

PROCEEDINGS OF THE FORTY-SEVENTH ANNUAL MEETING OF THE MINERALOGICAL ASSOCIATION OF CANADA, 2002

The 47th annual meeting of the Mineralogical Association of Canada was held May 27–29th at the University of Saskatoon, in the picturesque city of Saskatoon (“Hub City”), Saskatchewan. The meeting had over 530 registrants and included 11 field trips. One of the highlights for many attendees was the opportunity to view the new Canadian Light Source Synchrotron Radiation Facility, truly one of the most significant scientific facilities ever created in Canada. Visits, arranged as part of an MAC-organized short course (“Synchrotron Radiation: Earth, Environmental and Material Science Applications”), provided a behind-the-scenes look at the facility, which was nearing completion.

The scientific program consisted of four symposia, 20 special sessions and nine general sessions, along with 11 field trips. Outside of the regular GAC–MAC meeting venue, MAC sponsored the first Leonard G. Berry Summer School. It was held in the Department of Geological Sciences at Queen’s University, August 12–14, 2002, and focused on X-ray powder diffraction and application of the Rietveld method. Ron C. Peterson (Queen’s University) and Mati Raudsepp (University of British Columbia) co-chaired the school, which was attended by about 20 graduate students, researchers and professors alike. By all accounts, this first school was an immense success. MAC Council hopes that this is the first of many Berry Schools to come. The Association also supported the eighth biennial PACROFI Conference, which was held in Halifax, Nova Scotia (July 21–25) and co-chaired by Dan Kontak and Alan Anderson. The meeting attracted approximately 70 registrants and covered a wide variety of topics related to research on fluid inclusions.

The annual MAC luncheon and award presentations were held May 28 in Exeter Hall at University of Saskatoon. The Hawley Award for 2002, for the best paper in Volume 39 of *The Canadian Mineralogist*, was awarded by Association President Norman Halden to Rod C. Ewing for his paper, “The design and evaluation of nuclear-waste forms: clues from mineralogy” (Vol. 39, p. 697-716). The Past Presidents’ medal was awarded to John L. Jambor for his long-standing devotion and efforts to both MAC and *The Canadian Mineralogist*. The Berry medal was awarded to Robert T. Downs (Uni-

versity of Arizona) in recognition of his efforts in developing a Crystal Structure Database and acting as Technical Editor, Crystal Structures, for manuscripts submitted to *The Canadian Mineralogist*. The Young Scientist’s medal was awarded to James M. Brennan (University of Toronto). The Ann Sabina Awards, made on behalf of the CCFMS, were presented to Mr. Gilbert Benoit (Sudbury, Ontario; Advanced) and Mr. Jean-François Poulin (Sudbury, Ontario; Beginner) at the Sudbury Gem and Mineral Show.

The Annual Business meeting took place on May 29th in the Department of Geological Sciences at US. Once again, open discussion of the future of MAC in terms of joint meetings occurred. In general, it was concluded that MAC should be open to sponsoring or jointly holding meetings with organizations outside of the traditional GAC–MAC umbrella. The cost of Ordinary and Corporate/Institutional Memberships will remain unchanged for the coming year, thanks largely to efforts of the Publication Committee. Four new MAC publications will be available in the coming year. *The Atlas of Non-silicate Minerals in Thin Section* (a joint publication with the University of Barcelona) and *Mineral Species Discovered in Canada, and Species Named after Canadians* (by László Horváth, Special Publication 6) and two short-course volumes, one on the *Environmental Aspects of Mine Wastes* and one on the *Analysis and Applications of Fluid Inclusions*.

The audited financial statements to year end December 31, 2002, prepared by Joanne L. Dorman, Chartered Accountant (Burnaby, British Columbia) list our equity in excess of \$640 000, with a recognized surplus of \$66 000 over the past year. The audited financial statements are published in Newsletter 68 (p. 4-5).

The Association, through the MAC Foundation, awarded its \$10,000 graduate scholarship to Daniel Layton-Matthews, University of Toronto. Your financial support of this very deserving award is greatly appreciated. Please direct any inquiries regarding donations to the MAC Foundation to R.H. Mitchell, Chairman of the Board, MAC Foundation, Lakehead University, Thunder Bay, Ontario, P7B 5E1 (rmitchel@gale.lakeheadu.ca).

