



A Message from the Chair

It has been seven months since I began my term as chair of the Department of Geology. While I am very excited about what the future holds for the department, I would like to start this message by acknowledging the leadership of Steve Scott, whose term as chair ended last June. Under Steve's watch the department managed to recruit several outstanding new faculty members, went through a major academic planning process and two important external reviews, and saw significant achievements by both faculty and students. This summer, we were joined by our newest faculty members, Jörg Bollman and Charly Bank. Jörg's expertise is in paleo-oceanography and micropaleontology and he came to us after completing a PhD and research appointments at ETH, Zurich. He adds new strength to the growing area of geobiology within the department. Charly is our new Lecturer and has already made his mark in the delivery and design of our undergraduate programs. Charly comes to us following a PhD in geophysics at UBC and a previous teaching appointment at Colorado College. Both Jörg and Charly join our other two recent faculty additions, Uli Wortmann (2002) and Gopalan Srinivasan (2003). With a search ongoing for a new faculty position in Remote Sensing, and the recent cross appointments of Sharon Cowling and Myrna Simpson from Geography, our department will have seen major renewal and significant changes in direction over the last five years.



In addition to faculty renewal and growth, faculty in the department have continued to excel as academic leaders. Russ Pysklywec was awarded tenure in July, following Jim Mungall's successful promotion to Associate Professor the year before. Marianne Douglas was named to a Tier 1 Canada Research Chair last year, joining the four previously announced endowed chairs held by Professors Scott, Cruden, Miall and Spooner. Additional awards are noted in a following section of this Newsletter. Barbara Sherwood Lollar was elected as a Fellow of the Royal Society of Canada and is currently enjoying the final year of her Killam fellowship. National and international accolades to faculty and students have been many. For example and most recently, Gopalan Srinivasan was awarded the 2005 B.M. Birla prize, presented to an Indian scientist under 40 who has made outstanding original contributions to their field.

While we can reflect on our collective achievements, the next five years present the department with some major challenges and extraordinary opportunities. As demand for geoscientists continues to surge in Canada, we still have low enrolments in our undergraduate programs, despite teaching over 1500 students per year in our first and second year service courses. Our recent external review noted this as a major problem facing the department, and made several useful recommendations to address this issue. Our new Associate Chair for undergraduate affairs, Jim Mungall has been working hard over the Fall to implement some of these recommendations and we have started to review our programs and courses. To start with, next year we will be introducing a new "flagship" course in Earth sciences for first year science students, which we hope, together with enhanced outreach efforts, will draw more students into our programs. Last year the provincial government announced major plans to increase graduate student enrolments in Ontario universities. As

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part of a university wide exercise, Associate Chair for graduate affairs, James Brennan developed a strategy for increasing graduate student enrolment in the department by 40% over the next five years. If provincial funding comes through, graduate enrolment expansion will inject much needed resources into the department. Our challenge over the coming years will be to recruit even more top quality students into our graduate programs.

The external review of the department also strongly supported the main proposal in our 2004 academic plan, which was to explore ways to better integrate the considerable strength in Earth Sciences at the university that is currently distributed among Geography, Physics, Civil Engineering and Geology. I will be pursuing a number of possible models to achieve this goal and hope to have more concrete news in time for the next newsletter. I am always happy to hear the views of alumni and friends on future directions for the department, as well as from faculty and students.

Finally, as part of its 2004 SteppingUp academic plan, the university has made major commitments to improve the student experience. I think that it is fair to say the Department of Geology has always done well in this regard. As a relatively small department in a very large university we can offer our students a much more personalized experience than many other disciplines. As you all know, Geology students have always had many opportunities to interact with their peers and professors in the field. I feel that this is something that we should promote aggressively for both our undergraduate and graduate students. For example, our graduate students are planning an ambitious trip to South Africa this summer, and our undergraduates would like to organize a visit to the western USA this coming reading week. Improving the student experience in the department is an area where our alumni can really make a difference. To this end, this year we are launching three new fundraising initiatives, details of which are provided later in this Newsletter.

I look forward to meeting many of you and catching up with acquaintances at our annual reception at the PDAC on Tuesday, March 7th from 5:00 to 7:30 p.m. I would like to extend an invitation to all alumni and friends to visit the department at any time. I will be happy to show you around, and do my best to arrange meetings with students and faculty, as you like. If you can't make it in person, a good way to keep track of what we are up to is to visit our web site at www.geology.utoronto.ca and click on our newsletter, FRED ("Fossils, Rocks, Earth and Dirt").

Retirements

As part of the term-ending Rockfest Fest on April 8, a large crowd of well wishers bid Claudio and Paula Cermignani a happy retirement for Claudio on June 30. Claudio has been in our department since September 1967, first as a graduate student from Italy (Special, MSc, PhD) and then briefly as a postdoc until he moved into a technical position to run our electron microprobe. He has risen about as high as an engineering technologist can go capping his long and illustrious career as our head of technical services. Claudio can be best described as a benevolent and caring person, a talent he put to good use as our chief technician, who is very highly skilled at his trade of coaxing the best quality of analyses out of his Cameca SX-50 electron microprobe.

It was learned that Claudio is an aspiring artist. To help him along, the department gave him a professional easel and peripherals.

We all wish Claudio and Paula many fulfilling years to come.



A surprised Claudio accepted the gift of an artists easle and thanked the many people on hand to wish him well in his retirement.

Steve Scott

Recent Faculty Appointments

Charly Bank

After finishing an undergraduate degree at the University of Munich in Germany, earning a doctorate at UBC, and teaching for three years at Colorado College I am glad to join the Department of Geology at U of T as “the” lecturer.

My research is three-fold:

- (1) earthquake seismology and gravity help me constrain lower crustal and upper mantle structures,
- (2) near-surface geophysics can image geologic features, archeological sites, even groundwater contamination, and
- (3) innovative teaching methods improve undergraduate education.

However, as a lecturer my focus is on teaching undergraduates, often non-science students.

I aim to persuade some of the brightest of those students that geology is not just an interesting course to take, but a field worthwhile considering as a career.

I hope to instill in all my students a comprehension that our society is dependent on a firm geologic understanding; use of resources, mitigation for disasters, and environmental responsibility affect everyone - often much more than we realize or acknowledge.



Jörg Bollmann

Jörg Bollmann studied Geology and Paleontology at the Freie Universität Berlin, Germany and he completed a Ph.D. in natural sciences at the ETH Zurich, Switzerland. Since 2005 he has been an Assistant Professor in Paleocyanography at the Department of Geology, University of Toronto.

Jörg Bollmann's research interest is a more rigorous understanding of the relationships between the geosphere and the biosphere and their variability during the history of our planet. His research focus is Marine Geobiology, particularly the history of the global oceans including paleo-ecology, paleo-biogeography and the evolution of calcareous marine microorganisms. In addition, he is developing innovative methods especially fully automated microscopes for identification, counting and morphometry of calcareous microorganisms.

Alumni Reception

It has been a tradition for alumni and friends to gather at the Royal York Hotel during the Prospectors and Developers Association Convention. This year is no exception and we look forward to seeing you on

*Tuesday, March 7th, 2006
at the Library Room
of the Royal York Hotel,
Toronto ON
5:00pm to 7:30pm*

Awards and News - Faculty, Alumni and Friends of Geology

Gopalan Srinivasan was awarded the 2005 B.M. Birla prize, presented to an Indian scientist under 40 who has made outstanding original contributions to their field.

Andrew Miall recently completed eighteen years as Co-chief Editor of Elsevier's "Sedimentary Geology" and filled that empty time slot by accepting an editorship of the sedimentology content of "Earth Science Reviews. He has also become Vice-President of the Academy of Science of the Royal Society of Canada. In collaboration with Charlene Miall he has a new research project "The social construction of environmental degradation: Earth science perspectives on global warming. He did seven media interviews in the month of October, all related to the continuing series of natural disasters.

University Professor Emeritus **Tony Naldrett** is now based in England. He is a Visiting Professor at Royal Holloway College, London and holds an Honorary Professorship at the University of Witwatersrand where he is working on a project related to the Merensky Reef. He can now be contacted at 15, Alpers Ave., Woking, Surrey GU22 9NB, U.K.

Fred Wicks, emeritus professor, cross appointed from the Royal Ontario Museum has been named to receive the Marilyn and Sturgis W. Bailey Distinguished Member Award of The Clay Minerals Society for 2006. This is the highest award of The Clay Minerals Society and is presented for scientific eminence as represented primarily by publication of outstanding original research in clay science. Fred's technical contributions in clay mineralogy have made a strong impact in the professional community and are being recognized with this award.

Barbara Sherwood Lollar entered the final year of a Canada Council Killam Research Fellowship (2004-2006).

Pamela Strand (B.Sc 1988), President Shear Minerals Inc, was given the Consumer's Choice Business Woman of the Year award in Edmonton.



Pamela Strand in the field.

Beth Clemson received the Environmental Excellence in Exploration award from the Prospectors and Developers Association of Canada in 2005. It was her initiative that led to PDAC's ambitious expansion in this field.

Eric Grunsky (B.Sc 1973) received the Felix Chayes award for Excellence in Research in Mathematical Petrology" by the International Association for Mathematical Geology.

Congratulations to **Craig and Robin Jowett** on the extended article in the Toronto Star (November 28, 2005) on the successes of their company Waterloo Biofilter.

Profile

Sandy Cruden

BSc 1984 Dundee University

PhD 1989 Uppsala University

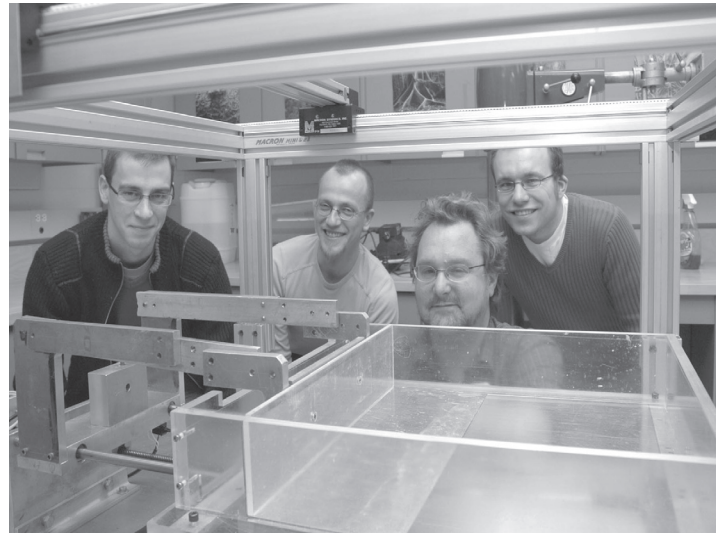


Sandy Cruden in the Sierra Nevada, October 2005

Sandy Cruden joined the department in 1989, directly out of his PhD in geodynamics at the Hans Ramberg tectonic laboratory, Uppsala University, Sweden. He was originally appointed at Erindale College (now University of Toronto at Mississauga) where he taught courses in Rock Formation, Tectonics and Geodynamics, and Remote Sensing, as well as the Whitefish Falls field camp, which is shared between the UTM and St. George Campuses. After moving his research group and analogue modeling laboratory to the St. George campus in 2000, Sandy served as the Associate Chair (Undergraduate) in 2001/03 and then in 2004 was appointed as the inaugural chair of the new Dept. of Chemical & Physical Sciences at UTM. In July 2005 Sandy returned to the St. George campus to become the chair of Geology and the McRae-Quantec chair of geosciences. Throughout his time in the GTA, