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FEATURE

LASER-ABLATION INDUCTIVELY COUPLED PLASMA-MASS SPECTROMETRY (LA-ICP-MS): A PERSONAL ODYSSEY¹

BY HENRY P. LONGERICH²

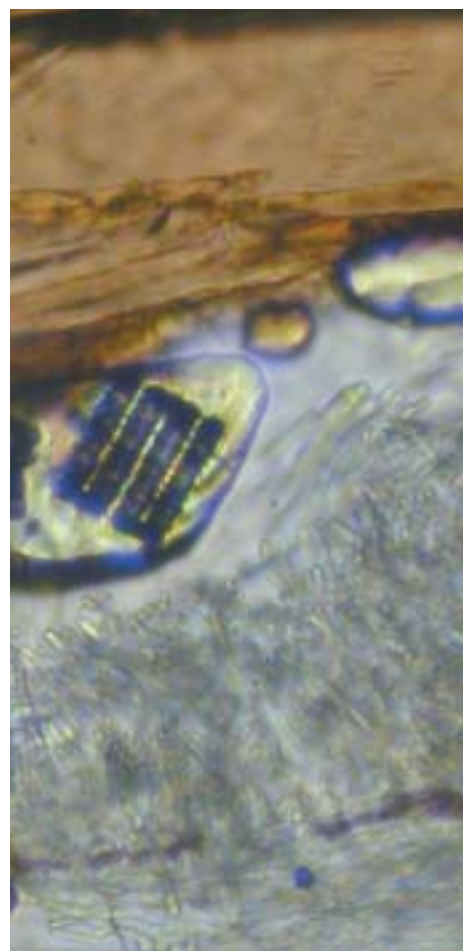
The word "Odyssey" originates from Homer's epic poem describing Odysseus' ten years of wandering after the Trojan War. It seems an appropriate term to describe our first

ten years of work in ICP-MS at Memorial University of Newfoundland (MUN), which started in 1984 with the installation of our first instrument (Longerich, 1995). Indeed, in the early years of ICP-MS development, the user community often felt very lost. Odyssey also seems a very appropriate term to describe the following early years of development of laser ablation (LA).

From Lasers to Laser Ablation

The LASER (Light Amplification by Stimulated Emission of Radiation) is the realization of the magic "ray gun of science fiction" (Günther *et al.*, 1999). Ever since the initial development of the laser in the early 1960's, investigations of its potential sampling capabilities have been carried out. An excellent review of the earlier literature of LA is contained in the book *Laser Microanalysis*, by Lieselotte Moenke-Blankenburg (1989). More recently, we published a review paper on LA-ICP-MS (Günther *et al.*, 1999), which contains 118 references dealing with a large number of applications, with a bias towards the Earth sciences.

Much of the earlier work in LA, along with some methods being developed today, relies on the laser's ability to volatilize material, and simultaneously produce ions and photons characteristic of the elemental and isotopic composition of the sample. For example, there is a renewed interest in Laser Induced Breakdown Spectroscopy (LIBS) in which the laser is used to sample and produce photons, whose wavelengths are diagnostic of the elements in the sample, and whose number is proportional to their concentration. Although high accuracy is difficult to obtain, the technique has an interesting potential to



Laser raster (40 x 40 micrometers) in a monazite crystal in a biotite-sillimanite gneiss. Photo courtesy Jan Košler.

analyze remote samples, for example, in nuclear waste and exploration applications.

1 Adapted from Longerich (1995) and Longerich (2001).

2 Department of Earth Sciences and Centre for Earth Resources Research, Memorial University of Newfoundland, St. John's, Newfoundland, A1B 3X5

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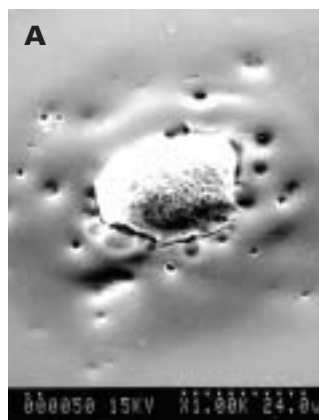
Royal Ontario Museum

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IMA

This Newsletter constitutes an insert to
The Canadian Mineralogist,
Volume 39, Part 5

SEM photographs from the early days of laser ablation when too much power and the wrong wavelength (1064nm) were used. Photographs and captions courtesy Simon Jackson.



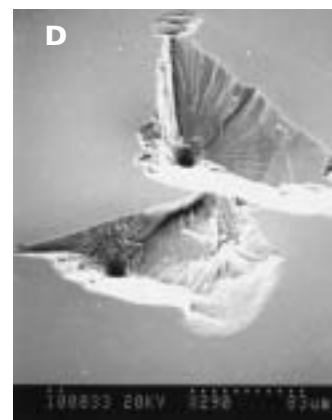
A was from the first set of ablations we ever tried on a glass slide. The interesting texture is probably the result of plasma-induced melting, given the very high pulse energies that we originally used, and improper focusing of the laser on the sample.



B was from the next set of ablations we ever tried – somewhat better ablation than A. Sample: glass slide.



C was from a set of analyses of Fe-rich garnet from the Preissac-Lacorne batholith (this is the same garnet we used in the Hawley award Can. Min paper). 1064 nm. On this day, many of the pits exhibited an extraordinary build up of ablated material around the pit, forming a “sinter cone”-like structure. I have never seen this phenomenon again.



D is a nice example of the problem of ablating non-absorbing minerals – in this case fluorite. The SEM shows cleavage-controlled spalling of fluorite around the pits.

More powerful techniques can be realized when the laser is used only as the sampling tool, and the ionization process is performed separately. This led to the development of laser-ablation ICP techniques. LA-ICP was used in a number of studies with Optical Emission Spectroscopy (OES) detection well before the appearance of ICP-MS instrumentation. While this work contributed greatly to the rapid development of LA-ICP-MS, the applications using OES detection were limited because ICP-OES is approximately 1000-fold less sensitive than first-generation ICP-MS instruments and 1 000 000-fold less sensitive than the most sensitive ICP-MS instruments available today. A LA-ICP-OES system had detection limits similar to those for electron probe X-Ray analysis. Thus, while development proceeded for many years, the tool was not widely adopted by the geo-analytical community.

ICP-MS in the Earth Sciences

ICP-MS applications are found in a wide variety of fields including the environmental (air, water, plant, and animal), semiconductor, and nuclear areas. However, ICP-MS, with both solution and LA sample introduction, has perhaps found its greatest field of application in the geological sciences. These were started by Alan Date, who was with the British Geological Survey and a colleague of Alan Gray, mentioned below. In the first year (1984) in which commercial ICP-MS instruments were installed, Sciex, a Canadian company, delivered 10 instruments. Six of these were installed in laboratories with an exclusive geological interest.

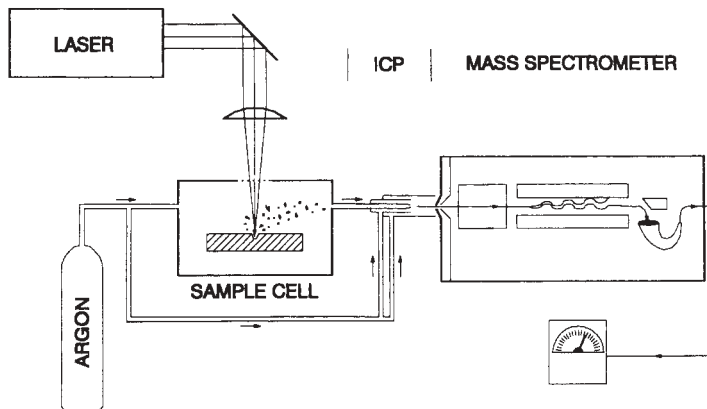
Laser-Ablation ICP-MS

In LA-ICP-MS, the laser produces a stream of sample particles, which are carried from the sample cell to the

ICP, where ions are created for analysis by the MS. In the ICP, most lithophile elements are nearly 100% ionized and the ions are “sucked” through the sampler cone into the vacuum of the mass spectrometer.

The development of LA-ICP-MS began soon after the introduction of ICP-MS in 1983 and the first commercial sales in 1984. Alan Gray

(1985), a pioneer in the development of ICP-MS, demonstrated the potential of the technique. He achieved detection limits as low as 10 ppb although, with pits as large as 1 mm in diameter, the technique could not be considered a micro-analytical tool. However, a large number of laser-ablation studies had demonstrated that laser sampling could be used to sample volumes of solid



Schematic diagram of the components of a laser-ablation sampling device connected to an ICP-MS. Reproduced with permission from *Can. Mineral.* 30, 1049-1064.

materials with spatial dimensions of less than 10 μm . Thus the potential existed to develop the technique for applications that required high spatial resolution sampling.

LA-ICP-MS at MUN

The development of Laser-Ablation (LA)-ICP-MS at MUN, or what we referred to as Laser-Ablation Microprobe (LAM)-ICP-MS (Jackson *et al.*, 1992), started in 1988, when the Natural Sciences and Engineering Research Council of Canada (NSERC) funded the purchase of the components required to fabricate a LA sample introduction system for our ICP-MS. These comprised a Nd:YAG laser and associated optics, including, most importantly, a petrographic microscope. We "fabricated" a LA system because, at that time, there was no commercial system that met our needs. The ICP-MS companies were developing LA systems, but did not appreciate the need of geologists to be able to sample on the scale of rock-forming minerals (often down to 10s μm) and to clearly see and identify their

samples using true petrographic microscope optics (transmitted and normal incident reflected illumination). The only source of illumination in these early commercial systems was fibre optics that delivered light obliquely to the sample, making mineral identification difficult or impossible.

A LA sample introduction system is very simple in concept. The first optical system we employed consisted simply of two mirrors, a prism and a single element lens, which steered the laser beam from the exit of the laser, down through the photo-tube of the microscope and focussed it through a window onto the sample contained in an in-house fabricated cell. Our cells also have a window at the bottom to allow sample observation using transmitted light. Interestingly, every cell that we have constructed, with volumes of from 1 cm^3 up to the size of a coffee cup, has produced useful data. The fraction of the ablated material that is transported from the cell through one to two metres of *ca* 6 mm outside diameter tubing in a flow of approximately 1 litre/minute

of argon or helium is surprisingly high.