The next Joint Annual Meeting of GAC, MAC and SEG will take place in Vancouver, British Columbia, May 25-28, 2003. The theme for the meeting is "On the Edge: Earth Science at North America's Western Margin" (Vancouver2003@nrcan.gc.ca). The MAC will continue to show a strong presence at the Joint Annual Meeting, including sponsorship of several special sessions and short courses. Hope to see you there!

Andrew M. McDonald
Secretary, MAC

**THE HAWLEY MEDAL FOR 2002
TO
RODNEY C. EWING**



RODNEY C. EWING

The Hawley Medalist for 2002 is Dr. Rodney C. Ewing. Dr Ewing is a Professor in the Departments of Nuclear Engineering and Radiological Sciences, Material Science and Engineering, and Geological Sciences at the University of Michigan. The Hawley Medal is awarded for the best paper to appear in *The Canadian Mineralogist* in the preceding year (2001). Dr. Ewing's paper, entitled "The Design and Evaluation of Nuclear-Waste Forms: Clues from Mineralogy", appeared in Volume 39, Part 3, pp. 697-715.

Dr. Ewing's paper was the only one selected by all three members of the Hawley Medal selection committee as one of the five best papers to appear the Volume 39 of *The Canadian Mineralogist*. The panel was composed of Charles V. Guidotti of the University of Maine, Encarnación Puga from the Instituto Andaluz de Ciencias de la Tierra in Granada, Spain, and Mavis Stout from the University of Calgary.

The committee described the paper as one that demonstrated an innovative application of mineralogy to an

important modern-day problem. The paper was judged to be clearly written, impeccably documented, and the author emphasized the importance of the mineralogical sciences to modern science. Crystal-chemical data, information, and insights based on the study of naturally occurring, relatively common minerals, such as zircon and monazite, provide the key for assessing approaches to a crucial problem facing modern society: how to safely dispose of and store nuclear wastes for long periods of time. Only by studying minerals that have naturally stored radioactive elements for long periods of time can society learn how to attack this problem. The author of this paper shows once again that research done by academically oriented mineralogists can be of key relevance in addressing major technological questions. The selection of this paper for the Hawley Medal rewards research on a topic of scientific importance, but also a long and fruitful research program.

Norman M. Halden
President, MAC

Mr. President, Members of the Mineralogical Association of Canada and guests,

An author is always pleased to have a paper recognized as a “best paper”, and I am certainly no different; however, I acknowledge the very subjective process by which a “best” paper is selected. Other papers published during 2001 certainly reached a higher level of science or required greater effort and skill. Still, even with these humbling qualifications, I am particularly pleased that this paper was selected, because I think the subject, nuclear materials, is so critically important. The fate of nuclear materials, consumed and generated in nuclear reactors, will determine the future of nuclear power.

Twenty percent of the world’s electricity is generated from approximately 400 nuclear reactors. The use of nuclear power as a replacement for carbon-based sources of energy reduces carbon emissions by an estimated 600 million metric tonnes per year. However, these same nuclear power plants, as well as reactors used to produce bomb materials, have left the world with a legacy of 150,000 tonnes of used nuclear fuel stored in 36 countries to varying degrees of care. The global production of used nuclear fuel is on the order of 10,000 tonnes per year, containing 100 tonnes of plutonium. The global inventory of plutonium is over 1,400 tonnes, of which approximately 450 tonnes have been separated by reprocessing (250 tonnes are used for weapons). The bare critical mass of ^{239}Pu is less than 10 kg. The fate of plutonium, and other fissile nuclides such as the much more abundant ^{235}U , is of critical environmental concern. Any significant increase in the use of nuclear power will result in substantial increases in the amount of spent nuclear fuel.

What is the role of geoscientists? If we consider the nuclear fuel cycle as the source term, then the geological repository is the intersection of the nuclear fuel cycle with geological cycles. The nuclear fuel cycle operates on a scale of tens of years, and the geochemical or hydrologic cycles operate on scales of hundreds to millions of years. From the nuclear engineering perspective, environmental impact can be lessened by careful design

of the fuel cycle. From the geological perspective, the most important step is in the selection of a repository site. Once the site is selected, the principal geological means of protecting the environment will be by a reduction in the release and transport rates combined with dilution. The science that supports the performance assessment of a site requires an analysis that couples atomic-scale processes, such as corrosion of spent fuel and waste packages, to crustal-scale processes, such as volcanic activity and climate change, that extend over temporal scales of thousands, if not tens of thousands, of years. The challenge for geoscientists is in modeling these complex, highly coupled, large-scale geological systems over extended periods.

