alcohol at 2000 bars"
Ziegler	May 68	"There's always something romantic about the unconformity between Precambrian and Cambrian Rocks"
	Nov 68	"We were lucky the bedding planes were outlined by bird droppings"
	Nov 68	"People, especially DOGS, have to learn that intercourse is not a four letter word."
Smith	Apr 68	"Actually, you can fool the feldspar."
	Sept 68	"Being a little confused is a necessary part of the education process."
	May 69	"Pigs are really students in disguise."
	Oct 69	"To hell with it, volleyball is more important!"
Pre-Dogsheet		"Pregnancy among grad students' wives is contagious."
Goldsmith	Apr 68	"Entropy is a green gas." "All feldspars in syenite are crazy." "Don't belch into a neck microphone." "The evolution of Buicks proves there is a secular increase in gravity."
Clayton	Mar 69	"The idea that the whole world is one big oxygen framework with cations sloshing around in it is ridiculous."
Moore	Nov 68	"If you want to get unplugged, go to Mexico City."
Olson	Mar 69	"Don't swim in the nude around Avicularia."
Wyllie	Nov 68	"If you don't know where a phase boundary is, smear it out a little bit and you won't be far wrong."
	May 69	"You can make geological observations to support almost any hypothesis."
Johnson	Dec 68	"The Pacific Ocean is anomalous, it doesn't have a mid-Atlantic ridge."
Schmidt	Dec 68	"The only thing that works around here is people."
Newton	Apr 68	"A microgeosyncline is a ripple mark."
	Jan 69	"If you're not looking for aragonite, you can't find it."
Nitecki	Apr 69	"I have 500 my between my legs."
Miller	Nov 69	"It's good they have a student lounge in the new DOGShouse, because now all the DOGS students can lounge in the same place."
Atlas	May 70	"A duck doesn't look much different from an ICBM."
		"There are 10^3 raindrops/m^3. Count them yourself. I've counted many in my early days."

The Dirty Old Gossip Sheet of the DOGS Vol 2, No 1
"All the News that Fits!" 1-8-68

THEY'RE BOYS!

A. Duba now burbles incessantly(see poem in art section) because his wife Lucy gave birth to 7½ pound Frank Eugene on Dec 24. J. Albright is bragging about 9 pound 12 ounce Matthew Thomasborn to his wife Ginny on Dec 27. These proud fathers have decided to let all DOGSheet readers share their joy with a good smoke. To smoke the cigar below, ignite the corner of DOGSheet with match(bunsen flame is also suitable).



QUOTE OF THE WEEK OF CHRISTMAS PAST

J. SMITH to graduate students: "...pregnancy among graduate students' wives is highly contagious."

QUOTE OF THE WEEK

J. SMITH to O. KLEPPA: "Your bottom is as well padded as mine."

KKK AND KAMPUS POLICE

The Imperial Gizzard of the KKK(Kommittee to Keep the Karvings) told DOGSheet reporter Ray Darr that there is no substance to the rumor that members of the Kampus police are also members of the KKK. "The confusion," says one Grand Draggin', "Probably arises from the fact that the Kampus Bolice's annual Masquerade Ball, the Kampus KOP Kapers, which is held every Feb 30, has the same initials. However, we would welcome any member who wants to protect the heritage of the DOGS' Homeland and help in our struggle to keep the Rosenwald Karvings."

DRAMA

On Sat, Dec 16, DOGS volleyballers were privileged to be entertained by 2 full-color spectaculars featuring talented DOGS' actors. I. Lambert, the accomplished star of "Hellzapoppin'" and "Bombs Away," gave an outstanding rendition of "Rear Window." Following this ripping performance was a smashing version of "Through a Glass Darkly," which starred M. Bennett and J. Smith.

ART SECTION

Below are three late late entries in the First Annual H. Zar Poetry Contest. Unfortunately, they were received past the deadline and are invalid entries. However, the editors of the DOGSheet feel that they are of sufficient worth to merit publication.

?

Oh I'm singing in tones adenoidal
Of waves which are somwhat cnoidal.
Using Jacobian functions ellipsoidal
I can generate these from the "Groidal."
But my time was clearly misspent
Instead of coming, they went.
.... IMPERIAL GIZZARD, KKK

PETROLOGY

A man whom most everyone knows
Once struck an embarassing pose:
He taught class so long
That everything went wrong--
His system would no longer stay closed
.... D. MOHR

A BIRTH ANNOUNCEMENT

Lucy and Al Duba are happy to report
That Frank Eugene was born December 24.
At 11:12 AM in old Chi-town,
He weighed in, just 7 and One half pounds.
He measures only 4 inches less than 2 feet,
Has a head full of black hair that really is neat.
We both hope that this silly little rhyme
Expresses our joy at this happy time.
. DUBA

ART MOVIES?

L. Walker announces the formation of the Proprietary Films Society(PFS). Future films will include "The River" with music by Virgil Thompson

The Dirty Old Gossip Sheet of the DOGS
"All the News that Fits!"

Vol 3 No 9
May 13, 1968

CHAMBERLIN ROSSBY MEETING

TOPIC: Student-Faculty Discussion of DOGS Thermodynamics
MODERATOR: Prof. J. V. Smith
TIME AND PLACE: 12:30 May 15, Ro 39

DOGS with Ideas on the thermodynamics needed by the various divisions of the DOGS and ways in which it should be presented to the students are urged to attend this informal meeting.

QUQTES OF THE WEEK

J. Smith: "Watch out for these pregnant men!"
R. Miller: "You're libel to regret it."

RUMORS

Did the Coastal Nostra put down the Boxzar Rebellion? Do lacquer and rustoleum mix, Howie? Does the MPoWB have a "clean Gene" of its own? Has the KKK acquired a frisbee with a diamond saw attachment for removal of the Rosenwald Karvings?

PICNIC DETAILS

The Second Annual Pfingstabend Picnic(SAPP) will be this Sun., May 19, in the Indiana Dunes, Volleyball, softball, horseshoes, badminton, ad soccer will be available beginning at 11:00. Participants may come ad go as they please.

Members of the Excellent Wives Coalition will dine around 1:30 - 2:00. The coalition consists of more than a dozen DOGS wives, their husbands, and about 10 bachelor DOGS and their friends, so far. The wives are preparing one dish each of sufficient quantity for 12 - 15 people, the husbands are providing beverages for themselves and their wives, and the bachelor DOGS and friends are bringing extra beverages and fruits, breads, or potato chips or, in some cases, a special dish. This promises to be an exciting culinary adventure. For further information or to join the coalition or arrange for a ride, call 667-2169 before Friday, May 17.