After our initial studies with LA, we quickly realized the need to control, measure, and limit the laser power incident on the sample. Later, to achieve increased absorption of the beam by colourless minerals, we moved from the fundamental wavelength of the Nd:YAG (1064 nm) in the infrared and developed a system based on the frequency-quadrupled harmonic ($\lambda = 266 \text{ nm}$) in the ultraviolet (Jenner *et al.*, 1993; Fryer *et al.*, 1995). We also developed time resolved data acquisition protocols and data reduction software to handle the commonly complex transient signals typical of analysis of heterogeneous materials such as minerals. More recently, we developed a LA system based on the frequency-quintupled harmonic ($\lambda = 213 \text{ nm}$), which we demonstrated to have significant advantages (Jeffries *et al.*, 1998). Interestingly, our original 1989 laser is still in use in our laboratory although it has been modified and rebuilt several times. The long life of this laser is related to the Nd:YAG (Neodymium-doped

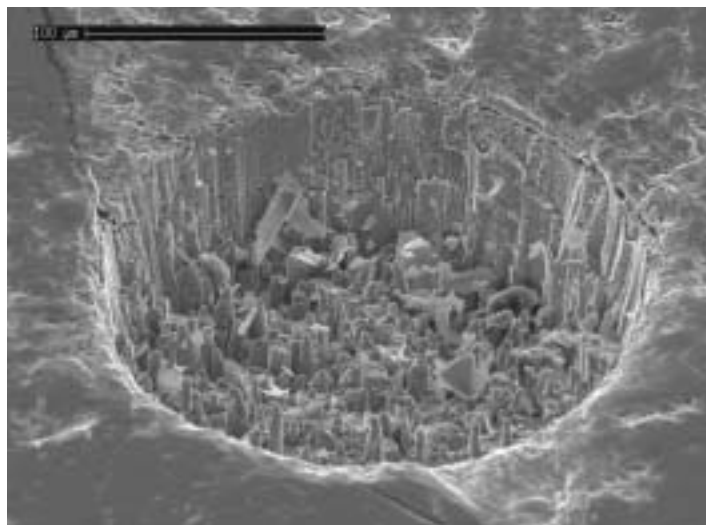
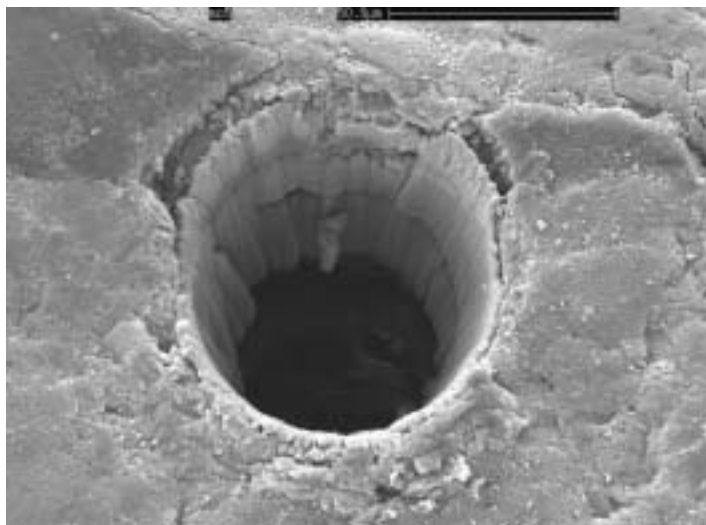
Yttrium Aluminum Garnet) lasing rod, garnet, fortunately, being a very stable phase.

In early 1994, we installed our second instrument, a Fisons/VG ICP-MS, that has a sensitivity almost 1000 times greater than the first-generation instruments. For the first time, this allowed geologically useful (low ppb) detection limits to be attained on geologically useful (40 μm) spot sizes. This new instrument truly opened up the field of applications of LA and led the way to the establishment of LA as an important tool in the toolbox of geo-analysis.

Figures of merit

How well can LA-ICP-MS analyse samples? It "just depends". It depends on how many elements (or isotopes) are to be determined and how large (or small) a volume of the sample can be ablated, which in turn is a function of grain size and sample heterogeneity. These questions are decided for each and every project and change as the characterization of the samples proceeds.

The most important analytical variable is the ablation



Laser-ablation pits drilled with a 193-nm ArF excimer laser in molybdenite: 70-micron (left) and 200-micron (right) pits. Photos courtesy P. J. Sylvester.

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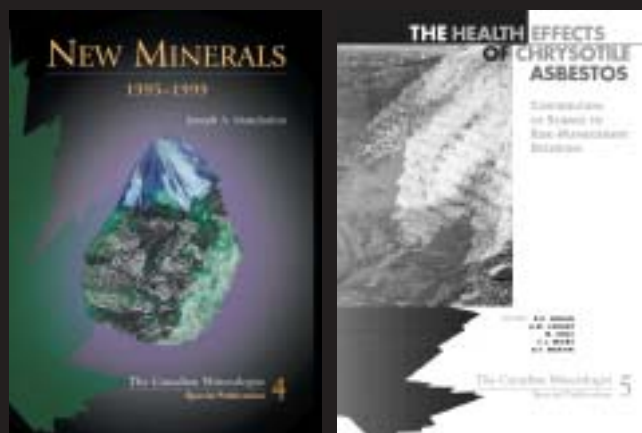
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spot size. There is a diffraction limit to the smallest crater that can be made, but pits with diameters of less than 5 μm are possible. However, the amount of sample that is removed from such a small pit yields detection limits that are three orders of magnitude larger than for pits that are 10 times wider (50 μm) (remembering the cubic relation between diameter and volume). When a sequential MS is used, detection limits depend upon the number of elements determined. Detection limits also differ considerably among elements and are dependent upon the ICP-MS instrument, newer instruments generally demonstrating higher sensitivity. With modern instrumentation, detection limits as low as 1 ppb are routinely possible for some elements (e. g., mid-mass mono-isotopic elements). Still lower detection limits are possible when a very limited set of elements is measured using large volume ablation pits.

Advances in LA-ICP-MS

Advances continue to be made in LA-ICP-MS instrumentation. Logically, the ICP-MS manufacturers have left the production of LA systems to more specialized companies that produce hardware systems usable on any ICP-MS instrument. After several years during which the 266 nm wavelength was considered to be the industry standard, there is currently a trend towards shorter wavelength LA systems based on the frequency quintupled Nd:YAG wavelength at 213 nm and ArF excimer at 193 nm.

The major requirement of an ICP-MS to be used for LA analysis of geological samples is high sensitivity (accompanied by low backgrounds) since this dictates

the spot size that must be used to attain required detection limits. Unfortunately, the numerous manufacturers of ICP-MS instrumentation have been slow to meet this need because solution sample introduction remains the major use of ICP-MS instruments. For routine whole-rock analysis of digested samples, our first generation instrument would still have sufficient sensitivity. For example, we routinely produced detection limits for mono-isotopic and nearly mono-isotopic REE's (La, Ce, Pr, Tb, Ho, Tm, and Lu) of less than 10 ppb (for the solid), which was adequate in greater than 90% of all cases.

While recent advances in quadrupole MS instruments have been limited, interesting developments have been made in alternative ICP-MS instrumentation. Time-of-flight (TOF) ICP-MS instruments, which allow simultaneous detection of the entire elemental mass range, have been developed. If ion transmission can be increased, these instruments could offer tremendous benefits for LA sampling where signals are complex and of limited duration. Several companies now offer a multi-collector-ICP-MS instrument that, by coupling high ion transmission with simultaneous detection of several isotopes using analogue detectors, allow very precise *in situ* determination of isotope ratios.

However, the biggest advances expected in the next five years are in the applications of LA-ICP-MS techniques. The special session *New Developments in LAM-ICP-MS Analytical Techniques* held at the GAC-MAC annual meeting in May 2001 consisted of an impres-

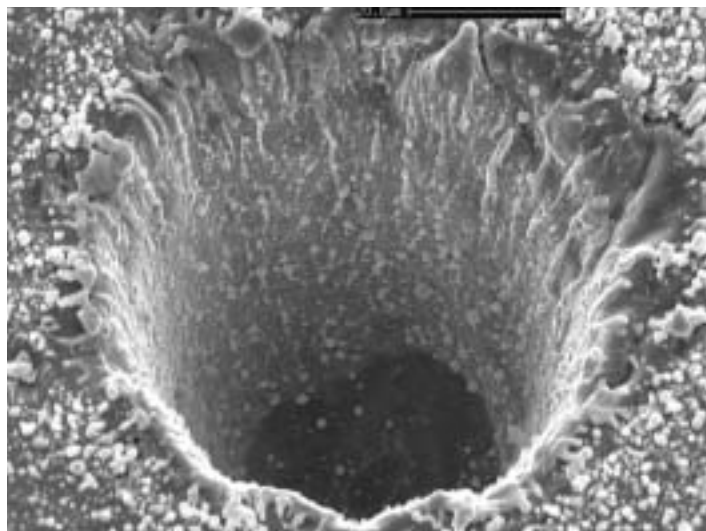


Photo courtesy Paul Sylvester

Laser-ablation pit (45 microns) made with a 266 nm Nd:YAG laser in pyrite.

sive total of 33 presentations, a notable increase over a similar special session held in St. John's at the GAC/MAC/CSPG annual meeting in 1988, when 11 presentations were made, of which 5 were from MUN staff. However, most notable is the change from 1988, when most of the papers were on fundamental or instrumental topics, to 2001, when 42% were applications, 36% concerned isotopic systems, and only 21% were fundamental and reference material studies. Thus, over time, there has been a most satisfying and widespread acceptance of the technique.

In addition to the special session, a short course "Laser-Ablation-ICPMS in the Earth Sciences" was given prior to the meeting. It consisted of 17 talks given by 9 speakers to more than 70 participants. The short-course notes are available from MAC as Short-Course Volume 29 (Sylvester, P. ed., 2001). This work will serve as an important reference textbook for years to come. Instructors included former MUN research-

ers, Simon Jackson (Macquarie University, Sydney), Detlef Günther (ETH, Zurich), and Geoff Vinott (DFO, St. John's); current MUN personnel, Paul Sylvester, Jan Košler, and the author; and LA proponents Paul Mason (University of Utrecht, Holland), Mark Norman (University of Tasmania, Australia), and Nuno Machado (GEO-TOP, Montreal).

Conclusion

LA-ICP-MS is now firmly established as a powerful tool among the various micro-analytical or micro-probe techniques available to the geological community. For the MUN group, receiving the Hawley Medal in 1993 at the annual MAC meeting for the best paper in *The Canadian Mineralogist* (Jackson *et al.*, 1992) was an important landmark. This paper highlighted the heterogeneity of trace elements in many minerals and the need for *in situ* micro-analytical techniques to determine the distribution of trace elements within mineral grains – important information that is lost in any "bulk"

analytical technique. The most satisfying aspect of this award was the recognition from the geological community that LA-ICP-MS was destined to be a very powerful tool.

LA-ICP-MS is not a panacea. Indeed, many would consider that the most important micro-analytical tool is still the electron microprobe (probe), which uses electron excitation and detection of the X-Ray emission. Despite its limited detection capability, the electron microprobe is not only an indispensable tool for the microanalysis of geological materials, it is also an important companion to LA-ICP-MS. This is because of the need in LA analysis to know in each unknown sample phase, the concentration of at least one element for use as a "naturally occurring internal standard" (Longerich *et al.*, 1996). This internal standard is used to correct for the various multiplicative effects on signal intensity, including, most importantly, the weight of sample ablated. While the concentration of the selected internal standard can often be calculated for minerals with fixed stoichiometry (*e.g.*, quartz, calcite, etc.), most minerals have a variable major element composition and must be pre-analyzed before LA analysis.

Another advantage of the combination of the probe with LA-ICP-MS is that ICP-MS performs much better with the heavier elements (Rb through U) than with the lighter major elements for which the probe is most suited. Thus the optimum procedure is to carry out major element analysis using the probe, followed by LA analysis.

Finally, there is a trend in research techniques from the



From left to right: Henry Longerich, Greg Dunning, Brian Fryer, Simon Jackson, authors of the paper that was awarded the Hawley medal in 1993.

"whole rock" to the micro-analysis of the components of the sample. Just as the electron microprobe made major element analyses of minerals routinely available, the widespread adoption of LA-ICP-MS has made trace-element analyses of minerals widely available to the geological community. If this development advances geological science as much as the electron microprobe, then we can expect major conceptual advances in the genesis of rocks and ore deposits in the not too distant future.

Acknowledgements

A very large number of persons have, over the years, contributed to the development of LA-ICP-MS at MUN. The ICP users group has been led (in chronological order) by David Strong, Brian Fryer, the author, Simon Jackson, and currently Paul Sylvester. Post-doctoral fellows Detlef Günther, Lance Forsythe, Ingo Horn, Teresa Jeffries, Caroline Petibon, and Jan Košler have all worked on LA development. Mike Tubrett, current facility manager, has not only contributed to the development, but has instructed many visitors in

the practice of the science. Many students have used and contributed to the facility. Since the early days of ICP-MS, samples from users around the world were analyzed. These users contributed not only their money, but, in so many ways, added to the richness of the environment.