Mineralogists can play an exceptionally important role in this process. On the nuclear side of the cycle, there is considerable interest in designing new fuels, inert matrix fuels that “burn up” excess actinides. This is just mineralogy plus neutrons. On the materials science side, the design, evaluation and selection of nuclear waste-forms are jobs tailor-made for mineralogists. Nuclear waste-forms of high chemical durability that are resistant to radiation damage provide the first and most important barrier against release to the environment. There is already considerable insight on the long-term behavior of such materials, many of them minerals, but much remains to be done in developing special waste-forms for specific waste-streams.

I believe that by recognizing this paper, the Mineralogical Association of Canada has focused the attention of the next generation of mineralogists on one of the major environmental issues of this century. Thank you for selecting this paper for the Hawley Medal.

Rodney C. Ewing
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Radiological Sciences
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**THE BERRY MEDAL FOR 2002
TO
ROBERT T. DOWNS**



ROBERT T. DOWNS

The Leonard G. Berry Medal is awarded for distinguished service to the Mineralogical Association of Canada. It is my honor and pleasure to introduce to you this year's recipient, Robert Terrance Downs, another of Manitoba's gifts to the mineralogical sciences. As you will learn, Robert Downs is indeed worthy of this honor, and I think that Leonard Berry himself would be most pleased with this year's recipient, as he has provided services that are of particular relevance and importance to the mineralogical community at an international level.

Born in Brandon, Manitoba, Robert took the road less traveled in becoming a respected mineralogist. While pursuing an early career as a construction worker contributing to the growth of the Vancouver area skyline (Cambie Street Bridge, Burrar and Granville Street subway stations) and northern development (Dempster Highway in the Yukon), he obtained his first degree at the University of British Columbia (Mathematics, 1986). Following stints as assistant curator at the UBC mineral museum with Joe Nagel and in the National Mineral Collection in Ottawa with Gary Ansell, Bob moved to Virginia Tech, where he obtained his M.Sc. (1989) and Ph.D. (1992) degrees in the area of thermal motion in minerals. After a post-doctoral position at the Geophysical Lab in Washington, D.C., Bob moved on to his present faculty position at the University of Arizona, where he resides with his wife Dori and two young boys, Gordie and Clay.

Whereas the Mineralogical Association of Canada appreciates the efforts and contributions Bob has made to the construction of famous Canadian structures and numerous publications in the mineralogical sciences, this is not why he is being honored today with the Berry Medal. In order to appreciate his worthiness of this honor, allow me to read to you part of the nominating letter, which will enlighten you as to the exemplary efforts of Robert Terrance Downs.

"I am pleased to nominate Robert Downs... for the Leonard Berry medal to recognize his work behind the scenes to make *The Canadian Mineralogist* a superior journal. Bob approached me ten or so years ago, and offered his services in a novel way. He wished to volunteer his services as Technical Editor of all crystallographic papers accepted for publication in *The Canadian Mineralogist*. In view of his research interests, he was interested in compiling a data bank of reliable crystal-structure data. He had found that the reams of tables of atom coordinates, bond lengths and bond angles, as then published in both *The Canadian Mineralogist* and *American Mineralogist*, and other journals of course, contained many errors, clerical in nature in many cases, but not all... Bob developed the software to carry out these checks systematically, and offered, as I say, his services to editors of both journals...Bob has been diligently recalculating everything in both journals since then [and] it soon becomes apparent if there are internal inconsistencies... I would estimate that serious errors

crop up in about two-thirds of the articles.... I claim that in his behind-the-scenes assiduous work on reams of tables that I send his way, Bob contributes in a very meaningful way to the excellence of our journal. Nothing gets published in the area of crystallography until it gets the Downs Seal of Approval! It is in recognition of this consistent and unsung service that I am nominating Bob for the Leonard G. Berry Medal.”