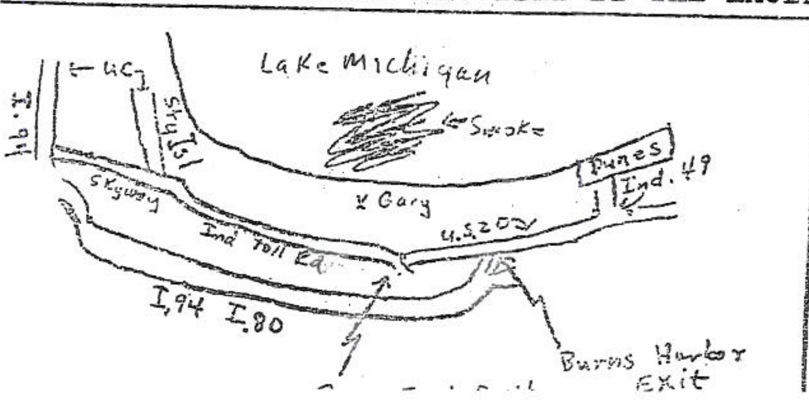
Maps A and B below are for navigation to the dunes. A shows 2 possible routes to the dunes from UC; the one by the toll road being a bit cheaper, time-wise; the one by Interstate 94 beigg a bit cheaper, money-wise:

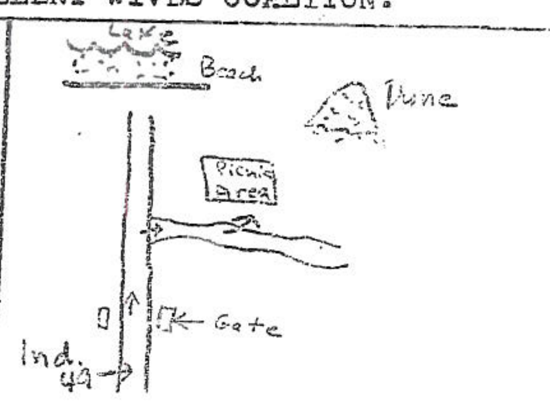
TOLL ROUTE: Take Stony Island to Chicago Skyway(Int 90) continue on Ind Toll Rd until Gary E. exit onto U.S. 20.

ATOLL ROUTE: Take Garfield Blvd to Int 94, follow 94 until Burns Harbor exit onto U. S. 20.

DUNE ROUTE: Map B shows the route within the Dunes to the Picnic Area. Exit from US 20(on the right hand side, via clover-leaf) onto Ind 49 into the Dunes. Take first right pass the toll booth entrance, then first left onto dirt road beside the first signs on the left-hand side of the road. Total distance is approximately 35 miles.

MAP SPACE PROVIDED BY THE EXCELLENT WIVES COALITON.





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Note: T[illegible] first right turn af[illegible] Gate, then make a le[illegible] turn on first dirt

Joe, Geoscience and Human Welfare

In November 1998, Joe presented the opening paper at a National Academy of Science colloquium titled "Geology, Mineralogy, and Human Welfare". Thus began his effort of several years to harness the skills of geoscientists to achieve major improvements in the human condition. He published several papers on this topic and on issues related to natural hazards. The approach affected his teaching and lecturing and he began an effort called the International Geoscience and Human Welfare Program. IGHW had very ambitious goals and was to involve geoscientists, institutions, and governments, worldwide. He was also working on a book on these topics.

Many geoscientists, environmental scientists, and others around the world were stimulated by Joe's efforts and a few items were funded, partly as a result, not the least being the Envirocat project at the Argonne National Laboratory.

A favorite quote of Joe's ends his 1998 paper:
"Biological Evolution, as seen in the context of geological time, indicates that fortune goes with increasingly skilful use of resources of many types, not the maximum use of resources."

Several pages representing these efforts of Joe's are included below.

Howard Zar

DEPARTMENT OF THE GEOPHYSICAL SCIENCES
Joseph V. Smith, The University of Chicago, 5734 South Ellis Avenue, Chicago, IL 60637
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2/22/96

Physical Sciences 108 Geology & Human Welfare

Calendar & General Logistics

Note. Students are informed by jvs in the nicest possible way that the weekly assignments must be completed on time without exception because of the heavy workload of the TA's in preparing the new laboratory sessions and field trips. These assignments are based on thorough integration of material presented in the lectures, laboratory classes and field trips. The grade for the course is based on the sum total of marks for the weekly assignments. Because of the variety of topics, there are no mid-term or final examinations. The last assignment is a field trip report which must be submitted in Week 9.

Each week, one of the TA's will be appointed Chief TA responsible for coordination of student interactions. Any concern about the grading of a report should go first to the Chief TA. If satisfaction is not reached, a written report should be presented to jvs for final resolution.

Most exercises will be given out in written form with spaces for written answers to be neatly figured in blue or black ink. Your TA will make corrections in red ink.

Two exercises will require answers prepared with a standard word processor (preferably Mac but PC accepted if translatable to Mac). A disc and a printout must be submitted. Your TA will mark the answer and return the disc with the original answer & corrected version. The aim of this procedure is to prepare you for the professional world. You will be given one Mac disc.

Weeks 1 & 2: Industrial Technology & Geology

Week 1: Stone, Bronze & Iron Ages

Mon 3/25 Lecture 1-1 11:30-12:20 Hinds 101

Mainly organizational: overview; literary & artistic heritage

Discussion with jvs 1:30- 3:20P Hinds 349

Tues 3/26 Preparation day for jvs & TA's

Wed 3/27 Lecture 1-2 11:30-12:20 Hinds 101

Early technology: Stone, Bronze & Iron Ages; flint tools and weapons; occurrence & mining; metal tools, weapons and jewelry

Laboratory session on atomic models of metallic minerals set in historical context from Greek philosophers to twentieth-century crystallographers & geophysicists; specimens of minerals & rocks on display

Written laboratory report due next Wednesday April 3

Note: because ther are only 4 TA's, we can handle at most 5 to 6 lab sessions in three time slots so that jvs can walk between the two nearby laboratories to answer questions referred by the TA's.

		Lab A	*1:30- 3:20P*	*Hinds 349*
		Lab B	*1:30- 3:20P*	*Hinds 361*
		Lab C	*3:30- 5:20P*	*Hinds 349*
		Lab D	*3:30- 5:20P*	*Hinds 361*
Thurs	*3/28*	*Lab E*	*1:30- 3:20P*	*Hinds 349*
		[Lab F	*1:30- 3:20P*	*Hinds 361]*

Fri 3/29 Lecture 1-3 11:30-12:20 Hinds 101

Early technology: Stone, Bronze & Iron Ages; occurrence of gold, silver, tin & lead; mining & smelting, relation to plate tectonics; archaeology

jvs & TA's at department seminars in afternoon: please do not contact us until Monday

Written exercise on specific chapters of Press-Siever & Graedel-Crutzen due Friday April 5

Mineralogy and Human Welfare: Applications in Geology, Petrology, Environmental Science and Industry; Catalog of Crystal Structures.

Introduction

A few personal words to give context.

I lived for 17 years at Barn Close Farm, Fritchley, Derbyshire, England, UK at the southern end of the Pennine Chain. I am now closing out my career as Professor of Physical Sciences at the University of Chicago, Illinois USA, where I am responsible for various duties including working on environmental matters.

Most of my scientific research has related to mineralogy. At the intellectual level of pure science, I have had a wonderful time working on minerals selected from rocks on Earth, the Moon and meteorites. On a practical level, I have worked on mineral catalysts that have truly revolutionized the chemical and petroleum industries, but even here I have been able to relate modern chemistry to pure mathematics. Furthermore, I have been able to teach students from around the World about the physics, chemistry, biology and mathematics of minerals, and have been able to profit from their diverse backgrounds.