Of the personnel mentioned, most are still involved in LA work. Without the willingness of our researchers to try the unknown, we would not have made progress, nor ever started in LA research. The financial contributions of NSERC made this work possible. The machine and electronics staff of the Department of Technical Services at MUN contributed to the maintenance of the facilities and, more importantly, to the fabrication of the special components that made new developments possible. Thanks to Simon Jackson for a careful read and edit of this text.

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FROM THE NEWSLETTER EDITOR

Where were you and what were you doing on September 11 at 8:45 am. I guess each of us will always remember every detail about that fateful morning when our world changed. I was in a bus en route for Montreal. Dr Nolan, who was the organizer of the 1997 workshop on asbestos we published the proceedings of, was coming from New York and had planned a small supper to celebrate the end of this project and I had been invited. I only learned what had happened when I phoned my daughter from the bus station. Needless to say, the supper was more subdued than planned.

On Tools

I knew something was wrong as soon as I turned on the computer: 78 new messages since the previous evening! My computer had been infected by the virus W32.Sircam.Worm. A visit to the Symantec web site (www.symantec.com) gave me plenty of chilling information on this worm type of virus and on all other virus in existence. So I have had my lesson: regularly updating my antivirus protection and running Norton Antivirus check is now a routine. What about you? My son the computer guru says that you should never open an attached file unless you know personally the person who sends it and even more, that you are expecting it. As this worm spread by sending messages to addresses from my address book at random, my apologies to any member who might have received tainted messages.

A most useful book

One of the books that I always keep close at hand and consult regularly is the *Direct*

tory of Geoscience Departments, published by the American Geological Institute. No more time wasted searching for e-mail addresses of researchers, addresses of departments, phone or fax numbers. It is all there at my fingertips and I have found it surprisingly accurate so far. Well worth its price! You can order it on the web site of the AGI at www.agiweb.org

More newsletters

Starting in 2002, MAC will publish three Newsletter a year so that news will appear in a more timely fashion. I am always looking for contributions to the Newsletter. In the feature articles, we seek to inform you on ground-breaking research areas or provide food for thought. If you have an idea for an article, please get in touch with me at mac.amc1@sympatico.ca

In case you were wondering

One of the most inexpensive means of advertizing our products is to exchange ads with other organizations. This is an area we are trying to develop in order to give greater exposure to our publications. Of course, we have regularly exchanged ads with the Mineralogical Society of America, such as the one on page 16. In this issue, we are also publishing an ad about *Geochemical Transactions* published by the Royal Society of Chemistry. In exchange, they will publish an advertisement on our latest short-course volume in the *Journal of Atomic Absorption Spectroscopy*.

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ASSOCIATION NEWS

COUNCIL MEETING HIGHLIGHTS

The MAC Annual Council Meeting was held in St. John's, Newfoundland, on May 26 and 27, prior to the GAC-MAC conference. The two-day format allowed for in-depth discussions of many issues facing the Association in the years to come. Our outgoing secretary, Gina LeCheminant, was on hand along with incoming secretary Andy McDonald. Andy is a professor of mineralogy at Laurentian University and we feel privileged to have him join the Executive. We also welcomed Ron Frost, incoming councilor. Disappointingly, several councilors had other commitments and could not attend the meeting. We would like to take this opportunity to thank our outgoing councilors – Yuanming Pan, Jonathan Fowler and Dante Canil – for their contribution to the Association during the past three years. We are sure they will continue being spokespersons for the Association in their respective milieu.

The first day of the Council meeting was dedicated to the presentation of various reports, and the second day, to an in-depth discussion centred on a report entitled *Mapping a future for MAC*, contracted out to Pierrette Tremblay. All motions with financial implications were tabled for resolution at the end of the two-day discussions. The report provided the basis for a review of all aspects of our operations. The first chapter of the report appropriately presented the wider context in which we operate and discussed the future of the Earth sciences and mineralogy. Then followed a historical overview of our Association. Critical issues facing us as regards to publications, mem-

bership, organization, and publicity were discussed in turn. These discussions all pointed to the need for someone to promote and develop the profile of the Association on an ongoing basis.

Finances

Mati Raudsepp, our treasurer, presented the financial picture of the Association at the end of 2000. There was an end of year surplus of \$62 198. See Financial Statements on pages 10 and 11.

Our auditor, Johanne Dorman, visited the business office in Ottawa prior to the annual meeting. She presented a report to the Executive with suggestions for improvements to the way MAC operates administratively and financially. At her urging, we will be dropping the artificial split in income between MAC and *The Canadian Mineralogist* in our financial reporting.

Producing *The Canadian Mineralogist* is our largest expense but also brings in the most income. Subscriptions to libraries represent the bulk of that income. Therefore, a subscription drive targeting institutions is planned for next year. It is essential that you, our members, encourage your institution to subscribe. Without the income generated from institutional subscriptions, we simply could not continue to produce our journal.

2002 Membership and Subscription Fees

Finance Chair, Iain Samson, presented various tables and scenarios for discussion. One of the hardest things to estimate is how electronic access to *The Canadian Mineralogist* will affect the subscription pattern. Once institutions provide electronic access to their employees, will our current individual members employed

ST. JOHN'S 2001

BY FRANK BLACKWOOD

St. John's 2001, the 46th Joint Annual Meeting of the Geological Association of Canada (GAC) and the Mineralogical Association of Canada (MAC), took place at Memorial University on May 27-30. The national meeting, the third to be held in St. John's since 1974, also included the second North Atlantic Minerals Symposium (NAMS).

By all accounts, the meeting was a great success. Some 1050 registrants participated in four symposia, nineteen special sessions, and eight general sessions. These covered a variety of topics including, to name a few, offshore petroleum resources, mineral deposits, global change, water, mineral policy, evolution of life, crustal evolution, glacial geology, and data-integration techniques. Two short courses, two workshops, and thirteen field trips were also part of the conference.

St. John's 2001 had nearly 40 exhibitors and was supported by some 38 corporate sponsors. Five of these sponsors gave exceptional support as major patrons of the meeting: 1) Newfoundland and Labrador Department of Mines and Energy, 2) Government of Ireland, 3) Memorial University of Newfoundland, 4) Atlantic Canada Opportunities Agency, and 5) the Geological Survey of Canada. The Organizing Committee relied on the generous support of professionals and agencies of the St. John's geoscience community, particularly MUN Earth Sciences and the Geological Survey of Newfoundland and Labrador.

From MAC's point of view

The MAC booth was quite busy, especially at the end of the day, when everyone gathered in the exhibit hall for the poster sessions. Selling older short course volumes at \$5 attracted a lot of students to our booth and several joined MAC.

The short course on Laser-Ablation-ICPMS was very successful. There were 72 registrants, including about 20 students, plus the speakers. We owe a big thank you to Paul Sylvester for his hard work at organizing and publicizing such a successful short course. The short-course volume was a big success as well. We sold the 60 copies we had brought with us. The two-day Longerich symposium that followed was well attended and the proceedings of it will be published in our Journal.

Many thanks to the Local Organizing Committee, led by Frank Blackwood and Toby Rivers, for going the extra mile to make this meeting a success.

by these institutions drop their membership? And what services do we have to provide in order to convince people to become or stay members?

Council decided to keep all categories of ordinary membership at current costs. There was considerable debate

about dropping the retired membership category. At \$30 a year, student and retired memberships are heavily subsidized and, while everyone agreed that student memberships should be encouraged and subsidized, there was disagreement over the retired

ASSOCIATION NEWS

member category. One suggestion was to provide only electronic access to the Journal for retired members. We would appreciate the comments of our retired members on this issue, which will resurface when we discuss 2003 memberships at the next Council meeting.

Institutional subscriptions will be increased to \$390 a year. This will include the printed version of the Journal as well as site-license electronic access. We think this is a really good deal and that it reflects the reality that libraries have no additional money to provide electronic subscriptions at inflated cost.

IMA 2002

MAC Council voted \$5000 in support of the organizing committee of the next IMA meeting to be held in Edinburgh, September 1-6, 2002. An additional amount has also been put aside to offer five \$600 scholarships to help student members of MAC to present their research in Edinburgh. Such scholarships often offer good leverage to raise more funds (see p. 15).

Ann Sabina Award

The Mineralogical Association of Canada, in cooperation with the Central Canadian Federation of Mineralogical Societies, presents this annual award since 1985. It honors Ann Sabina's 25 years of outstanding service as Treasurer of the Association. The award is a \$100 prize presented to the winners of the best self-assembled collection at the annual show competition, as determined by the Central Canadian Confederation of Mineralogical Societies. The 2000 winners were Dick Stata (advanced) from Scarborough, and Nicholas Gere (beginner) from Brampton.

EDITORIAL

ON ANNUAL MEETINGS

NORM M. HALDEN, VICE-PRESIDENT

Annual meetings are important events in the life of an association. They are like birthdays and they really should mean something. It appears that, over time, MAC members have been opting to attend meetings other than the annual GAC-MAC meeting. This is telling us something about the content and structure of GAC-MAC meetings and the nature of our membership.

What's a meeting good for? A meeting for MAC should be an opportunity to discuss and disseminate Mineralogical Sciences. It should provide an environment for social interchange about our science and opportunities for students to "cut their teeth" in the professional arena. A meeting might also provide an opportunity to hold short courses and go on field trips to see unusual or historic mineral occurrences. From an Association perspective, a meeting provides an opportunity for the officers to meet face-to-face to discuss and organize the business of the Association. Constitutionally we must have an "Annual General Meeting" to deal with legal and accounting issues, and so annual general business meetings are usually organized in such a way as to coincide with scientific meetings in an effort to ensure a quorum.

Consideration of our meetings has to be done in the framework of our membership and our science. Some of the issues that I think we need to take into consideration are:

- MAC has a very dispersed worldwide membership, which is however concentrated in North America;

- Our ordinary membership has declined in numbers and members have aged somewhat;
- Our science has retained a central mineralogical theme;
- Our science spans and impacts on all aspects of Earth Sciences and many aspects of Materials Science.

From a business and organizational perspective:

- MAC now conducts a considerable amount of its discussions and business using e-mail and the WWW;
- MAC has an executive coordinator and a business office that function effectively;
- MAC executive and MAC council meet twice and once a year respectively;
- MAC does not depend on annual meetings for income.

What this really distills down to is first, from a business perspective, Council needs to meet once and that really can be anywhere; second, the annual meeting has to focus on science, particularly the science being done by our membership.

Discussion of the science amongst individuals and small groups is usually animated and vigorous. The various themes that come to the fore include "minerals and materials", "minerals and the environment", "reactions at mineral surfaces", "the mineral-biosphere interface", and "toxic waste disposal". Add to this the mineralogy, crystallography, petrology, mineral deposit and geochemistry themes from our journal and it is clear there is no shortage of ideas. It seems to be that the forum and a critical mass of mineralogically-oriented scientists have become important to us.

Our options for a scientific meeting include "going it alone"; here I suggest our numbers would be small and specialized meetings might result. While there may well be a place for such specialized meetings, which we should investigate, my sense is that we want a larger, mineralogically-oriented meeting. We could continue with the current GAC-MAC format. As GAC points out, this is run by an LOC; if mineralogy is not central to the work being done in a particular region, then it tends to play a minor role in the meeting. We might opt for more centralized, MAC-organized content for such a GAC-MAC meeting, but that would conflict with how GAC-MAC meetings are currently organized. A third alternative might be to hold meetings with other Associations. Those of you who have read GEOLOG or who are members of MSA will note that we are not alone in these considerations.

Informal discussions with MSA have indicated that there is a window to test this third option in 2005 as we could jointly organize the Goldschmidt meeting in 2005 with the Mineralogical Society of America and the Geochemical Society. The venue for this meeting is still undetermined. However, a resort in Washington State has been suggested.

While we can all come up with reasons why our annual meetings appear to be declining in popularity, it is important to our science and to the Association to re-invigorate the annual meetings. As Council will be making decisions on this issue in the next year, feedback from our members on this topic is important. I look forward to hearing from many of you: nm_halden@umanitoba.ca

ASSOCIATION NEWS

FINANCIAL STATEMENTS

As our by-laws require, this Newsletter includes our financial statements for 2000. Please take the time to look at them.

Auditor's report

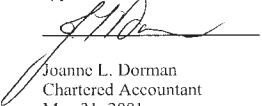
To **The Members**
The Mineralogical Association of Canada

I have audited the balance sheet of the General Fund and the net assets of the Treasury Reserve Fund of **The Mineralogical Association of Canada** as at December 31, 2000 and the statements of receipts and disbursements members surplus and changes in cash for the year then ended. These financial statements are the responsibility of the society's management. My responsibility is to express an opinion on these financial statements based on my audit.

Except as explained in the following paragraph I have conducted my audit in accordance with generally accepted auditing standards. Those standards require that I plan and perform an audit to obtain reasonable assurance whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In common with many charitable organizations, the organization derives revenue from donations, the completeness of which are not susceptible to satisfactory audit verification. Accordingly, my verification of these revenues was limited to the amounts recorded in the records of the organization and I was not able to determine whether any adjustment might be necessary to donation revenues, excess of expenses over revenue, assets and surplus.

In my opinion, except for the effect of adjustment, if any, which I might have determined to be necessary had I been able to satisfy myself concerning the completeness of the donations referred to in the preceding paragraph, these financial statements present fairly, in all material respects, the financial position of the society as at December 31, 2000 and the results of its operations and the changes in its financial position for the year then ended in accordance with generally accepted accounting principles, as disclosed in Note 2 to the financial statements applied on a basis consistent with that of the preceding year.


Joanne L. Dorman
Chartered Accountant
May 31, 2001

Vancouver, BC

Statement of Receipts and Disbursements and Surplus Treasury Reserve Fund For the year ended December 31, 2000 (with comparative figures as at December 31, 1999)

	2000	1999
Revenue		
Schedule A - The Canadian Mineralogist	52,883	38,914
Interest income	28,444	21,691
	81,327	60,605
Expenditures		
Endowment - Mineralogical Foundation	77,596	175,000
	77,596	175,000
Net income for the year	3,731	(114,395)
Net assets, beginning of year	514,018	628,413
Net assets, end of year	\$ 517,749	\$ 514,018

The Mineralogical Association of Canada Balance Sheet As at December 31, 2000 (with comparative figures as at December 31, 1999)

	2000	1999
Assets		
Current		
Bank (Note 4)	\$ 269,662	\$ 305,857
Short-term investments (Note 5)	103,000	90,919
Accounts receivable	30,216	23,246
Accrued interest receivable	4,890	4,890
Prepaid expenses	10,075	21,810
	417,843	446,722
Marketable securities (Note 5)	438,305	279,507
	\$ 856,148	\$ 726,229
Liabilities & Members' Equity		
Current		
Accounts payable and accrued liabilities	\$ 55,096	\$ 48,686
Due to the MAC Foundation	69,742	-
Deferred revenue (Note 3)	151,363	140,187
	276,201	188,873
Surplus		
General fund	62,198	23,338
Treasury reserve fund	517,749	514,018
	\$ 856,148	\$ 726,229

The Mineralogical Association of Canada Statement of Cash Flows For the year ended December 31, 2000 (with comparative figures as at December 31, 1999)

	2000	1999
Cash flows from operating activities:		
Excess revenue over expenditures		
General fund	\$ 38,860	\$ 114,796
Excess revenue over expenditures		
Treasury fund	3,731	(114,395)
	42,591	401
Changes in non-cash working capital		
Marketable securities	(12,081)	(64,363)
Short-term investments	12,081	64,363
Accounts receivable	(6,970)	36,052
Accrued interest receivable	-	21
Prepaid expenses	11,736	9,832
Accounts payable and accrued liabilities	6,409	4,004
Due to MAC Foundation	69,742	-
Deferred revenue	11,176	86
	134,684	50,396
Cash flows from financing activities:		
(Purchase) Disposal of marketable securities	(170,879)	8,550
(Decrease) increase in cash	(36,195)	58,946
Cash at beginning of year	305,857	246,911
Cash at end of year	\$ 269,662	\$ 305,857

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The Mineralogical Association of Canada
Statement of Receipts and Disbursements and Surplus
General Fund
For the year ended December 31, 2000
(with comparative figures as at December 31, 1999)

	2000	1999
Revenue		
Annual meeting	\$ 15,000	\$ 12,003
Donations	195	220
Special publications 1	3,061	9,233
Special publications 2	5,485	15,642
Special publications 3	21,519	33,926
Membership fees	56,204	58,790
Other	851	75,830
Posters	616	2,052
Short course notes	21,501	32,459
	124,432	240,155
Expenditures		
Annual dues	2,475	1,676
Bank charges	3,340	4,847
Grants & awards	450	300
Loss on disposal of investments	-	2,833
Loss (gain) on exchange	3,434	(1,232)
Marketing Director's fees	3,520	-
Meetings	12,351	6,494
Office expenses	21,587	29,451
Postage & shipping	10,655	15,624
Promotion	7,103	25,594
Professional fees	4,865	6,310
Special publications	536	28,284
Short course notes	12,902	-
Travel	2,354	5,178
	85,572	125,359
Net income for the year	38,860	114,796
Surplus (deficit), beginning of year	23,338	(91,458)
Surplus, end of year	\$ 62,198	\$ 23,338

The Mineralogical Association of Canada
Notes to the Financial Statements
As at December 31, 2000

1. Purpose of the Organization

The Association was incorporated on August 5, 1955, by Letters Patent under the Canadian Corporations Act for the purposes of advancing knowledge in crystallography, geochemistry, mineralogy, petrology, mineral deposits and allied sciences. The Association is incorporated without share capital. The Association is a registered charity under the Income Tax Act.

2. Summary of Significant Accounting Policies

The accounting policies of the society are in accordance with generally accepted accounting principles. Outlined below are the policies considered particularly significant.

Foreign Currency Translation

The Association follows the Temporal method of translation whereby:

- i) balance sheet items are translated at the rate of exchange in effect at the balance sheet date;
- ii) revenue and expense items are translated at the rate of exchange in effect on the dates they occur.

Any gains or losses are charged directly to income.

Marketable Securities

Marketable securities are valued at cost, unless circumstances have indicated an impairment in value which necessitates a write-down to net realizable value.

Capital Assets

Capital assets are expensed on acquisition. Capital assets totaling \$ 4,497 were purchased during the year.

Revenue Recognition

The Association uses the accrual basis of accounting, matching revenue with expenditures. Membership fees are allocated 20% to the General Fund and 80% to the Treasury Reserve Fund.

3. Deferred Revenue

	2000	1999
Prepaid membership dues	\$ 151,363	\$ 140,187
	\$ 151,363	\$ 140,187

4. Bank

	2000	1999
Deposit on hand	\$ 60,993	\$ -
Operating account - Canadian dollar	28,264	120,536
Operating account - US dollar	96,389	112,179
Visa account	9,281	22,831
Mastercard account	8,495	41,636
RBC Dominion - cash account	66,240	8,675
	\$ 269,662	\$ 305,857

5. Marketable Securities

	2000	1999
Marketable securities	\$ 438,305	\$ 279,507
Short-term investments	103,000	90,919
Total marketable securities - cost	\$ 541,305	\$ 370,426
Total marketable securities - market	\$ 550,292	\$ 367,829

6. Inventories

The Association's inventories consist of short course notes, back issues and special publications which are available for future sale. Due to the nature of the inventories, the costs are expensed as incurred when preparing short courses and publications and revenue is recognized when realized. The cost of inventories on hand is estimated by management to be \$ 784,057.

The Mineralogical Association of Canada
Schedule A - The Canadian Mineralogist
Statement of Receipts and Disbursements
For the Year Ended December 31, 2000

	2000	1999
Revenue		
Back issue and miscellaneous issue sales	\$ 7,635	\$ 9,331
Donations	769	1,463
Membership fees	230,742	222,761
Reprints	19,774	20,257
	258,920	253,812
Expenses		
Editorial assistance	32,490	44,255
Grants & awards	13,000	-
Office expenses	19,273	24,646
Postage & shipping	23,208	29,308
Publication	118,066	116,689
	206,037	214,898
Net revenue over expenses for the year	\$ 52,883	\$ 38,914

ASSOCIATION NEWS

2001 AWARDS

One of the highlights of the meeting was the MAC luncheon, when this year's awards were presented. We publish here the citations for the various awards. Citations and responses will be published in the December issue of *The Canadian Mineralogist*.

James S. Scoates receives Young Scientist Award

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 S. Scoates for the 2001 Young Scientist Award. Although he completed his Ph.D. a few short years ago in 1994, he has established an international reputation in the petrology of mafic igneous intrusions and the origin of the ore bodies they host.

Dr. Scoates earned his B.Sc. at Queen's University in 1987 and completed an honours degree supervised by a past president of the Association, Dr. Peter Roeder. He subsequently attended the State University of New York at Stony Brook before earning his Ph.D. at the University of Wyoming under the supervision of Dr. Ronald Frost and Dr. Don Lindsley. Dr. Scoates also worked



James Scoates receiving Young Scientist Award from MAC President, Brian Fryer



Michele Huminicki and Jeff Keith receiving the Hawley Medal. Adrienne Larocque and Jim Stimac sent a response but could not be present.

as a field geologist with the Geological Survey of Canada from 1984 to 1992.

Dr. Scoates is the author or co-author of some 16 papers and 50 abstracts. These papers display an amazing range of expertise: microthermometry, isotope and trace element geochemistry, emplacement of flood basalts, geology and petrology of anorthosites and gabbros, origin of iron-titanium oxide, base metal and hydrothermal ore deposits.

Dr. Scoates has accepted a position at the University of British Columbia after teaching at the Université Libre de Bruxelles in Belgium.

Hawley Medal awarded to Larocque, Stimac, Keith & Huminicki

The Hawley Medal is awarded for the best paper to appear in *The Canadian Mineralogist* in 2000. The selection this year was, as usual, difficult because of the large number of excellent papers. The Hawley committee, formed of Penny King, Maya Kopylova, and Tony Peterson, had a difficult time selecting among approximately eight papers. After several e-mail discussions, they reached the consensus that the best paper this year was:

LAROCQUE, A.C.L., STIMAC, J.A., KEITH, J.D., HUMINICKI, M.A.E. (2000): Evidence for open-system behavior in immiscible Fe-S-O liquids in silicate

magmas: Implications for contributions of metals and sulfur to ore-forming fluids. *Can. Mineral.*, **38**, 1233-1249.

The paper is based on extensive study of sulfide inclusions in a variety of volcanic rocks from several localities. The rock types ranged from rhyolites to basalts and the localities included active, dormant, and extinct volcanoes as well as rocks from porphyry copper districts. Samples were examined with an SEM and phases in the rocks were analyzed with the electron microprobe. Concentrations of Au in sulfide and Fe-oxide were determined with an ion microprobe.

The paper was extremely well illustrated, meticulously organized, and clearly written. The authors based their interpretations on close observation of textures and on thermodynamic theory. This led to a clear exposition of the criteria that can be used to determine the origin of sulfides in volcanic rocks. The paper also has implications for ore formation and exploration.

Kurt Kyser receives Past Presidents' Medal

The Mineralogical Association of Canada awards the Past Presidents' Medal to scientists who have made significant contributions to the mineralogical sciences during their career. Kurt Kyser, the medallist for 2001, really needs no introduction, as he is known to



Jim Nicholls presenting the Past Presidents' Medal to Kurt Kyser

nearly all of you, either personally as a collaborator in research or by reputation for his research.

The basic theme of Professor Kyser's work is fluid-rock interaction. Within this general framework, in the words of his nominator, the breadth of his interest is staggering. Professor Kyser began his career by examining stable isotope distributions in mantle xenoliths. More recently, his interests have expanded to sedimentary basins and the processes that occur in these complex structures that contain water supplies, oil and gas reser-

voirs, potash and uranium deposits. In between, he has contributed to the development of microanalytical geochemical techniques and the study of hydrogen isotope exchange at low temperatures between fluids and minerals.

Dr. Kyser recognized that fluids passing through sediments deposit iron minerals that provide a magnetic signature to diagenetic processes. Combined with geochemistry, these studies provide additional information on the role of fluids in sedimentary basins and the timing of the processes.

Dr. Kurt Kyser is an excellent example of an outstanding scientist: intelligent, driven by curiosity, and a perfectionist with a wide range of interests.

Berry Medal to Robert F. Martin

The Mineralogical Association of Canada, the Special Publications and *The Canadian Mineralogist* don't just happen. They represent the efforts of people toiling in the engine room of the mineralogical sciences. The Berry Medal is awarded for outstanding service to the Mineralogical Association of Canada. This year's winner of the Leonard G. Berry Medal for distinguished service to the Association is Robert F. Martin, the quintessential *Canadian Mineralogist*.

Bob Martin has served MAC for many years in his capacity as Editor of *The Canadian Mineralogist*; he is also the longest serving member of MAC council. Bob commenced his editorship in the late 70's as a co-editor and became sole editor in 1983. He has since that time raised the standard and profile of the *Canadian Mineralogist* to that of a major

international journal. The journal is the best of the association journals and of far superior quality to many periodicals published by multinational publishing houses. The rise of *The Canadian Mineralogist* to its present status as the preeminent mineralogical journal is a direct result of Bob's attention to detail and style as well as the unusual degree of attention he gives to every manuscript. No other editor reads, understands and annotates every paper submitted; Bob's comments are always knowledgeable, constructive and helpful. This task takes an enormous amount of time.

Not content with editing *The Canadian Mineralogist*, Bob has shown tremendous initiative in instituting a series of Special Publications. These too have required enormous amounts of work in ensuring that they meet his high standards. In addition, and to his credit, Bob has also managed to maintain an active and significant research program.

MAC has benefited immeasurably from Bob's work; he is without doubt one of the most deserving candidates ever for the Berry Medal.



Bob Martin receiving the Berry Medal from Vice-President Norm Halden



Bob with Vicki Loschiavo, his wife and managing editor of Can. Min.

CALL FOR NOMINATIONS

The Mineralogical Association of Canada honors outstanding scientists each year with its Past Presidents' Medal and its Young Scientist Award. Selecting medallists requires the help of members of the Association in the form of nominations. Assembling the documentation to support the nomination takes some effort and energy from the nominator but the reward of seeing outstanding scientists recognized more than repays the effort.

I ask you, the members of the Association, to please give some thought to nominating scientists you think are deserving of these awards. The criteria for the medals are listed below. I look forward to receiving your nominations.

J. Nicholls

THE YOUNG SCIENTIST AWARD

This award is given to a young scientist who has made a significant international research contribution in a promising start to a scientific career. The areas of research considered are any or all of those covered by the Mineralogical Association of Canada.

- The scientist will be 40 years or younger at the time of the award.
- The scientist must be a Canadian working anywhere in the world or a scientist of any nationality working in Canada.
- The research areas include mineralogy, crystallography, petrology, geochemistry, mineral deposits, and related fields of study.
- The candidate must be nominated by a member of MAC.
- The letter of nomination must be accompanied by a statement giving the accomplishments of the candidate, the candidate's curriculum vitae, and a list of publications.
- Candidates may also be identified by members of the selection committee.
- The selection committee will be made up of the Past President and three other MAC members selected by the Past President.
- The selection of the winning scientist normally will be made in January or February in order that the award be presented at the Annual Meeting of the Association.
- The award need not be presented in any given year if a suitable candidate cannot be found.
- Previous winners of the award are Peter C. Burns (1998), Lee A. Groat (1999), Greg Dipple (2000) and James S. Scoates (2001).

Nominations should be sent to Dr. Jim Nicholls, Department of Geology & Geophysics, University of Calgary, 2500 University Drive NW, Calgary, Alberta T2N 1N4, by December 31, 2001.

PAST PRESIDENTS' MEDAL

The Past Presidents' Medal is awarded to a scientist who has made outstanding contributions to the mineralogical sciences in Canada. There is no restriction regarding nationality or residency. The medal is intended to recognize the breadth and universality of these contributions in mineralogy, applied mineralogy, petrology, crystallography, geochemistry or the study of mineral deposits rather than in a narrow area of expertise. A committee of three Past Presidents, chaired by the immediate Past President, considers all nominations received. Nominations should be accompanied by a one-page explanation of the merits of the nominee and forwarded to Dr. Jim Nicholls, Department of Geology & Geophysics, University of Calgary, 2500 University Drive NW, Calgary, Alberta T2N 1N4, by December 31, 2001.

Previous recipients of the medal are:

Len Berry (1982), Gabrielle Donnay (1983), Petr Černý (1984), Denis Shaw (1985), Don Sangster (1986), Peter Roeder (1987), Steve Scott (1988), Rob Kerrich (1989), Lincoln Hollister (1990), Tony Naldrett (1991), Robert Boyle (1992), Louis Cabri (1993), Roger Mitchell (1994), Hugh Greenwood (1995), Thomas E. Krogh (1996), Mike E. Fleet (1997), Fred J. Longstaffe (1998), Frank C. Hawthorne (1999), Greg Anderson (2000) and Kurt Kyser (2001).

BERRY MEDAL

The Leonard G. Berry Medal is awarded annually for distinguished service to the Association. The award recognizes service in one or more areas that may include leadership or long-term service in an elected or appointed office. The medal is named after Leonard G. Berry (1914-1982), a founding member of the MAC, editor of *The Canadian Mineralogist* and its predecessor for 25 years and first winner of the MAC Past Presidents' medal. The medallist is chosen by a committee, consisting of the two immediate past recipients of the medal and one member-at-large, chaired by the Vice-President (ex officio). Nominations are encouraged from the membership at large and should be sent to Dr. Norm M. Halden, Dept. of Geological Sciences, University of Manitoba, Winnipeg, Manitoba, R3T 2N2, by December 31, 2001.

Previous recipients of this medal are :

Les Nuffield (1988), Guy Perrault (1989), Joe Mandarino (1990), Dick Alcock (1991), John Jambor (1992), Louis Cabri (1993), Ann Sabina (1994), Bob Gait (1995), Sol Kaiman (1996), J.M. Duke (1997), Dorian G.W. Smith (1998), Norman M. Halden (1999) and Robert F. Martin (2001).

THE STUDENTS' PAGE

ANDREW J. LOCOCK, RECIPIENT OF MAC FOUNDATION SCHOLARSHIP FOR 2001

Andrew J. Locock, a Ph.D. student at University of Notre Dame, under the supervision of Peter Burns, is this year's recipient of the \$10 000 MAC Foundation scholarship. We asked him to introduce himself.

I am a native of Edmonton, and obtained my B.Sc. with Honours in Geology from the University of Alberta. During the summers of my undergraduate studies, I worked in British Columbia, Saskatchewan and the Northwest Territories for gold exploration companies. I continued my studies at the University of Alberta and obtained a M.Sc. in Geology under the direction of Dr. D.G.W. Smith, Dr. H. Baadsgaard and Dr. R. St. J. Lambert. During this time, I worked as a part-time assistant to the Curator of Geology at the Provincial Museum of Alberta, Mr. R. Mussieux, and helped in the design and creation of the current Mineralogy and Geology galleries and the preceding Treasures exhibit. After completing my studies, I worked in South America as a diamond-exploration mineralogist and subsequently in Nunavut and the Northwest Territories on advanced gold and diamond projects, respectively.

In 2000, I began my Ph.D. at the University of Notre Dame under the guidance of Dr. P.C. Burns. My research project is a multi-faceted investigation into the crystal structures and crystal chemistry of selected actinide-bearing minerals and analogous synthetic compounds. The study of uranium crystal chemistry has taken on renewed importance with the proposal for geologic disposal of spent nuclear fuel, which consists mainly of uranium dioxide. Under the long-term storage (damp, oxidizing) conditions of the proposed repository at Yucca Mountain, spent fuel will corrode and produce many corrosion products that are identical with known uranyl minerals. Of particular concern is the behavior of the long-lived fission products and trans-uranium actinides during and after oxidation.

My objectives in this research project are:

- to investigate the crystal chemistry of relatively insoluble uranyl minerals, which may control the concentration of uranium in groundwaters and repository fluids,
- to examine the incorporation of radionuclides into minerals suspected to form on nuclear waste in a geologic repository, and



Photo Dr. Marco Fulle

Dr. R.H. Mitchell's article on Oldoinyo Lengai in the December 2000 issue of the Newsletter inspired me to participate in a 2001 expedition to this volcano. Although unconnected to my current research, this was a "chance-of-a-lifetime" trip, and the volcano rewarded us with an exceptional amount of eruptive activity. In this photograph, I am standing beside, perhaps even too close to, an active natrocarbonatite lava channel.

- to extend the basis for the use of X-ray absorption spectroscopy for the characterization of structural aspects of uranium minerals that do not form crystals of suitable size for complete structure analysis, as well as studies of sorption of uranium onto mineral surfaces.

I have started my thesis project by examining uranyl phosphate and arsenate minerals and compounds using a combination of synthesis and single crystal X-ray diffraction techniques. The uranyl phosphates are widespread minerals, which are relatively insoluble and may limit the concentration of uranium in many groundwaters. These mineral groups (including phosphuranylite, phurcalite, autunite, meta-autunite) remain poorly characterized, and it is likely that several new species will be identified by the study of natural specimens. This work is intended to increase our knowledge of uranium crystal chemistry, and ultimately to aid in understanding the relations between the structures and occurrences of uranyl minerals.

UNDERGRADUATE STUDENTS AWARDS 2000-2001

Congratulations to the following students who have received MAC undergraduate awards in 2000-2001.

Karine Bédard, University of Ottawa
Sean A. Bosman, University of Western Ontario
Ellen Choi, University of Toronto
Andrea M. Cox, University of Western Ontario

STUDENTS – STUDENTS

TRAVEL GRANTS FOR IMA MEETING
The MAC Foundation is offering five CDN\$600 grants to help student members attend the International Mineralogical Association (IMA) meeting to be held in Edinburgh, September 1-6, 2002. Any student member of MAC in 2002 can apply. Payment of the grant will be made after the conference, subsequent to provision of proof of attendance.

How to apply:

1. Send your abstract for the IMA meeting.
2. Include a one-page letter outlining your research and stating why you need such a grant.
3. Provide telephone, fax and e-mail contact numbers and addresses plus those of your thesis supervisor or department chairman.

DEADLINE TO APPLY: February 28, 2002
Winners will be notified at least one month before abstract submission deadline.