The councillors of the Mineralogical Association of Canada indeed also recognize the significance of Bob’s work over the past many years and its importance in contributing to the stature of the journal. In acknowledgment of these unsung volunteer efforts in favor of the association, it gives me great pleasure to present to you the Leonard G. Berry Medal for 2002. Thank you for your services, and congratulations!

Daniel J. Kontak
Vice-President. MAC

I thank the Mineralogical Association of Canada for honoring me with the Berry Medal for significant contributions to the Association. Every person and their accomplishments are the net result of their experiences and opportunities, so I would like to tell my story and thank those involved.

I was born in the Shilo Army Camp near Brandon, Manitoba, home of hookers and hockey players. My mom was a goalie. When my dad was discharged from the Army, he became a construction worker, and we moved out to northern British Columbia, where he eventually became a Labour Union leader. We moved around a lot, and lived in some remote places, often eating moose or grizzly that my dad hunted. In one of these places, I met an old prospector who, if I visited him, would give me crystals from out of a bucket that he kept on his front porch. My parents divorced, and I moved with my mom and sisters to the welfare projects in Windsor, Ontario. In Windsor, I had the best mineral collection of any kid on the block, and this perhaps provided the inspiration to get me started in my life-long interest in minerals and mineral collecting.

I left home at the age of 14 and started hitchhiking and hopping trains in order to get back to British Columbia to see my dad. I ended up finishing my high school in Nanaimo, B.C., and enrolled at U.B.C. Although Geology was the carrot that I chased to become the first member of my family to ever go to college, I was not excited by my introductory course, and consequently I changed my major to mathematics. It was difficult to attend school every year because I would get these high-paying summer jobs in construction in the middle of nowhere, and I would stay till the job played

out. I graduated with my degree at the age of 30. In between starting and ending university, I also kept up with my mineral collecting and even tried professional collecting for a while, learning how to drill and blast rock from Bob Jackson. During my last year as an undergraduate, I was fortunate to get a part-time job with the late Joe Nagel, the curator of the U.B.C. mineral museum. Joe encouraged me to pursue a graduate degree and also helped me find a summer job with Gary Ansell at the Geological Survey of Canada, working on the national mineral collection.

Graduate school was in Blacksburg at Virginia Tech, where I studied with Jerry Gibbs and Monte Boisen. The mix of minerals and math provided by these two wonderful scientists provided the best education I could have hoped for. They perhaps got more than they bargained for, and had to spend a great deal of effort to polish my rough edges. I consider Monte and Jerry to be two of my best friends. My graduate research involved obtaining a large number of crystal-structure datasets from the literature. I started collecting these datasets and studying the information that could be obtained from them. I was surprised and appalled at how many errors the published tables contained and how carelessly prepared the manuscripts must have been. My best friend in grad school and best man at my wedding was Kurt Bartelmehs. In 1988, he and I decided to write some computer graphics programs to visualize the crystal-structure data in order to help us in our research and to help teach mineralogy labs. Together, we collected a large number of datasets and created some significant software for analyzing and visualizing the data.

I had the opportunity to do both a pre-doc and a post-doc at the Geophysical Lab with Bob Hazen, Larry Finger, Charlie Prewitt and Hexiong Yang. Bob is a good friend and has provided me with practical, sound advice that includes “Always keep the diffractometer running!” and “Never shut your office door when a female student is inside”. Larry taught me not to let the instruments limit my ideas, and Charlie is the wise sage who knows everything. Yang is a best friend; we completed post-docs together and really enjoyed working together.

While I was at my post-doc, I went to the NATO fieldspar meeting in Edinburgh and had the chance to sit next to Bob Martin, editor of *The Canadian Mineralogist*, while on a bus tour. If I recollect the events correctly, we got to talking about crystal-structure datasets and I told him about the problems with data in the literature and he asked me if I would check some of the data about to be published in his journal. The very first dataset that he gave me had absolutely nothing to do with the contents of the paper with which it was being published! It was amazing to both of us that we would see this happen in the proof stage of a paper and further

emphasized my concern about the quality of published crystal-structure data. Soon I was given the title of Technical Editor (Structures) of *The Canadian Mineralogist*, and I now examine each dataset prior to publication. Bob Martin is a consummate editor who is always looking for ways to improve his journal and thus improve the quality of scientific communication. In contrast, it was the position of the editors of the *American Mineralogist* that the quality of data was the sole responsibility of the authors and not the journal. This position changed once Rich Reeder was editor, and then I began to check the crystal-structure data for *American Mineralogist* as well.

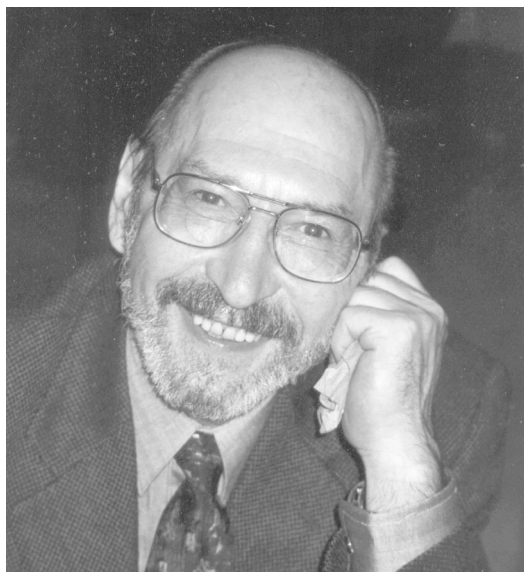
Given that I was now collecting data that had been carefully checked, I decided to make these datasets available to the general public. I was then an assistant professor at the University of Arizona, and needed to come up with funding opportunities. Fortunately for me, the National Science Foundation began a program to financially support Information Technology, and I have been awarded funding to build and maintain a mineral-

ogical crystal-structure database on the Internet. It will be accessible through the web pages of the Mineralogical Association of Canada and the Mineralogical Society of America and will contain the checked crystal-structure data for every structure published in *American Mineralogist* and *The Canadian Mineralogist*. Now with the Berry Medal pinned on my chest and grant money burning a hole in my pocket, Arizona is promoting me to associate professor this summer.

Finally, I would like to acknowledge the support of my family. I met my wonderful wife, Dori, during graduate school. We fell in love while playing volleyball, and she has been a source of encouragement and inspiration since then. When I failed my prelims, she wanted to burn her diploma. Together, we have created a happy family with two very fun boys, Gordie and Clay. I thank them for their love.

Robert T. Downs
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**THE PAST-PRESIDENTS' MEDAL
FOR 2002
TO JOHN L. JAMBOR**



JOHN L. JAMBOR

Photo taken at the closing banquet for the European Mineralogical Union short course on environmental mineralogy, Budapest, May 2000. Photo by H. Catherine W. Skinner.

The Mineralogical Association of Canada awards its Past-Presidents' Medal to scientists who have made significant contributions to the mineralogical sciences during their career. John Jambor, the medalist for 2002, has a long and wide-ranging career covering all aspects of the earth sciences. He began his career as a mineralogist in the Geological Survey of Canada in 1960, and as economic geologist in 1972, then at CANMET as a mineralogist from 1975 to 1993, at which time he resigned to pursue a career of consultant and researcher (adjunct professor at the University of Waterloo and later at the University of British Columbia).

Dr. Jambor has published widely, making important contributions in the fields of mineralogy, petrology, crystallography, and mineral deposits (134 refereed publications and 123 other publications). The mineralogical contributions include the characterization of numerous new minerals, the mineralogy of several mineral deposits, characterization of jarosite-group minerals and sulfosalts. Contributions in applied mineralogy have ranged from metallurgical to acid mine-drainage and environmental mineralogy. He has made contributions to a wide range of ore deposits, including Ag-Pb-Zn at

Keno Hill (Yukon), Ag-Co at Cobalt (Ontario), porphyry copper (British Columbia), base metal (New Brunswick), massive sulfide in the Buchans area (Newfoundland), and REE deposits (NWT, Labrador-Quebec).

Dr. Jambor also contributed to the earth sciences through editorial duties, of which the most significant are Scientific Editor of *The Canadian Mineralogist* (1971-1975); Co-Editor, *The Canadian Mineralogist* (1975-1977); New Minerals Editor, *American Mineralogist* (1989-present); Consulting Editor and Production Manager, *Exploration and Mining Geology* (1991-present). Dr. Jambor has also been editor or co-editor of seven special issues, short courses and related books, as well as series editor for five MAC short courses. In recognition, he has been awarded the L.J. Berry Medal (MAC), Honorary Life Membership (MAC), and the Julian Boldy Memorial Award (CIM Geological Society). Dr. Jambor's interests included environmental mineralogy when environmental mineralogy was not even named as a mineralogical science. He is using this expertise to organize, with David Blowes, a forthcoming MAC short course, on the theme

Environmental Geochemistry and Mineralogy, which will be presented at the GAC–MAC meeting in Vancouver in 2003.