On the negative side, I have been forced to consider how certain minerals can be bad for human health. In Derbyshire, I saw the medical effects of lead poisoning and of drinking water low in iodine and fluorine, together with bronchitis induced by dirty air. In the Chicago region, I have seen the effects of air and water pollution from intense industrial and agricultural activities. Fortunately, these problems are being reduced in the developed World by detailed scientific studies followed by legal and political actions, mandated in the USA by the Environmental Protection Agency. However, traveling around the World, I have seen growing evidence of dangers to human health from poor air, water and food, typically aggravated in slums resulting from the growth and movement of people desperately seeking a better life.

On the positive side, I have helped industrial scientists triple the yield of gasoline (petrol) from oil, and described the first new mineral on the Moon, while on the negative side I have been truly appalled at the development of dangerous useless nuclear/rocket weapons, and the sheer waste of energy and money on military and civil conflicts. The people of the World have yet to take sensible steps to guard against impacts from asteroids and comets, let alone the problems caused by earthquakes, volcanoes, landslides, coastal erosion, and other major geological hazards.

At the National Academy of Sciences Colloquium on *Geology, Mineralogy and Human Welfare* in 1998, like all other attendees, I was appalled at the growing problems of chemical poisons that seriously affect one-fifth of the people around the World, and am haunted by what to do to alleviate the medical problems from the viewpoint of mineralogy (*senso lato*). Perhaps the best that can be done by a scientist like me is to present accurate factual observations and sober interpretations for ultimate social evaluation by all cognizant human beings. It is easy to get depressed and think that people will continue to produce too many children who will continue to be subject to negative environments, and end up in early death either from wars or pandemics. However, I am optimistic enough to believe that the problems will be recognized as facing the entire human race, and that ultimately there will be assignment of the correct actions by and for everyone. So here is my go at providing a background for mineralogists!

This database began merely as a support for directing my research and teaching on the crystal structure and the chemical and physical properties of minerals which now amount to some 4,000 species. It is now expanding to cover biological properties and medical applications. Although it is highly technical, brief statements are added for less experienced readers. You will be able to find references to arsenic in Bengal; zeolite molecular sieve catalysts in the petroleum industry; bacteria and soil minerals; applications in art and archaeology, to give just a few examples.

Joseph V. Smith, Mineralogist, 1928-2007

April 13, 2007

When University of Chicago professor Joseph Victor Smith was a boy on his parents' farm in the north of England, he would pull away from his farmwork, look at the moon and wonder why part of it was white and part was black.

Years later, Smith found himself conducting tests on Apollo 11 lunar samples. In early December 1969, the answer to his boyhood question about the moon's colors dawned on him. The white material was rock enriched with feldspar. The black material was basalt, solidified lava. Smith realized that feldspar crystals, being lighter than basalt, probably floated to the highland areas of the moon when the planet was a ball of molten lava. The moon's crust must have been extensively melted, Smith concluded, in a series of catastrophic meteorite impacts.

"There had to have been tremendous collisions. There's no way the moon could have got where it was without melting. This was heresy in those days," Smith said in a 1999 interview, recalling prevailing theory of 1970. His model of a "hot moon" has gained increasing support over the cooler models and had led to a greater understanding of the origins of the universe.

Smith was the Louis Block Professor Emeritus in Geophysical Sciences at the University of Chicago, where he taught and conducted research from 1960 to 2003. He died of pneumonia at Beth Israel Deaconess Medical Center in Boston on April 6, aged 78, after a five-year battle with Parkinson's disease.

Smith had a longstanding concern for the environment and the preservation of the Earth. Since the 1980s, he had drawn attention to threats to the human race presented by Earth — colliding asteroids, comets and other natural hazards— in a series of articles and conference presentations. In 1982, in accepting the Roebling Medal from the Mineralogical Society of America, he argued that society must shift funds from "war machines" to science, and work toward an understanding that "we all belong to one human race, and must learn to live in peace on this planet."

In 1998, he organized a National Academy of Sciences colloquium on "Geology, Mineralogy, and Human Welfare." At the time of his death, he was completing a manuscript titled "Living Safely," which was part-memoir of his life as a farmer's boy and research scientist, part-environmental treatise.

Smith wrote more 400 scientific articles that were published in journals including Science, Nature, Journal of Geology, Scientific American, and Proceedings of the International Seminar on Nuclear War. He also was author of Geometrical and Structural Crystallography, published by Wiley, and a three-volume scientific reference series on feldspar minerals.

"Feldspars are the most abundant, most important minerals in the crust of the Earth, and Joe Smith was the world authority on those minerals," said Robert Clayton, the Enrico Fermi Distinguished Service Professor Emeritus in Chemistry and Geophysical Sciences at the University of Chicago. Smith also studied an industrially important mineral group called zeolites, volcanism in east Africa, and lunar geology, said J. Barry Dawson, Professor Emeritus of Earth Science at the University of Edinburgh. "A very multifaceted man was Joe," Dawson said.

For much of his career, Smith served as a consultant to Union Carbide Corporation and UOP for his zeolite expertise. Smith helped industry harness zeolite as molecular sieves to improve the yield of gasoline from oil and produce environmentally friendly, phosphate-free detergents.

In the early 1970s, Smith collaborated with Dawson, who was then at the University of St. Andrews, in analyzing the composition of rocks and minerals brought to the Earth's surface from the upper mantle, the layer below the outer crust. Their studies identified the first sample of diamond in garnet lherzolite, a solid rock from the mantle. Their work showed that diamond formation was not connected with volcanic activity, which geologists had previously assumed.

Smith also was a scientific entrepreneur in the development of scientific instruments, Clayton said. At the Carnegie Institution of Washington in the early 1950s, Smith built an X-ray generator out of junk equipment and chicken wire. When he arrived at the University of Chicago in 1960, he immediately built an electron microprobe for the Department of Geophysical Sciences.

"Now every geology department has to have an electron probe, and the department here was one of the first to get it," Clayton said. "He was a real pioneer in developing the instrument." Smith was also a pioneer in championing the careers of women scientists, whom he believed were unfairly underrepresented in science.

As a visiting physicist and consultant to Brookhaven National Laboratory in New York since the mid-1980s, he helped develop a microprobe for precision X-ray analysis of experimental samples. And in the early 1990s, Smith organized a multi-institutional, multi-disciplinary group of scientists to found the Consortium for Advanced Radiation Sources — CARS — to use the Advanced Photon Source in their research. The U.S. Department of Energy's APS at Argonne National Laboratory provides the most brilliant source of X-ray beams for research in the Western Hemisphere.

Reflecting Smith's broad interests, CARS embraced the geophysical sciences, soil and environmental science, structural biology, chemistry and materials science. Smith directed CARS from its founding until 1993.

Smith was born July 30, 1928, in Derbyshire, England. Raised on a farm in the Peak District of Derbyshire, he won a scholarship to Cambridge University. There he received a B.A. with first class honors in natural science, in 1948, and a Ph.D. in physics in 1951. Smith married his wife, Brenda Wallis, at St. Mary's Church, Crich, Derbyshire, on Aug. 31, 1951.

He began his research career at the Geophysical Laboratory of the Carnegie Institution in Washington, in 1951, returning to teach at Cambridge in 1954. From 1956 to 1960 he was a faculty member at Pennsylvania State University, where he began his seminal research on feldspar minerals. He joined the University of Chicago faculty as a full professor in 1960 at the age of 32.

Smith received many honors during his career, including election to the National Academy of Sciences, and was awarded the Geological Society of London's Murchison Medal and the Mineralogical Society of America's Roebling Medal and MSA Award.

He was an elected Fellow of the American Academy of Arts and Sciences, American Association for the Advancement of Science, American Geophysical Union, Geological Society of America, Meteoritical Society, Mineralogical Society of America and The Royal Society of London. He also was an Honorary Fellow of the Geological Society of London and of the Mineralogical Society of London.

He stayed connected to his native England, spending three months every year in Derbyshire when his daughters were young. "He never forgot his place of birth, and returned each summer to help with the hay-making," Dawson recalled. "He was exceptionally loyal to family and friends."

Professor Smith is survived by his wife, Brenda Smith, formerly of the Hyde Park neighborhood of Chicago, now of Brookline, Mass., and two daughters, Virginia Smith, Brookline; and Susan Werther, Madison, Wisc.; and four grandchildren: Katie, John and Meg Hitchcock-Smith, and Jessica Werther.

He will be buried in Crich, Derbyshire in June. A memorial service will be held at Bond Chapel at the University of Chicago later this year.

Permalink: http://www-news.uchicago.edu/releases/07/070413.smith.shtml
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OBITUARY FOR JOSEPH V. SMITH

Joseph Victor Smith died of pneumonia at the Beth Israel Medical Centre in Boston on 6 April 2007, at the age of 78. He was born on 30 July 1928 and raised on a hill farm in the Peak District of Derbyshire in the north of England. With the encouragement of his mother and uncle, both teachers at a school not noted for its academic successes, Joe won an open scholarship to Cambridge where he obtained a first-class honours degree in physics. After post-graduate work on the crystallography of calcium silico-carbonate minerals, he spent some time at the Geophysical Laboratory in Washington where he was influenced by W.S. Mackenzie (who, Joe said, gave him his lifelong interest in feldspars), Hat Yoder and Felix Chayes. After a brief return to Cambridge, Joe went to Penn State where he began work in earnest on feldspars and also became involved, via his consultancy with the Union Carbide Corporation, in zeolites – the molecular sieves that have proved so successful in improving the yield of gasoline from oil and producing phosphate-free detergents. He moved to the University of Chicago in 1960, becoming a full professor at the early age of 32.

One of his early achievements in Chicago was the building of one of the first operating electron microprobes. In those early days, there was considerable scepticism as to whether such probes would ever deliver meaningful results, but its routine use these days is a legacy of a few imaginative pioneers, one of whom was Joe. He was concerned not just with the numbers obtained but also with what they meant; for example, he noted the low Ca concentrations in mantle olivine, due to high pressures, compared with the higher amounts in its volcanic equivalent. In 1965, Joe started the Short Courses in Mineralogy, run in conjunction with the annual meetings of the Geological Society of America. These, and the accompanying Reviews in Mineralogy, published by the Mineralogical Society of America (the first 40 being edited by Paul Ribbe), continue to the present day with the added involvement of the Geochemical Society. In 1969 Joe became a Principal Investigator in the Apollo Programme, which led him to another interest: planetary geology and mineralogy. As if this were not enough, in the early 1970s he became involved in research on upper mantle mineralogy. His later interests included threats to mankind from meteorite collisions with the Earth and global conflict, but these went hand-in-hand with his fundamental interest in new technology and what it could do for mineralogy and crystallography. He became interested in the role of mineral surfaces in the origin of life, a subject on which he wrote an article for *Elements* (Volume 1, issue 3). He was involved with Bob Clayton in setting up the ion probe at the Enrico Fermi Laboratory at the University of Chicago. Another major achievement was when he organised a multi-institutional, multi-disciplinary group of scientists and founded the Consortium for Advanced Radiation Sources to use the Advanced Photon Source at the Argonne National Laboratory. His research has resulted in over 400 publications in most of the major journals and includes his three encyclopaedic books on feldspars.

Among the many honours he received for this work were his election to the fellowship of the Royal Society of London and the National Academy of Sciences, and the award of the prestigious Roebling Medal of the Mineralogical Society of America and the Murchison Medal of the Geological Society of London.

So much for Smith the scientist. What of Smith the man? He was one of the most multi-faceted men I have met. Intensely curious, he was interested in literature, art and music; one of the pleasures of visiting Chicago in the autumn was the weekly trips downtown with Joe and Brenda to hear concerts of the Chicago Symphony Orchestra. He was

Joe and Brenda Smith collecting weathered feldspars at Shap in the north of England in 2000

also a prodigious reader, and not only of the scientific literature. He lived life intensely and, being an extremely dedicated and well-organised man, he was sometimes held by students to be a hard taskmaster. Those who knew him better recognised that this was only because he took it for granted that students and collaborators should be prepared to work as hard as he did himself. I can say personally that his rigorous working to deadlines was good for our collaboration. Even off duty, Joe's unbridled energy meant that he could hardly relax completely and, in the early days when the Derbyshire farm was still in family hands, he returned to England each summer, not only to show his daughters the rural and architectural heritage of Britain, but also to help his father and his brother with the hay making. He was very loyal to family and friends. In later years, he and Brenda spent weekends at their lovely home on the shore of Lake Michigan in the Indiana Dunes Park, where they took great pleasure in entertaining friends from many parts of the world – but there were always jobs like installing a new rain-butt and fence-making to be done.

With his passing, the mineralogical community has lost one of its most productive and influential members. All the same, I like to imagine Joe is up there building another probe, just to find out what the Pearly Gates are really made from!

Barry Dawson
University of Edinburgh

Elements
6/2007

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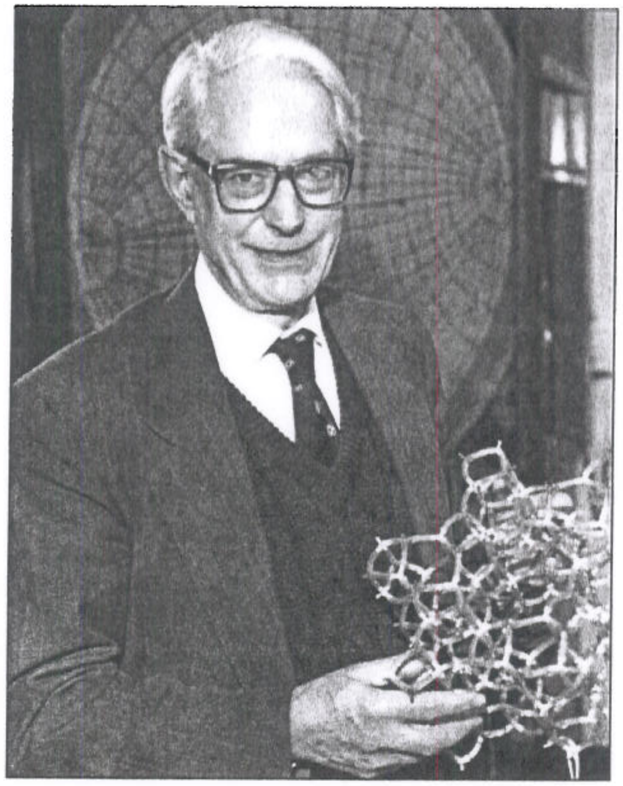
Min. Mag., 2007, vol. 71, p. 113 -119

JOSEPH V. SMITH 1928–2007



Joseph V. Smith was born on the 30th of July 1928, in Derbyshire, England. He married Brenda Wallis at Crich, Derbyshire, on the 31st of August, 1951, moved to the USA, and their family grew with two daughters, Virginia and Susan. He retired in September 2005 as the Louis Block Professor Emeritus in Geophysical Sciences and the College at the University of Chicago. On Friday the 6th of April, 2007, at age 78, he died of pneumonia at Beth Israel Deaconess Medical Center in Boston. Parkinson's disease had begun to take its cruel toll about five years earlier. He and his wife Brenda moved to Brookline in 2005 to be near their daughter, Virginia, and family, where he suffered a broken hip and several heart attacks before the final event. In the meantime, he continued to write an autobiographical book *Living Safely* which dealt with local and global problems facing our species. As Brenda said: "He was very strong and very stoic. He handled any difficulties in life the way he handled his illness."

In early April, a reporter from the Boston Globe asked me, by phone, for information about Professor Smith. From my troubled, garbled conversation the reporter recovered the following quotation: "Joe was one of the great mineralogists of his time, both in an intellectual sense and a practical sense. He did first-rate science that was always at the forefront. And he pursued practical applications in a very powerful way. He was also always looking for the next, best way of studying minerals." His many honours support these statements. These include election as Fellow of the Royal Society of London and member of the

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US National Academy of Sciences, and award of the Murchison Medal (Geological Society of London), the MSA Award (young scientist award of the Mineralogical Society of America) and the Roebling Medal (the highest research award of the Mineralogical Society of America). He published at least four books and more than 400 scientific papers that spanned several disciplines. There is a mineral, joesmithite, named in his honour by Paul Moore, in 1968 (a plumbous amphibole). Below I have taken the opportunity to offer more comments with outlines of his education, his academic and administrative appointments, his work developing instruments, his books, some of his research programmes, and his concerns about stewardship of the Earth and its inhabitants.

Joe Smith was very proud of his first 17 years living on a farm in Derbyshire, England, and always maintained that he was still a farm boy. He attended village schools, and because he was the only candidate for the Cambridge Entrance Examinations, he was excused from all classes so that he could study on his own. He worked through all the Entrance Exams from the previous 30 years and won a scholarship to Gonville and Caius College. His admission to Cambridge University in 1945 would have been considered a triumph for his school. In Joe's own words: "My competitors came from famous public schools such as Eton, Harrow and Winchester and long-established grammar schools. The country mouse was awed but not intimidated." He earned a B.A. (first class honours) in Natural Sciences in 1948, and advanced to a PhD in crystallography in 1951. He reported "superb teaching" for undergraduates, but found his assigned computations for the structure of calcium carbonate minerals so tedious that he almost quit the academic path. However, he liked the research environment and faculty associates, so he persisted.

William H. Taylor recommended him for a Fellowship at the Geophysical Laboratory of the Carnegie Institution of Washington, and Joe concluded later that this was "perhaps my greatest good fortune". In fact, his greatest good fortune came first when he "rushed home to get married to Brenda Wallis, a beautiful and intelligent girl from Fritchley, Derbyshire. We had been at Fritchley elementary school, where she later told me that she had picked me out for a husband at the age of ten!" They married, and sailed to the USA on the *Queen Mary* in 1951.

For Joe, the Geophysical Laboratory was an intellectual and experimental mecca. He credited his new colleagues W.S. MacKenzie, O.F. Tuttle, H.S. Yoder and F. Chayes for educating him to some extent in Earth Sciences while still remaining "green as grass. Geology was baffling ...". He reported that he found rather primitive facilities for crystallography compared with those at his training grounds in Cambridge University, so he had to build his own X-ray generator from miscellaneous old equipment, chicken wire, and a cocoa tin at a cost of $2. When asked why he had such a fine pair of experimental hands, he would explain that thanks to his upbringing on a farm, he was one of the few crystallographers who could obtain satisfaction from sitting on a stool and milking a cow, the old-fashioned way. He claimed that it was this kind of training that guided him in the construction of his generator that yielded four single-crystal diffraction photos a day.

I was introduced to J.V. Smith in a series of papers on feldspars by MacKenzie and Smith that were required reading during my honours year and as a graduate student. William Scott MacKenzie had been the Teaching Assistant during my undergraduate years at the University of St. Andrews, Scotland, and he had made his way to the Geophysical Laboratory in 1952, *via* Cambridge. He introduced Joe to the feldspars, and the combination of Joe's knowledge of solid-state chemistry and physics with Mac's knowledge of minerals and rocks generated a remarkable series of papers, and a life-long friendship. That was when Joe realized that he must learn petrology and geology.

Before examining his developments with instruments and broader Earth and Planetary Sciences, let us preview his successive travels and appointments. After Washington, the Smiths returned to Cambridge where Joe was a Demonstrator between 1954 and 1956. Then, Frank Tuttle invited Joe to join him as Assistant Professor in the Division of Earth Sciences at Pennsylvania State University, which had become home for several former Geophysical Laboratory scientists. Joe did not want to leave England, but in his own words "on checking around, no suitable tenured position was available. Oxford paid strictly by age, and my advanced experience did not count; Bristol decided that I would be better off at Penn State; and Cambridge stated that no tenured positions would be available for some years". English newspapers at that time were full of stories about the 'brain-drain', and the Smiths joined the movement in November 1956. That was when I first met the Smiths in person, because Harald Drever (St. Andrews) and MacKenzie had arranged for me to join Frank Tuttle as research assistant in 1956, while I completed my St Andrews PhD. I returned to Leeds University in 1959, and the Smiths moved on to the University of Chicago in 1960; Joe was full professor at the age of 32. I returned to Penn State in 1961, and was in turn enticed to the University of Chicago by Joe Smith and Julian Goldsmith in 1965. We shared 18 years together in the intimate community of Hyde Park, with growing families and scientific goals. After my family moved to the California Institute of Technology in 1983, I watched Joe's expanding horizons with awe. When he retired in 2005, at age 77, he had been a Chicago professor for 45 years.

Joe Smith's Chicago colleague Robert Clayton described him as "an entrepreneur in the development of instruments". When Joe arrived in 1960, he devoted about four years, as a pioneer, to the building an electron microprobe for the Department of Geophysical Sciences, and in developing the techniques that made the machine work successfully. In the early 1960s there were many analysts who said that the electron probe would never yield quality results because there were just too many problems. The task was rather like making science fiction become fact. The Chicago department was one of the first to have a successful instrument, an instrument that is now ubiquitous in geology departments. Twenty years later, he devoted similar efforts to the ion microprobe. For establishment of the difficult analytical procedures he gave much credit to Ian Steele, Ian Hutcheon and Ron Draus.

From the mid-1980s, Joe became intensely involved with a second generation of synchrotrons that were built to optimize X-ray and infrared beams. In addition to participating in national planning for these advanced radiation sources, he was Principal Investigator for a programme at Brookhaven National Laboratory to set up a national facility for X-ray fluorescence analysis. When a high-energy source was assigned to Argonne National Laboratory, managed by the University of Chicago, he was asked (as the local expert) to build the facility at the Advanced Photon Source. In 1988, at 60 years of age, Joe somewhat reluctantly accepted this administrative load. He reported that this set him on a 12–16 hour day through the next five years before turning over the

JOSEPH V. S

facility to Keith Moffat, Mark Rivers, Steve Sutton, James Viccaro and Joy Talsma. But he did not neglect research. In 1989 he organized a multi-institutional, multidisciplinary group of scientists to use the Advanced Photon Source. CARS, the Consortium for Advanced Radiation Sources, developed into a productive activity spanning three sectors for the application of X-rays to: structural biology; chemistry and material sciences; and geo-soil-environmental sciences. CARS raised millions of dollars through 15 years. Joe was director until 1993. He noted that although this turned him effectively into a full-time businessman as he hunted for money, it also required that he read widely. He became increasingly concerned about the use of the world's limited resources for war rather than for humanity, and he became interested in the toxic elements that affect the health of so many people around the world. This influenced his research and writing from the 1990s. So, let us return to some aspects of his research development.