Send application to Roger Mitchell
Department of Geology
Lakehead University
955 Oliver Road
Thunder Bay, ON, Canada P7B 5E1
rmitchel@gale.lakeheadu.ca

Adrian E. Forsyth, University of Windsor
Stephen C. Ingram, St. Mary's University
Nathalie MacLean, Acadia University
Anetta Markussen-Brown, Carleton University
Christina Ponte, Lakehead University
Lynn Reich, University of Alberta
Shovik Sengupta, University of Waterloo
Brian Tucker, Laurentian University

These awards are given annually to undergraduate students at recognized Canadian universities or institutions of higher education, for excellence in one of the specialties supported by MAC (mineralogy, crystallography, petrology, geochemistry and economic geology). The award consists of one of MAC's publications, the choice of which is left to the prize recipient, and a one-year subscription to *The Canadian Mineralogist*. For more information, contact Jeanne Percival at jperciva@nrc.gc.ca

SASKATOON 2002

The Local Organizing Committee of Saskatoon 2002 is hard at work. MAC will offer a short course on Synchrotron Radiation (see ad on p. 24 for more information) and will co-sponsor the following two symposiums:

DISTRIBUTION OF METALS IN THE ENVIRONMENT AROUND SMELTERS

This symposium, co-sponsored by the Geological Survey of Canada and the Mineralogical Association of Canada, is organized by Graeme Bonham-Carter, Martine Savard, and Deborah Kliz, of the Geological Survey of Canada. It will present a series of coordinated studies dealing mainly with the distribution of metals around the smelters at Rouyn-Noranda (Quebec) and Belledune (New Brunswick), completed as part of the GSC's Metals in the Environment (GSC-MITE) initiative (1997-2002), with contributions from the concurrent university-led MITE Research Network. Presentations of case-studies from other areas are also welcome. Studies of metals in soils, lake sediments, snow, peat, and

tree rings provide a detailed spatio-temporal distribution of metal dispersal from a geological viewpoint. Work on plume sampling and modelling, isotopes, selective geochemical extractions, GIS and other studies, including those dealing with biological effects, will provide a picture of the anthropogenic 'footprint' of base-metal smelters. Both oral and poster presentations are welcome. There will be a closing roundtable discussion.

APPLICATIONS OF SYNCHROTRON LIGHT SOURCES TO THE EARTH SCIENCES

With the construction of the Canadian Light Source synchrotron in Saskatoon, Canadian scientists from many disciplines, including the Earth sciences, will have unprecedented access to high intensity X-ray light sources for analytical, structural, and imaging purposes. This symposium, convened by Jeremy Richards (University of Alberta), and co-sponsored by the Mineral Deposits Division of GAC and by MAC, will review applications of syn-

Preliminary Call for Geoarchaeology Papers Special Session 13 Applications of Geology, Geochemistry and Geochronology in Archaeology.

A fieldtrip to ancient quarry, mine and archaeological sites in Central BC is being organized in association with the special session. With enough interest, there is also the possibility of a special issue in the Canadian Journal of Earth Sciences. For further information, see the conference website at www.usask.ca/geology/sask2002/ or e-mail the session chairs John Greenough and Leanne M. Mallory-Greenough at jdgreeno@ouc.bc.ca

chrotron techniques to Earth sciences problems, including ore deposits, mineralogy, and microbeam geochemistry, and will look ahead to new opportunities presented by the specific configuration of the CLS instrument. Both oral and poster presentations are welcome.



New Publications from the Mineralogical Society of America and the Geochemical Society



There are two new publications in the *Reviews in Mineralogy and Geochemistry* (RiMG) series. In addition MSA is now carrying the *European Mineralogical Union Notes in Mineralogy* series.

RiMG Volume 41 is titled **High-Temperature and High Pressure Crystal Chemistry** and is edited by Robert M. Hazen and Robert T. Downs. Topics include the characterization, interpretation, and description of structural variations with temperature and pressure, and experimental techniques used to investigate them. There are several unusual features about this RiMG volume. It has a lenticular print on the front cover that is a short movie showing the structural change in quartz with changing pressure and temperature, there is a 4-page color signature, and a series of flip movies on the margins of chapter 4 showing structural changes. 596 pp. ISBN 0-939950-53-7. Members US\$27; nonmembers US\$36.

RiMG Volume 42 is titled **Molecular Modeling Theory: Applications in the Geosciences**, and edited by Randall T. Cygan and James D. Kubicki to accompany the The Geochemical Society short course of the same name held Roanoke, VA May 18-20,

2001. General introduction to molecular modeling methods and a review of various applications of the theory to problems in the geosciences. Molecular mechanics methods that are reviewed include energy minimization, lattice dynamics, Monte Carlo methods, and molecular dynamics. Important concepts of quantum mechanics and electronic structure calculations, including both molecular orbital and density functional theories, are also presented. Applications cover a broad range of mineralogy and geochemistry topics—from atmospheric reactions to fluid-rock interactions to properties of mantle and core phases. Emphasis is placed on the comparison of molecular simulations with experimental data and the synergy that can be generated by using both approaches in tandem. 550 pp. ISBN 0-939950-52-9. Members US\$24; nonmembers US\$32.

The European Mineralogical Union (EMU) launched its series of short courses ("Schools") and accompanying review volumes ("Notes", ISSN 1417 2917) in 1997. *EMU Notes in Mineralogy* are available through MSA. Members US\$18; nonmembers US\$24. There are three volumes:

EMUN Volume 1, **Modular Aspects of Minerals**. Edited by Stefano Merlino (1997) 448 pp. Modular structures of minerals and inorganic materials: OD structures, polytypism and mixed layer minerals in phyllosilicates, polysomatism, sulphides and sulphosalts, different approaches to modularity.

EMUN Volume 2, **Environmental Mineralogy**. Edited by D. J. Vaughan and R. A. Wogelius (2000) 434 pp. Nature of environmental mineralogy, analytical, experimental, and computational techniques, mineralogy of key environmental systems: soils, marine sediments, microbes, aerosols, mine wastes, landfills, nuclear waste depositories; minerals & cultural heritage and human health.

EMUN Volume 3, **Solid Solution in Silicate and Oxide Systems of Geological Importance**. Edited by Charles Geiger (available after June, 2001)

More information about these publications is available on the MSA website at www.minsocam.org or from MSA Business Office, 1015 Eighteenth Street NW Ste 601, Washington, DC 20036-5212, USA. ph: 202-775-4344 fax: 202-775-0018 e-mail: business@minsocam.org. You may also order these publications online.

THE EDITOR'S CORNER

Robert F. Martin

The summer is slipping by at an alarming rate for all of us. Many of you probably think that the editorial office is closed for the summer, with a prominent "Gone Fishing" sign hung on the door. In fact, not much slows down around here, even during the summer, such that if I happen to leave for a while, I have to pay for that transgression once I return!

I hope that you enjoyed the thematic issue this year (April 2001), on basic and ultrabasic rocks and associated mineralization. I believe that it is a terrific issue, and one that should have a definite impact on an audience that historically has not been drawn to *The Canadian Mineralogist*. I am thinking of investigators of komatiitic volcanism. Our April issue contains a number of stimulating articles on the physics and chemistry of komatiitic magmas... No one has ever seen such magmas in nature. As a result, volcanologists and economic geologists must adopt the approach of multiple working hypotheses, and also must refer to experimental simulations and scale accordingly. Komatiitic flows are economically very significant, as they host important nickel sulfide deposits. I learned a lot from those papers on komatiitic systems, and I hope that a good part of the readership shares this view.

The April issue also contains papers dedicated to Peter Roeder. Thus petrology and mineralogy of basaltic volcanism was the focus here. What I found most interesting was the prospect that the part of the audience interested in komatiites and mineralization likely would find in the papers dedicated to Peter quite a bit of new information that they could apply directly in their



research activities, and *vice versa*! As usual, the editor receives very little feedback of any sort from readers, but I have given you my personal assessment of the merits of the 2001 thematic issue.

I am struck by an emerging concentration of articles in our journal on the detailed mineralogy of ores. You may have noticed this developing theme as you surveyed the contents of the June issue. I see this as an area of growth, which should eventually make the journal increasingly attractive to economic geologists out there. This field may even lead to new subscribers! I see more such articles coming in future issues, and anticipate a large number of them in the 2002 thematic issue dedicated to my predecessor, Louis J. Cabri.

The June issue also contains a must-read article on the importance of mineralogy in designing and evaluating nuclear-waste forms, certainly one of the most pressing of societal issues facing all of us in the near future. Its author, Rodney C. Ewing, is the incoming president of the Mineralogical Society of America, and certainly is well placed to speak to a broad audience on

the profile of mineralogy in this very interdisciplinary field of investigation.

The August issue of *The Canadian Mineralogist* will contain the second update to the *Encyclopedia of Mineral Names* (1997). The first was published exactly two years ago, and was distributed upon demand to all those who purchased the Encyclopedia, which was our Special Publication 1. We will hand out this second update to all who request it, including those stopping by at our booth at the Tucson Gem and Mineral Show next February. Also, we will post it on our Web site. With this second update, we have an up-to-date listing of all approved species. Each entry provides the mineral's formula, symmetry and space group, the origin of the name and details about the type locality and associated minerals, and key references. When the time comes to publish a second edition of the Encyclopedia, we will be ready!

As a result of the publication of our Special Publication 4, "*New Minerals 1995-1999*", by Joseph A. Mandarino, I have decided to start getting ready for the next installment, "*New Minerals 2000-2004*", by publishing excerpts in each regular issue, as space permits. Thus you will start seeing a segment entitled "New Minerals" starting with the October issue. As we get rolling, we will get caught up, so that when the time comes to collate everything and publish the next book, most of the work will already have been done. Of course, Joe Mandarino and I expect you to supply us with corrections and addenda!

So things are cooking around here! Never a dull moment, even in summer! I hope that you all had a good one!

Another New Publication



At last it is out! *The Health Effects of Chrysotile Asbestos: Contribution of Science to Risk-Management Decisions* is now available. This publication results from the proceedings of an International Workshop on the Health Effects of Chrysotile Asbestos: Contribution of Science to Risk-Management Decisions, held in Montreal, Quebec, September 14-16, 1997. The workshop brought together scientists of widely different backgrounds in order to benefit from their different perspectives. All contributions have been updated to 2001.

This collection of papers summarizes the current state of knowledge about chrysotile and amphibole-group asbestos minerals like tremolite, riebeckite and grunerite, from historical and modern perspectives

The table of contents of the volume and an order form can be downloaded at our web site www.mineralogicalassociation.ca.

PEOPLE BEHIND MINERAL NAMES

PAOLO ORLANDI

Orlandiite, $Pb_3Cl_4(SeO_3) \cdot H_2O$, was recently named in honor of Paolo Orlandi (b. 1946), Professor of Mineralogy at the University of Pisa, Italy, in recognition of his work in establishing new mineral species from Italy. The mineral was found in the selenium-rich part of the oxidation zone at the Baccu Locci lead-arsenic mine near Villaputzu, Sardinia, Italy. The description of this new species was published in *The Canadian Mineralogist* in 1999:

CAMPOSTRINI, I., GRAMACCIOLI, C.M. & DEMARTIN, F. (1999): Orlandiite, $Pb_3Cl_4(SeO_3) \cdot H_2O$, a new mineral species, and an associated lead-copper selenite chloride from the Baccu Locci mine, Sardinia, Italy. *Can. Mineral.* **37**, 1493-1498.

The locality seems to be among the richest in selenium oxysalts in the world, and is unusual in showing clear evidence of chlorine enrichment in the environment of growth. The find could well lead to the discovery of other new species.

So just who is Paolo Orlandi? Paolo was born in Livorno (Leghorn), Italy. He developed a keen interest in minerals and mineral collecting during his high school years. After earning a degree in chemistry, he graduated in geological sciences in 1971 from the University of Pisa. He served as Curator of the Mineralogical Museum from 1972 to 1980, and then he became associate Professor of mineralogy in the Department of Earth sciences at that university.

An important feature of Professor Orlandi's work has been his constant and productive relations with the community of mineral collectors. He soon became an important source of information for them, by identifying specimens, providing analytical work, and lecturing at mineral clubs, among other activities.

In turn, this cooperation has had a major influence on his scientific productivity, which includes over one hundred articles in the most important mineralogical magazines. Paolo Orlandi has also been the senior author of four



Professor Orlandi alle cave di marmo delle Madielle

regional books on his native area, Tuscany. One book deals with the minerals of the Isle of Elba, and three with the minerals in marble of the Apuan Alps. The special relation that Paolo Orlandi has with Tuscany and the local collectors is underscored by the fact that eleven of the 26 descriptions of new minerals authored or coauthored by him come from this interesting district. Six of them were found in the small iron oxide and barite mine of Buca della Vena in the Province of Lucca: versiliaite and apuanite, two complex iron and antimony sulfo-oxides, structurally related to schafarikite; scaiinite and pillaitite, two oxysulfosalts of lead and antimony; desautite, a uranium-bearing member of the crichtonite-davidite group; and stibivanite-2O (*Can. Mineral.* **27**, 625, 1989), an orthorhombic polytype of stibivanite.

Four more new species were des-

cribed from the Apuan marbles: carraraite, a germanium mineral structurally analogous to thaumasite; zaccagnaite, an aluminum- and zinc-dominant member of the pyroaurite group; and two new species approved by the Commission on New Minerals and Mineral Names (CNMMN) of the International Mineralogical Association (IMA) and due for publication (an antimony and aluminum oxide and a lead and antimony sulfosalts).

The eleventh new mineral to be discovered in the Apuan Alps, specifically from the old cinnabar mine of Levigliani, is a sulfide of mercury and bismuth for which Professor Orlandi proposed the unusual name *grumiplucite* (*Can. Mineral.* **36**, 1321, 1998), an acronym derived from *Gruppo Mineralogico e Paleontologico Lucchese*, the local mineral club from which the first specimen was received. By its acceptance of this name, the CNMMN provides recognition of the

important role that amateur mineralogists the world over play in the world of science

Paolo has reached out to the amateur mineralogist audience in another way, by publishing on the mineralogy and geology of the Buca della Vena mine (**17**, 261-268, 1986) and the Carrara marble quarry (**18**, 263-296, 1987) in *The Mineralogical Record*.

In the little free time he can find away from his academic work and his family, Paolo Orlandi likes to farm a small orchard with a tiny vineyard and a few beehives in the countryside near Pisa.

I thank Renato Pagano for contributing this profile of Paolo Orlandi.

Robert F. Martin

MEMBERS IN THE NEWS

JIM NICHOLLS

Professor James Nicholls of the University of Calgary and current Past-President of the Mineralogical Association of Canada has been chosen the third winner of the Felix Chayes Prize for Excellence in Research in Mathematical Petrology. The Prize, funded by an endowment in honor of the late Felix Chayes, is awarded in alternate years by the International Association for Mathematical Geology to an individual who has exhibited exceptional potential and proven research ability.

It is most appropriate that Jim receive this award because, like Felix Chayes, he has devoted his professional life to important problems within the discipline of mathematical petrology. All of Jim's work is done with characteristic rigour. He takes great care to ask relevant scientific questions, formulate hypotheses, and test them. Moreover, he has always scrupulously analyzed the error associated with measurement. Learning new mathematical techniques as required, Jim has applied linear algebra, vector calculus, multivariate calculus, analysis of variance, and Bayesian statistics to problems in petrology.

A native of Idaho, Jim obtained a B.Sc. from Texas Christian University. He then began Ph.D. studies with Ian Carmichael at Berkeley. The work he started there and continued during the 1970's employed methods from multivariate calculus and was fundamental to the quantitative understanding of magmatic systems. During the 1980's, he turned his mathematical talents to analytical methods, in particular, those involving electron beams. He and his colleague Mavis Stout (Calgary) published an influential paper on the characterization of modes (i.e., the mineralogical composition of a rock), their spatial distribution, and texture and pattern recognition using point counts of X-ray intensities. Jim has also published an elegant paper on the relation between electromagnetic radiation and the optical indicatrix for visible light in anisotropic minerals.



Jim Nicholls in the field

Appropriate to this award, Jim has worked on the "Chayes closure problem", which is central to the use of geochemical data. In a 1988 paper, Jim demonstrated that the Pearce element ratio technique (T. Pearce, Queen's) is statistically valid, and that Pearce element ratio diagrams serve to depict processes leading to differentiation in igneous suites. Jim and his former Ph.D. student Kelly Russell (UBC) and their colleague Terry Gordon (Calgary) used linear algebra to facilitate the use of complex numerators in Pearce element ratio diagrams, and to demonstrate applications related to the testing of petrologic hypotheses. This led to Jim's work on Bayesian statistics and what will undoubtedly become a classic paper in the petrological literature. Jim is breaking new ground in applying Baye's theorem to the use of qualitative data, such as from field mapping and microscopy, in petrological statistical methods. Jim is currently working on ways to extend our thermodynamic database for the modeling of magmatic systems to include volatile components. We look forward to seeing more of Jim's brilliant work in the future.

Note from the editor: The above is excerpted from a citation written by A. Fowler. The full text and references can be downloaded at www.iamg.org

PETR ČERNÝ

Petr Černý, emeritus professor at the University of Manitoba, was elected a member-correspondent of the Asociación Geológica Argentina. At the conclusion of his recent field work and lecture tour, he also was awarded a medal from this society (coming from Argentina, the medal is all silver, of course!). With colleagues from the National Research Council detachment in Mendoza, Petr was extensively involved over the past decade in research into granitic pegmatites in several provinces of Argentina, particularly the mineralogy of niobium and tantalum oxide minerals and phosphates.

Also, Petr was recently elected an honorary member of the Learned Society of the Czech Republic, the Czech analog of the Royal Society of Canada (of which he also is a member). So far, Petr and his former colleague from Prague, Zdenek Johan (BRGM, Orleans) are the only representatives of the geological sciences in the Learned Society, associated with the Czech Academy of Sciences. The Society encompasses all branches of science, but is currently restricted to just under 100 regular members (Czech citizens) and honorary members (ethnic Czechs with foreign citizenship).

Claire Roeder, beloved wife of Peter L. Roeder of Queen's University, passed away suddenly on August 20, 2001. Claire touched the lives of countless people - including many former graduate students who will always remember her kindness and her gentle ways.

We extend our deepest sympathies to Peter and his family.

CALENDAR

April 14-16, 2002

Global Exploration 2002 – Integrated Methods for Discovery, the Society of Economic Geologists' upcoming meeting will be in Denver, Colorado, USA. More information may be obtained at www.seg2002.org

July 22-24, 2002

PACROFI 2002 – HALIFAX, NS

The eighth biennial Pan-American Conference on Research on Fluid Inclusions (PACROFI VIII) will be held in Halifax, Nova Scotia, July 22-24, 2002. The meeting will be hosted by the Department of Geology, St. Francis Xavier University, and the Nova Scotia Department of Natural Resources. Details are available at the following website <http://www.gov.ns.ca/natr/meb/pacrofi8/zindex.htm>. For additional information, contact either Alan Anderson (aanderso@stfx.ca) or Dan Kontak (kontakdj@gov.ns.ca).

There will also be a pre-meeting (July 20-21) short course entitled **Fluid Inclusions in Hydrocarbon Systems**. The list of speakers currently includes Bob Burruss (USGS, Reston), Bob Goldstein (U of Kansas), Don Hall (FIT, Tulsa), Gordon Macleod (Shell, Houston). More information about the short course may be obtained from the following web site <http://www.gov.ns.ca/natr/meb/pacrofi8/index.htm>

For a complete listing of meetings of mineralogical interest, see Dr Andrea Koziol's web page at <http://homepages.udayton.edu/~koziol/meetings.html>

ANNOUNCEMENT AND CALL FOR PAPERS

GEMSTONE DEPOSITS OF COLORADO AND THE ROCKY MOUNTAIN REGION

September 7-10, 2002

Sponsored by the Colorado Chapter of Friends of Mineralogy, Colorado School of Mines Geology Museum, Denver Museum of Nature and Science, and U.S. Geological Survey

A symposium on the mineralogy, geology, and field occurrences of gemstone deposits in the Rocky Mountain states will be held on the Colorado School of Mines campus, Golden, Colorado, in September, 2002. The symposium will include 1-1/2 days of lectures (September 7-8), followed by two days of field trips to selected Colorado gem localities (September 9-10). The symposium will

July 22-26, 2002

11th Quadrennial IAGOD Symposium and GEOCONGRESS 2002, Sedimentary, Magmatic and Ore-Forming responses to Compressional and Extensional Tectonics: A focus on Africa, Windhoek, Namibia, with field excursions throughout southern Africa. Hosted by the Geological Societies of Namibia, South Africa and Zambia, sponsored by SEG and SGA.

Contact: Conference Link, P.O. Box 9870, Windhoek, Namibia. Tel.: +264-61-251014, Fax: +264-61-272032, e-mail: alice@conferencelink.com.na Web: www.geoconference2002.com

August 18-23, 2002

From Stars to Life, the 2002 geochemistry Goldschmidt Conference will be held in Davos, Switzerland.

For more information, www.goldschmidt-conference.com or e-mail: goldschmidt2002@campublic.co.uk

September 1-6, 2002

Mineralogy for the New Millennium, meeting of the International Mineralogical Association at the Edinburgh International Conference Centre, Edinburgh, Scotland.

For further information, visit www.minesoc.org/IMA2002 or e-mail: ima2002@ed.ac.uk

endeavor to bring together professionals and knowledgeable amateurs involved in mining, collecting, or mineralogical research of gem materials from the Rocky Mountain region. Papers on all important gemstone deposits of the region are being solicited.

The symposium will precede the 2002 Denver Gem and Mineral Show, which will be held September 13-15; the theme of the show will be "Gemstones of Colorado".

Anyone interested in presenting a paper should submit a title and a 50-word summary by January 1, 2002, to: Pete Modreski, email pmodresk@usgs.gov, or to Friends of Mineralogy, Colorado Chapter, P.O. Box 5276, Golden, Colorado, 80401-5276. Further information about the symposium is also available at these addresses.

OBITUARY

JERRY VAN VELTHUIZEN: A PASSION FOR MINERALOGY

By ROBERT GAULT,
CANADIAN MUSEUM OF NATURE

Our good friend and colleague, Jerry van Velthuisen, passed away on Sunday, June 17 after a brief struggle with cancer. He was 50.



In 1978, Jerry began work as an X-ray technician in the Mineralogy section of the Canadian Museum of Nature's Research Division. He continued until 1993, when he was laid off in a downsizing of staff. He continued doing contract work for the museum until very recently.

Jerry's consuming interest in mineralogy began in childhood, sparked by visits to the old mineral gallery in the museum's Victoria Memorial Museum Building in downtown Ottawa. After joining the staff, he became thoroughly dedicated to the museum and his colleagues, the study of minerals, and the kindling of interest for mineral collecting among young people.

Jerry discovered many new mineral species, particularly from the alkaline complex at Mont Saint-Hilaire, Quebec, and he helped to describe them in numerous publications, most notably in *The Canadian Mineralogist*. Later, he became interested in the mining history of Quebec's Gatineau region and worked hard to convince the provincial government to preserve some of the mining heritage in the area.

More recently, he developed an interest in invertebrate fossils. In typical fashion, he thoroughly researched localities and amassed an extensive collection of Ordovician fossils from the Ottawa Valley. As he had wished, this collection is in the process of being donated to the Museum.

A true character of Quebec's Gatineau and Pontiac regions, Jerry will be missed by all who knew him.

MUSEUM NEWS

THE ROM ACQUIRES THE CHARLES KEY CANADIAN MINERAL COLLECTION

The Royal Ontario Museum (ROM) acquired early this year the Charles Key Canadian Mineral Collection, one of the best private collections of Canadian minerals in existence. The Key Collection contains several thousand top-quality specimens. This important acquisition, made possible through the ROM's Louise Hawley Stone Charitable Trust strategic acquisitions Fund, makes the ROM's mineral collection the world's pre-eminent collection of Canadian minerals, and will provide highly significant research material for years to come.

"I saw the entire Key Collection in August 1999, and I was stunned by the quality and depth of the collection," said Dr. Fred Wicks, Head of the ROM's Department of Earth Sciences. "I realized that the acquisition of this collection, a great natural treasure of Canada, was a once-in-a-lifetime opportunity and an incredible coup for the ROM."

Charles Key currently lives in Maine and has been an avid collector since childhood. His fine collection, which includes a number of "world-class" specimens, has made him an internationally known figure throughout the mineral community. The Charles Key Canadian Mineral Collection is centred in three locality suites from the province



Photos courtesy K. Dunnell

The ROM gang, at the 2001 Tucson show, proudly standing beside the ROM showcase. From left to right, Ian Nicklin, Terry Ottoway, assistant curator, Katherine Dunnell, collection manager, and Fred Wicks, Head of the Earth Sciences Department.

of Quebec, which make up about two-thirds of the total:

- an unrivalled suite of minerals from the Jeffrey Mine at Asbestos, Quebec,
- a remarkable suite of minerals from the Black Lake Mine at Thetford, Quebec, including blue-green andradite, pink thulite, and the first known North American occurrence of blue suolunite
- a large and comprehensive suite of minerals from the quarry at Mont St. Hilaire.

The entire collection contains well over 5000 pieces. It will take many months to unpack and catalogue this vast collection. A selection of specimens from the collection is on display at the front of the Inco Ltd. Gallery of Earth



Charles Key in front of the ROM showcase on minerals from the asbestos mines of Quebec, part of the Charles Key Collection.

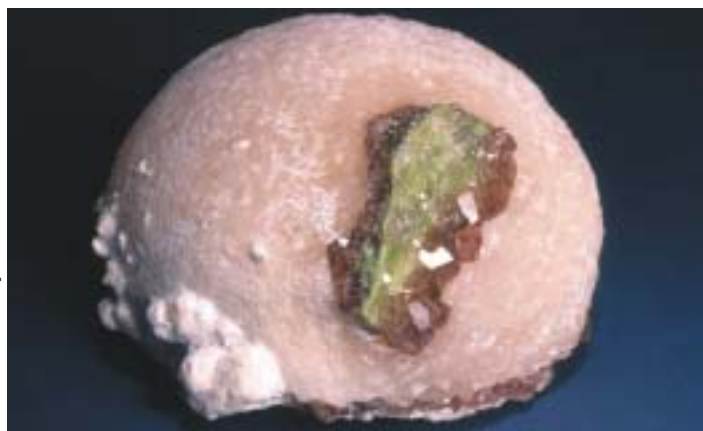
Sciences, and will be changed every three months as new minerals are unpacked. As well, many of the specimens will be exhibited at mineral shows, and next year's Tucson case will be the Mont St. Hilaire minerals from this collection.

In April 1998, the late Louise Hawley Stone bequeathed to the ROM a \$45 million trust, the largest cash bequest ever received by a Canadian cultural institution. The Louise Hawley Stone Charitable Trust Fund supports the purchase of objects and the production of publications by the ROM.

Katherine M. Dunnell
katherin@rom.on.ca



Gem-quality serandite crystal (4 x 4 x 1.5 cm) with a faceted serandite gem cut from a similar crystal. Mont Saint-Hilaire, Quebec.



Radially-arranged prehnite crystals with garnet and diopside crystals. Jeffrey Mine, Asbestos, Quebec.

Photos courtesy ROM

OUTSIDE NEWS

COMMISSIONS AND WORKING GROUPS OF IMA AND THEIR RECENT ACTIVITIES

TONY NALDRETT (PRESIDENT IMA)
AND TOMAS WEISZBURG (SECRETARY IMA)

A list of commissions and working groups of IMA follows, along with notes on their most recent activities (NB – the notes are based on events that occurred in 2000; absence of an entry merely indicates that no significant event occurred in this particular calendar year):

Commission on Ore Mineralogy – The COM organized a short course entitled *Ore and Environmental Mineralogy* in conjunction with the Geological Survey of Finland and the Helsinki University of Technology in June 2000.

Commission on New Minerals and New Mineral Names – The main role of this commission, which is one of the most active of IMA commissions, is the ongoing assessment of proposals to establish new minerals, the reviewing of the status of existing minerals, and the preparation of papers that provide mineralogists and petrologists with internationally accepted guidelines on nomenclature. Each month, members of the commission, who currently represent 30 countries, vote and comment on new mineral proposals that have been received and assembled by the Chairman; the Commission receives from 60 to 80 proposals per year. Also, on a monthly basis, the Vice-Chairman circulates proposals to change the status or name of minerals for members to vote on. CNMMN sponsored the session "New minerals; their impact on the mineralogical sciences" during IGC31.

Commission on the Classification of Minerals – Current information pertinent to the classification (and re-classification) of minerals is circulated to members of this commission who discuss, in concert with members of CNMMN, how to develop the principles underlying mineral classification. CCM organized a micro-symposium "Mineralogical Crystallography" during the meeting of European Crystallography, in Nancy in August 2000.

Commission on Museums – This commission supported the meeting "Mineralogy and Museums 4" held in Melbourne in December 2000.

Commission on History and Teaching of Mineralogy – The CHT co-sponsored the "Preparation of a coordinated European core curriculum in Mineralogy" project which runs under the Socrates/Erasmus program of the European Union. They also co-sponsored the European Mineralogical Union School and Symposium on "Environmental Mineralogy" which was held in Budapest, Hungary in May 2000.

Commission on Crystal Growth of Minerals – The main event of this commission in 2000 was the organization of a session entitled "Surfaces of Minerals" at the 31st IGC Meeting, Rio de Janeiro, Brazil.

Commission on Applied Mineralogy

Commission on Gem Minerals

Commission on Physics of Minerals

Working Group on Mineral Equilibria – This working group helped organize a symposium at the Rio IGC entitled "Mineral Equilibrium in Mantle-derived Rocks".

Working Group on Organic Minerals – The WGOM is preparing a list of valid and rejected names of organic minerals. A newsletter is regularly distributed amongst its members.

Working Group on Inclusions in Minerals – The WGIM sponsored a session "Modern Microbeam Techniques Applied to Fluid and Solid Species" at the Rio IGC. This was concerned with fluid, gaseous, and solid inclusions in minerals, and their applicability in interpreting geological processes in the crust and mantle.

Working Group on Cosmic Mineralogy

Working Group on Data Bases and Computer Applications

Interface with Other International Organizations

Cooperation has been particularly close in recent years with the following international organizations:

- European Mineralogical Union (EMU): the IMA co-sponsors its edition of the 'Directory of Institutions'.
- International Association of Geochemistry and Cosmochemistry (IAGC): the IAGC co-sponsored a plenary lecture at the 1998 General Meeting of the IMA.
- International Association of Volcanology and Chemistry of the Earth's Interior (IAVCEI).
- International Association on the Genesis of Ore Deposits: the IAGOD sponsored a session at the 1998 General Meeting.
- International Council for Applied Mineralogy: the ICAM co-sponsored two sessions at the 1998 General Meeting.
- International Geological Correlation Programme: the IGCP co-sponsored a session at the 1998 General Meeting.
- International Union of Crystallography.
- Society for Geology Applied to Ore Deposits: SGA co-sponsored a symposium at the 1998 General Meeting.
- Society of Economic Geologists: the SEG co-sponsored a session at the 1998 General Meeting.

NEWS FROM ICDD

The J.D. Hanawalt Award to Raymond P. Goehner and Joseph R. Michael

Raymond P. Goehner and Joseph R. Michael, both of Sandia National Laboratories, Albuquerque, New Mexico, U.S.A. received the 2001 J.D. Hanawalt Award for excellence in the field of X-ray powder diffraction at the 50th Annual Denver X-ray conference. The J.D. Hanawalt Award is presented every three years for important, recent contributions to the field of X-ray powder diffraction and phase identification published within the last five years. The award consists of a commemorative plaque, an honorarium, and travel funds to attend the meeting at which the award and lecture is presented. Previous recipients of this prestigious award include: Herbert Gobel, 1998; Daniel Louer, 1992; William Parrish, 1986; and Ludo K. Frevel, 1983. For more information, see www.icdd.com

Call for Papers

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Geochemical Transactions, published by the Royal Society of Chemistry in collaboration with the Division of Geochemistry of the American Chemical Society, is an electronic journal for the rapid publication of high impact articles from all areas of geochemistry.

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Submissions for Geochemical Transactions are now being sought, for example, in the following areas:

- Organic geochemistry
- Inorganic geochemistry
- Aquatic geochemistry
- Marine chemistry and chemical oceanography
- Biogeochemical investigations of organic, inorganic and biogeochemical processes
- Molecular and isotopic analyses
- Chemical and elemental cycles
- Geochemical aspects of global change
- Instrumental or analytical techniques applying to the above
- Numeric or computational models of geochemical processes

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Submissions can be sent via e-mail to the Managing Editor at geochem@rsc.org or via the web site at

www.rsc.org/geochem

The web site also contains further details, including instructions for authors, etc

The Mineralogical Association of Canada was incorporated in 1955 to promote and advance the knowledge of mineralogy and the related disciplines of crystallography, petrology, geochemistry and mineral deposits.

Any person or organization engaged or interested in the fields of mineralogy, crystallography, petrology, geochemistry and mineral deposits can become a member.

Membership benefits include: six issues a year of *The Canadian Mineralogist*; **20% discount** on publications of the Association; special discount on registration fee at our annual meeting held jointly with the Geological Association of Canada.

Individual membership	\$90
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Sustaining membership	\$610
Student or retired membership	\$30

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Short Course

Synchrotron Radiation: Earth, Environmental and Materials Sciences Applications

May 25 and 26, 2002

University of Saskatchewan campus, prior to
the 2002 GAC-MAC meeting in Saskatoon.

THE short course will present what synchrotron radiation is, what the latest techniques are, what types of Earth, environmental and materials science problems can be investigated using synchrotron techniques, what the Canadian Light Source can do, how one gains access to the CLS and other sources, and how data are reduced and analyzed for specific techniques.

Most of the material will be at a level of understanding for most upper undergraduate and graduate students although recent results and ideas presented throughout the lectures will appeal to both pure and applied researchers working on Earth, environmental and materials sciences. The presentations of the first day (90-minute lectures) will be broad overviews of various aspects of synchrotron research. The second day will be dedicated to more specific applications, and some of the lecturers will go through the reduction and analysis of real raw data with the audience (where appropriate).

On the afternoon of the second day, there will be a tour of the Canadian Light Source. A symposium on APPLICATIONS OF SYNCHROTRON LIGHT SOURCES TO THE EARTH SCIENCES will also be held during the GAC-MAC meeting. Both oral and poster presentations are welcome.



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Registration fee: \$275CDN (Students \$150CDN)

For more information, contact Grant S. Henderson at henders@geology.utoronto.ca
Or visit the web site of Saskatoon 2002 www.usask.ca/geology/sask2002/

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