It gives me great pleasure to present the Past Presidents' Medal of the Mineralogical Association of Canada to John Leslie Jambor.

Brian J. Fryer
Past-President, MAC

For many in science, whether it be Earth Sciences or other, the chosen field has been a topic of fascination since the individual's youth. Although I was born in the famous mining town of Noranda, Quebec, our family moved to Vancouver at a time when my lifespan had barely reached double digits, and it wasn't until my first year at UBC that there is the recollection of hearing the term "geology". The introduction was accidental, and came about after accepting a ride from a fellow student, the floor of whose car was strewn with hand specimens of various rocks. The response to my inevitable question led me to think that geology might be an interesting pursuit, but it wasn't until the following year, after having completed the introductory geology course, that the decision to become a geologist was made.

My career has been blessed by a series of similarly happy accidents. Successive summers as a student had been spent mapping in the Yukon, the Coast Mountains of British Columbia, the Northwest Territories, and in doing stratigraphy and well-sitting in Alberta, and the decision was that petroleum geology was to be my chosen profession. Upon receiving my M.Sc. from UBC, however, employment prospects had changed, and the first "real" job, a permanent position as it was called, was in a laboratory at the Geological Survey of Canada in Ottawa. That was a period in which the GSC was in full bloom, when science was viewed so favorably that management fought, successfully, to have the term Research Scientist installed as a job classification. Although that situation changed over the years, not only at the GSC but in similar organizations worldwide, the personal interest in scientific work, whether directed to pure or applied objectives, has not waned.

When I joined the GSC, it was with the intention of staying for about two years. Opportunities to move elsewhere eventually arrived, but it took little introspection to reach the conclusion that nothing could be more satisfying than what I was already doing. Consequently, the stay at the GSC, and a roughly equal period at CANMET (the former Mines Branch), spanned more than 30 years.

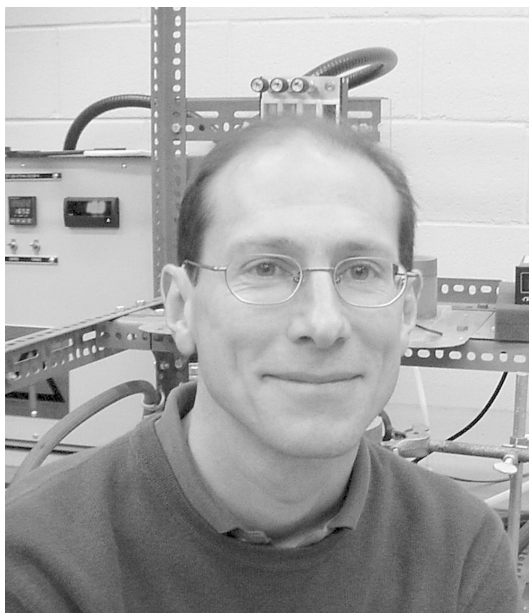
Through such a lengthy career there are inevitably many individuals who have had a strong influence on

the directions that were taken, and I hope to be forgiven for restricting mention to only a few who have influenced or shaped that direction since my return to Vancouver in 1993. Much of my work over the past decade has been focused on environmental mineralogy, and much of that has been the result of collaborations with David Blowes and his former students from the University of Waterloo. David is a geochemist, but he long ago recognized the benefits and constraining effects of integrating mineralogical and geochemical data for interpreting the geochemical behavior of weathering mine wastes. An ardent champion of mineralogy as applied to environmental geochemistry, he was the chief organizer of the 1994 MAC short course on *Environmental Geochemistry of Sulfide Mine-Wastes*, and we co-edited the resulting short-course volume. John Dutrizac of CANMET has continued to support and collaborate on research into the mineralogical aspects that govern the results of tests currently utilized to predict whether wastes will be acid-generating. Louis Cabri was instrumental in providing the opportunity to participate in the IMA–COM–MAC short courses on *Modern Approaches to Ore and Environmental Mineralogy*, which were subsequently published as MAC Short-Course Volume 27. My collaboration at UBC has been mainly with Lee Groat and Mati Raudsepp. Although how that came about has passed detailed recollection, I know that I am grateful to Lee for his gentle but persistent prodding that the connection be made.