Joe started off as a crystallographer, and followed his structural interests into mineralogy. The early series of feldspar papers by Smith and MacKenzie guided Joe deeper into the details of his most important rock-forming mineral of the Earth's crust. He described Tom Barth as a genial host at the 1963 NATO Institute on Feldspars at Oslo, and blamed him for the inspiration to begin writing a treatise on feldspars. The task was facilitated in 1965 by preparation of a course on feldspars during a term visiting at the California Institute of Technology. I saw Joe at work on this treatise. He was a literature soak. He went on most Saturday mornings to the library armed with index cards and pen, and returned with a stack of notes. I had the impression that he checked every worth-while journal, gathering information on feldspars (and anything else that caught his fancy). He also copied and collected abstracts. Furthermore, he seemed to remember nearly everything that he collected on those cards. His encyclopedic knowledge and critical insight were well represented 10 years later when his treatise on *Feldspar Minerals* appeared in two volumes (Smith, 1974). One reviewer wrote that libraries should purchase two copies, because the first set would soon be worn out. A third volume was published in 1988 (Smith and Brown, 1988). These books identified Joe Smith as the world's feldspar authority.

Joe's textbook on *Geometrical and Structural Crystallography* (Smith, 1982) followed the monumental feldspar monographs. The contents are very different from the crystallography that I enjoyed as an undergraduate and I cannot write about them with insight. The book cover comments: "...unique approach begins on a simple level with symmetry, packing and topology as a framework for subsequent study of crystal structure. Complicated mathematics and theorems are avoided in the early chapters. Point group symmetry and equivalent positions are developed early in the text, so that the shapes of crystals are explained on the basis of atom construction". There are more than 200 illustrations, and graded exercises divided into three levels planned to encourage the development of thinking in three dimensions. Joe's office and laboratory were full of three-dimensional models of crystal structures of real minerals and designer zeolites.

During the feldspar-production years, Joe began to work on the structures of zeolites as a consultant to the Linde Division of Union Carbide Corporation at Tonawanda, NY. He started consulting originally in 1956 to pay family fares for visits to England, and he fell into one of the great success stories of industrial chemistry. Zeolite molecular sieves have revolutionized catalysis, and this led him into quite a different world. Donald Breck and Edith Flanagan of Union Carbide guided Joe, and he described them as brilliant chemists ready to preserve the scientific integrity of his research. I understand that Joe designed possible zeolite structures and compositions, and they synthesized the minerals. Joe's role was to answer basic questions concerning how many zeolite frameworks were possible; how were structural frameworks of the existing zeolites assembled from sub-units, and could the pieces be assembled in other ways; was there a limit to the size of windows for the molecular sieves; how many atoms could be expected to go into the zeolite frameworks; where did the exchangeable cations reside in the crystal structures; and so on. This basic crystallographic research had huge societal impact. One synthetic zeolite became a commercial success as a component of washing powder that replaced the phosphorus compounds that promoted noxious algal blooms in rivers and lakes. Other zeolites replaced the old amorphous catalysts and tripled the yield of gasoline from oil. The world of molecular sieves is one in which major oil companies sue each other over patents on the use of zeolites as catalysts for cracking petroleum. Joe Smith was called on as an expert witness in at least one of those suits. For their meticulous research on synthetic zeolites, Joe has expressed debts to his academic colleagues Gerry Gibbs, Joe Pluth and Michael Bennett.

While feldspars and zeolites were still perking away, the Apollo Program to land men on the moon and to return rock samples was steaming to a boil, and Joe could not resist the excitement. He became a principal investigator and extended his research to the origin of lunar rocks, which completed his transition from crystallographer through mineralogist to petrologist. Apollo 11 in July 1969 returned the first lunar rock samples to Earth. The results were presented in March 1970 at the first Lunar and Planetary Science Conference. Joe reported the first new mineral on the Moon, *pyroxferroite*, and presented a model for a hot Moon which contradicted the dominant, standard model that the Moon had remained cold during its formation. The hot Moon of Joe Smith and his Chicago team (of about nine colleagues) was given a somewhat frigid reception. Joe presented a model relating the mineralogy and petrology of the rocks to the differentiation of a very large body of magma, with feldspars rising to form the light-coloured highlands. He credited John Wood for a related interpretation of floating feldspars. Joe maintained that the Moon's surface must have been extensively melted in a series of catastrophic meteorite impacts. At a press conference afterwards, Harold Urey, the eminent former Chicago faculty member, stated that he could not imagine how someone from his Alma Mater dared to propose such a ridiculous scheme. The moon had accreted as a cold body, and the presence of lavas demonstrated only that some local events had temporarily caused minor heating. A decade later, magma oceans on both moon and Earth appeared to be accepted even by those who wrote in 1971: "this is not possible" and "entirely lacking in supporting evidence" and "encounters a fatal difficulty". What Joe did, in fact, was to look at the evidence, reach a conclusion, and state it, despite the fact that it ran counter to 1970 rules. A farm boy ploughs his own furrow. His co-authors were convinced. The lunar work expanded Joe's horizons to the origin of planets.

His research, his intensive extended reading, and his deliberations were well represented by his Hallimond Lecture for the Centenary of the Mineralogical Society of Great Britain, published as: *Mineralogy of the Planets: a Voyage in Space* *and Time* (Smith, 1979). This began and ended ith verses from Milton's *Paradise Lost*. He was saddened by developments in the Space Program after Apollo, writing in his acceptance of the Roebling Medal (Smith, 1983): On this happy occasion, "I will not pursue the present state of the space program which is increasingly bedeviled by the evil consequences of political and nationalistic rivalries".

The Apollo Program established a surplus of excellent analytical facilities for a small number of returned samples, and Joe joined other investigators in seeking ways to put the facilities to continued good use. Barry Dawson reminded me that I had put Joe in touch with him because he had a superb collection of rare African rocks. Joe visited Barry in St. Andrews in August 1971, returning with selected samples. Barry visited Chicago in April 1972, and returned for later visits that led to an incredibly productive series of joint papers dealing with analyses and interpretations of mantle nodules and other African beauties. Barry Dawson was one of the organizers of the First International Kimberlite Conference of 1973, when De Beers opened up several kimberlite mines for detailed, guided tours. S[illegible] and Dawson presented three papers on [illegible]te mineralogy. Joe was one of the many participants who had their eyes opened in the darkness of deep mines to the complexities of kimberlite magmas. Excellent field trips were organized, and I recall fragments of stimulating stories of Joe riding (or failing to ride?) a donkey (or was it a mule?) on the mountains of Lesotho. Joe thus graduated as a field geologist.

At that time, it was widely held that diamonds had precipitated from kimberlite magma, they were phenocrysts rather than xenocrysts. Diamonds had been found in a few eclogites derived from the mantle (some said 'crust'), and Vladimir Sobolev in 1969 had described a xenolith of pyrope-bearing serpentine containing diamond. Dawson and Smith were the first to identify diamond in a xenolith of garnet lherzolite, a rock that was recognized as a common upper-mantle rock. This was potentially an abundant source of rare xenocrystic diamond. It was probably this discovery that led to the general acceptance of the idea that most diamonds were just getting a ride on the kimberlite magma train as it shot through the crust.

Joe's lunar research had attracted him to the role of asteroid impacts in the origin of the moon, and their ancient and potential effects on Earth. This topic became lively with the general acceptance in 1980 that events caused by the asteroid impact at Chicxulub were responsible for the dinosaurs' extinction. Then came the concept of the 'nuclear winter' that might follow a major nuclear exchange capable of killing up to 1 billion people in the first few days. Joe was strongly affected by these discussions, and became increasingly concerned about the state of the world and the dismal prospects for its future. During the 1980s he began to write, and make conference presentations, about natural hazards such as earthquakes, volcanoes and threats presented by Earth-colliding asteroids and comets. In 1983, he was asked by the American Geophysical Union to organize a session at the December meeting in San Francisco on 'The Geophysical Consequences of Nuclear Explosions'. As he read the preliminary reports, Joe found that he was becoming obsessed by mental images of burning cities and broken bodies. Then he was invited to present a paper on natural hazards at the 'Fourth International Seminar on Nuclear War' in the hill-top town of Erice in Sicily. This 1984 conference included representatives of the nuclear powers giving papers on military and diplomatic planning. Joe reported that the participants were psychologically incompatible.

In 1983, he wrote in the final paragraph from his acceptance of the Roebling Medal of the Mineralogical Society of America (Smith, 1983): "Let me finish with a hope for the future. Currently the forces of love and friendship seem to be weakening in the world in the face of scientifically-based technology misdirected by fear, hatred and greed. There is no simple choice for an individual scientist, and the easy out is to get on with research and hope for the best. I trust that this society and other ones will make a special effort to develop programs that will increase international cooperation in as many ways as possible. Just consider how research and teaching in mineralogy and other sciences could be improved around the world with just one percent of the money spent on war machines. This is a small goal which is not immediately relevant to the pressing problems of neutron bombs and cruise missiles. But in the long term, international ties between scientists can help to establish that we all belong to one human race, and must learn to live in peace on this planet". This concern for the future intensified through his years with synchrotron-based research.

In 1993, when Joe relinquished the directorship of CARS, he was relieved to return from administration to a professorial life of research and teaching. His science reflected his concerns about the future of the human race. In 1998 he organized a National Academy of Sciences Colloquium on 'Geology, Mineralogy, and Human Welfare'. His opening paper included reviews of emerging chemical microscopes that use neutrons, synchrotron X-rays, and electrons. These were revolutionizing the study of mineral surfaces, fluids and microbes and had many applications to agriculture and soils, trace elements and food quality, the hazards of toxic elements and asbestos, and the formation of ore deposits. Other contributions dealt with topics such as the consequence that as human society expands its dominion over Earth, using natural geological resources, it is increasingly threatened by the destructive power of volcanic eruptions, earthquakes, landslides, floods and storms. The natural geological processes become hazards.

Similar concerns were manifest in his teaching. The University of Chicago College required a 3-term sequence of science courses, general education for non-science students. This was known in the 1970s as 'Rocks and Stars'. In the late 1990s, Joe took on the third term and organized a course entitled 'Geology and Human Welfare'. This was designed to convey the links between Earth science and the human condition. Topics included industrial technology and Earth resources, volcanoes and earthquakes and their impacts, floods and landslides, atmospheric physics and chemistry, military affairs and geology, and ecology and ethics. The geology of the Chicago region included field trips. He felt fulfilled through the three years that he taught this course to intelligent students. Some of the themes covered in the National Academy Colloquium and in the teaching course were developed in a long review paper (Smith, 2000).

Starting in 1998, Joe published several papers on biochemical evolution, beginning with his old friends the feldspars and zeolites (Smith, 1998). His course 'Geology and Human Welfare' led him to ponder the reasons for human evolution in East Africa, which he discussed with Barry Dawson, his collaborative African expert (now at the University of Edinburgh). During four years of discussions, Barry came up with a correlation between fossil remains and the unusual carbonatite volcanism in the Rift Valley, which could produce soils high in nutrients such as phos-

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phorus. Joe related this to the importance of biological nutrients in a favourable environment for good health. They speculated whether volcanic trace elements might have been a propelling influence on hominid evolution by effecting gene mutation. Their joint manuscript has not been published, but Joe has a paper: *Geochemical Influences on Life's Origins and Evolution* (Smith, 2005). He noted that after the first living cells were generated by geochemistry on internal mineral surfaces, about 4 billion years ago, life evolved with utilization of energy from the sun and incorporation of selected elements. Then he drew on emerging evidence from metabolism, gene regulation and medicine and its possible relationship to geochemistry and an evolving large-brained primate population that happened to be in a good place during the right volcanic interlude.

After retirement Joe Smith was trying to complete his multi-dimensional, autobiographical book (Smith, 2007). Two quotations from that text provide his message to all of us:

"Even in 2006, most people are quite unaware of the ecological effects of their actions and the critical need for sustainability. Training in geology, astronomy and ecology, and thinking about the future should be a key feature of school, college and university curricula." "Let us leave a better world for our own grandchildren and every grandchild around the World."

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PETER. J. WYLLIE

Joseph Victor Smith

July 30, 1928 - April 6, 2007

Joe Smith was a man of many talents and interests. His study of the moon, his investigation of feldspars or his contribution to the electron microprobe: each of these achievements by itself would have earned him the respect of his scientific colleagues.

We remember Joe Smith mostly as a zeolite scientist and as a man who advanced the field in many ways. I would like to celebrate his accomplishments and remember his scientific life by reminding you of some of the best of his zeolite-related work. For more details of his vita and of his other interests see the obituaries on the University of Chicago, the Boston Globe and the Chicago Sun Times websites.

Between 1929 and 1933 the crystal structures of zeolite minerals of the **SOD**, **ANA**, **EDI**, **NAT** and **THO**-types had been determined. It took more than 20 years before any further zeolite crystal structures were correctly solved: the **CAN**-type in 1955, **LTA** (the first synthetic zeolite) in 1956 and **FAU** and **CHA** in 1958. It is hardly imaginable today, but when Dent and Smith determined the structure of the **CHA**-type in 1958 it was a difficult undertaking, what with five crystallographically independent atoms! Wyart had attempted it in 1933, but his determination was wrong (he had obtained the **SOD**-type structure in rhombohedral setting instead). Following Dent and Smith, Nowacki and collaborators published an independent structure determination of the **CHA**-type in 1958 as well. This was the time when Barrer's work was beginning to bear fruit and various industrial applications of zeolites became a reality. It kindled the interest in the crystal structures of these strange compounds and was followed by a flurry of activity: numerous zeolite crystal structures were determined in the 1960's.

Twenty years later Joe was again at the forefront. By this time the impact of computers on the practice of crystallography had revolutionized the field and allowed the determination of complicated structures such as silicalite. Both ZSM-5 and silicalite were known as extremely interesting materials of **MFI** topology. This topology was established in a February 1978 publication on silicalite in the journal Nature by Flanigen, Bennett, Smith and collaborators. In March of the same year the structural description of ZSM-5 by Kokotailo, Lawton, Olson and Meier was published. These were the most complicated crystal structures of zeolites determined so far. This work opened the way to much fruitful research in the coming years.

After the tetrahedral aluminophosphate molecular sieves were synthesized in the early 1980's it was again Joe Smith, who, together with Bennett, Flanigen and Pluth led the way in exploring these new crystal stuctures. The first to be studied was the structure of **AFI** topology, to be followed by several more. Investigations of this group of compounds continue into the present.

But even when Joe was not the first to enter an area of study, he still could set the standard for the quality of workmanship. In five carefully performed experiments published from 1979 to 1983 Pluth and Smith showed how to refine the crystal structures of **LTA**-type compounds. They established that the so-called zero-coordinated cations claimed to occur there were the artifacts of faulty refinements.

However, Joe was never satisfied with experiments alone. He saw the potential of seeing things in their context. For example he followed the path indicated by A. F. Wells and studied the three-dimensional nets of bonds outlined by the T-O connections in zeolites. He began this work in 1964 with a paper by Moore and Smith, and he continued to explore this field systematically over the years. In 2000 Joe published a book in the Landolt-Börnstein series summarizing his exploits along those lines. In this book he analyzed the topological properties of numerous nets occurring in actual crystal structures, mostly in zeolites. This is an excerpt from his unpublished Catalog of Theoretical Nets comprising 1300 examples. His heroic and thoughtful work in this direction is now being superseded by computer-based approaches as pursued by Mike Treacy and collaborators.

Because Joe liked to see the general case behind each specific instance he was very good at writing review articles. Rather early in his "zeolite-career" and at a time when many zeolite crystal structures where not known yet, he published in 1963 a Structural Classification of Zeolites. His "Topochemistry of Zeolites and Related Materials. 1. Topology and Geometry" of 1988 became an instant classic and has been cited almost 400 times. His voracious appetite for reading is documented by the 525 references given in that paper. I am not aware that he ever published the second part, which I assume would have been titled "Topochemistry of Zeolites and Related Materials. 2. Chemistry". Somebody else will have to do that.

I estimate that about one quarter of his ca. 400 published papers deal in one way or another with zeolites. However many zeolitic papers he wrote, he always had a keen awareness of what was important and often his work defined what was to become important.

Incidentally, the photographs of Joe at two of the websites mentioned above show him the way we all have seen him often: he holds in his hands one of his numerous zeolite models. While we mourn his parting let us remember Joe the way he was: an enthusiastic scientist, always full of stimulating ideas. Let us remember him with one of the zeolite models in his hands.

Werner H. Baur
April 30, 2007

In memory of J.V. Smith

Only now, a few months from his departure which unfortunately coincided with the tragic loss of my brother, I can leaf through the book of my memories about Joe and share with friends and colleagues a few personal cameos which have been with me for the last 37 years.

Joe's figure as a scientist and the huge imprint his work has left in the fields of the Earth Sciences and mineralogical research, is part of the memory of each one of us. In our work we have all had many opportunities to meet Joe through his works and have always admired his gift for innovation, fore-sight and the ability to catch aspects and perspectives of research work which had sometimes escaped the authors themselves of the vast amount of literature he painstakingly studied for his famous review works.

The part of Joe's figure I would like to evoke here is the one that comes to my mind from a couple of episodes I have lived with him in person.

When I arrived as a post-grad at The University of Chicago in 1970, the Department of Geophysical Sciences had only recently been transferred to its present location on Ellis Avenue. The building had been planned and built specifically to host all the research and teaching activities in the Earth Sciences, from geophysics of the solid Earth to physics of the atmosphere, including marine geology, stratigraphy, palaeontology and so on, therefore uniting, under the same roof, researchers from a large variety of disciplines with prominent figures in many fields. Among these, Joe was the reference for mineralogy, crystallography, crystal physics and crystal chemistry of minerals and related compounds.

The new Department building had been designed by a famous architect who had taken his inspiration from the skyline of the town of San Giminiano in Italy, with its many towers; a place well known to Joe and also to myself. The architecture of the building was a mixture of medieval austerity with prevailing vertical lines including tall and narrow windows reminiscent of the defence slits in a fortress and modern, rational interiors, clearly planned for optimum functionality. The main entrance, with an outer structure reminiscent of the draw bridge, received the visitor literally inside a work of art of immediate impact; a bas-relief polychrome ceramic decoration, by a famous artist, with colours and shapes inspired by themes of the inner and outer environments of the planet Earth.

The architectural value of the building and the artistic significance of the ceramic decoration at the entrance did not seem to please the aesthetic sense of several scientists on Campus, even among the occupants of the Department. However, Joe never missed an opportunity to remark on the aesthetic and artistic value of the new building. Actually, once inside, the building was rather monotonous and impersonal with white perimetral corridors, identical on each one of the floors, lined with a seemingly endless sequence of dark office doors on the outer side, and fewer lab double doors on the inner side. Whereas the offices enjoyed some natural light from the narrow windows, the labs and the corridors had none. The atmosphere of a medieval convent with cells opening on to a corridor seemed to have been taken a bit to an extreme, where the open cloisters had been replaced by the windowless corridors and labs.

It was during the first couple of months of my stay that, having made friends with the resident Artist of the University at that time, the sculptor Virginio Ferrari, I proposed him to Joe for a seminar on a totally new subject for the Department: "The relationship between art and science; the viewpoint of an artist". Joe received the proposal enthusiastically, the seminar was quite successful and from this, a series of contacts and collaborations between artists and scientists (mainly Joe on the latter side) begun. This activity resulted in the realization of a series of decorative paintings, based on scientific subjects, to replace the white paint on the walls of the corridors, therefore giving a definitely more interesting and characteristic aspect to the interior of the building with different themes on the various floors.

Joe participated very actively in all stages of the endeavour and was often seen, brush in hand, taking care of the actual work himself. He used to say that, similar to building models of 44 crystal structures (mostly zeolites), to which he also dedicated considerable time, there was nothing better for a relaxing break, especially the kind one takes to get away from an apparently unsolvable problem which then becomes trivial upon resuming work.

One of the lesser known traits of Joe's character was his desire to confront his pupils and collaborators also on the physical level in the two sports activities he preferred: volleyball and hand-ball. His determination to involve everyone in regular volleyball games was proverbial, so much so that a joke was circulating in the Department identifying the initial of his middle name, actually known only to a few, with the word "volleyball", so that his full name should have been read "Joseph Volleyball Smith". As a matter of fact his real middle name, Victor, evokes a tendency to victory, in sports or otherwise, which Joe pursued with tenacity and ability.

I had a chance to appreciate this ability of Joe's in the two hand-ball matches he conceded to me. At the first one, my younger legs, trained by athletics, allowed me to return almost all his precise and rapid shots. However, my inadequacy to put him into difficulty with shots as effective as his, became apparent in the second match when his shots became so well planned that they were practically impossible to return. A good lesson of life, beyond hand-ball!

Good bye, Joe; you will always be in my thoughts.

Romano Rinaldi
Italian Zeolite Association