To be the recipient of the MAC Past-Presidents' Medal is a great honor, and I am grateful to those who supported the nomination, and to those who accepted it. Two things are necessary for one to receive such an award. First, it is necessary to have a *résumé* that is deemed to be appropriate, and there are many candidates who would qualify in that regard. The second requirement, which is not of lesser importance, is that the candidate be nominated. That means an individual or group must be willing to make the effort and take the time to prepare the required documentation, with the prospects of a return on that investment limited to possible self-satisfaction and, of course, the undying gratitude of a successful nominee. When Jim Nicholls phoned to say that I was to be the 2002 recipient, he mentioned that Louis Cabri had been responsible for the nomination. To have had that done by a former co-worker, who is also a past recipient of the award, is truly overwhelming. I thank all who were involved, and especially my patient and helpful wife Lynne, whose assistance has been instrumental in bringing to fruition much of what has been accomplished.

John L. Jambor
Tsawwassen, British Columbia

**THE YOUNG SCIENTIST AWARD
FOR 2002
TO JAMES M. BRENAN**



JAMES M. BRENAN

The Young Scientist Award is given to an individual who has made a significant research contribution in a promising start to a scientific career. The Mineralogical Association of Canada has selected Dr. James M. Brenan from the University of Toronto for the Young Scientist Award. His impact on igneous petrology, fluid geochemistry and ore genesis are out of proportion to the 11 years since his Ph.D. graduation from Rensselaer Polytechnic in 1990 (after a B.Sc. at McGill in 1985). During this time, he has published 18 papers in the best of the refereed journals (*Nature*, *The Canadian Mineralogist*, *American Mineralogist*, *Economic Geology*, *Geochimica et Cosmochimica Acta*). He is the senior or sole author on all but two of these. As well, he has contributed to five (sole author of four) significant non-refereed publications, including a 1991 MSA short course.

All of Dr. Brenan's papers have sought answers to significant fundamental questions, and he has adopted the techniques that are best able to provide answers. His earlier research focused on fluids in the mantle and lithosphere, primarily at convergent boundaries. More recently, he has been investigating the genesis of

magmatic sulfide and oxide ores. He has devised and executed key and, in some cases, ingenious piston-cylinder experiments to interpret intelligently the signatures produced by trace elements and isotopes in the products of crust-scale recycling and formation of continental crust. His strategy has been to investigate both equilibrium and kinetic aspects of fluid-mineral interactions, mechanisms of fluid migration and mineral-fluid partitioning of high field-strength elements and radiogenic isotopes. More recently, he has tackled experimentally the geochemistry and fluid dynamics of immiscible sulfides, and has furthered our understanding of Re-Os isotopic chronometry.

In another aspect of his work, Dr. Brenan has been a leader in the characterization of equilibrium textures between minerals and important fluids in the crust and mantle. He has applied some of this same approach to fluid migration during contact metamorphism. This latter work was summarized in an MSA short course and provided the first quantitative data that can be used to identify the effects of fluid chemistry on textural equilibrium.

As an indication of his intense involvement in his discipline, Dr. Brenan has presented papers at 20 conferences during the past five years and has given ten invited talks. He has organized two Goldschmidt symposia (1997, 2001), is on the editorial board of *Chemical Geology* and *Journal of Geophysical Research*, was a presenter in an Mineralogical Society of America short course and is or has been on various national and international scientific committees. Such a high level of dedicated activity is rare for a young scientist.

In 2000, Dr. Brenan received a Premier's Research Excellence Award. This hotly contested award is given to only the best young scientists in Ontario. More significantly, Dr. Brenan is the 1998 recipient of the Mineralogical Society of America Award. This award is given annually for outstanding contributions to mineralogy, petrology and geochemistry that have been produced before the age of 35.

Norman M. Halden
President, MAC

I am honored to be selected as this year's MAC Young Scientist, and relieved to know that I still qualify as "young". Although I was born "south of the border", I spent my formative years as a geologist here in Canada, and now that I have had the opportunity to teach and pursue research in this country, recognition by my Canadian peers is truly special for me.

As a child, I was quite interested in the natural world, but had no specific inclination to geology. In our family history, the closest to an "earth scientist" would have been my great grandfather, who was a mortician (founder of Brenan's Funeral Home, St. John, N.B.). However, my parents, John and Jean, were highly tolerant of my various forays into chemistry (making napalm in the garage) and biology (storing nematodes for the newts in the fridge) and were happy to get up at 4 a.m. for bird walks, balloon launches and the like. They instilled in me the great value of education and that learning is a life-long pursuit.

Upon entering McGill in the fall of 1981, my broad interest in natural science resulted in a problem: how do I focus my interests and graduate in a timely fashion? Professor A.E. "Willy" Williams-Jones solved this dilemma for me. In addition to being a first-rate scientist, Willy is a great teacher, and after taking his intro to geology course, I was hooked. Once a particular area of endeavor is chosen, whether one continues on that path, and in what direction, is very much influenced by the people you meet along the way. My initial path at McGill was to Gertrude's Pub, but this was somewhat altered one Friday afternoon during one of the many

social events sponsored by McGill's Department of Geological Sciences. I was sitting with a group consisting of Don Francis and his students when Don abruptly turned to me and said in an accusing tone "Why aren't you doing research?" I had no good answer for him, and the following summer found myself mapping peridotite with M.Sc. student Benoit Rivard in the black-fly-infested woods east of James Bay. Despite the physical challenge of this mapping exercise (which I repeated the following summer!), my enthusiasm for geology, and specifically igneous petrology, only grew. In addition to field observation, both Don and Bob Martin emphasized the importance of experimental work as a powerful tool for understanding igneous rocks. As such, when I expressed an interest in doing graduate work, Don suggested a fellow named Bruce Watson at a school in the States known as Rensselaer Polytechnic Institute.

When I started my Ph.D. in the fall of 1985, mantle metasomatism was a hot topic, yet the agents of mass transfer in the upper mantle were poorly constrained. Bruce had already recognized this as a problem that experimentalists could help to solve, so he suggested it as a thesis topic. Being young and naive, I had no idea that high P-T experiments involving aqueous and carbonic fluids were notoriously difficult, and began my work with enthusiasm for early success. Not unexpectedly, I did not have my thesis work done in six months. Fortunately for me, Bruce is a master of experiment design, and the unwritten lab credo was "you won't know if it's going to work until you try it". The eventual success of my experiments and completion of my thesis were a direct result of that influence. It was this "upbringing" that has also allowed me to achieve some measure of success on an even greater current experimental challenge, which is sorting out the geochemistry of the platinum-group elements.

After acquiring my Ph.D., I was a post-doc at the Geophysical Lab and then Lawrence Livermore National Lab. The post-doc at Livermore was one of the most productive times in my research career, mainly because the Lab had the key combination of facilities for both high P-T experiments, and *in situ* trace-element analysis. With Doug Phinney, Ian Hutcheon and Henry Shaw running the ion probe, and Rick Ryerson's expertise in the experimental lab, we were the first to produce a reasonably comprehensive database for fluid-mineral trace-element partitioning. Rick also taught me the art of distilling a problem to its essential components, allowing one to formulate "silver bullet" experiments, thus providing results with the highest impact.

Since 1996, I have been a faculty member in the Department of Geology at the University of Toronto. Given its very large size, the U of T can seem like a cold and faceless entity. Fortunately, I have been

warmly received by my colleagues in the department, and am particularly grateful to Tony Naldrett, Jeff Fawcett and Grant Henderson, who have been generous with both their insight on the workings of the university and in helping me to establish my lab. I also thank Steve Scott for nominating me, and for his very generous citation.

Graduate students are at the core of any successful research program, and I have been very fortunate to have been able to attract an excellent group of young and eager individuals, including Dave Andrews, Natalie Caciagli, Craig Finnigan, Lesley Rose and Parisa Sattari. Not only do those guys work really hard, but they have

an enthusiasm for their own research that makes my job really worthwhile.

Finally, I'd like to say that I would not be standing here today without the loving support of my wife, Josée. She has patiently endured all those times when I said "I'll be leaving the lab in 10 minutes", but not to return home for two hours. I'd also like to thank my daughter Catherine for helping me retain my perspective.

James M. Brenan
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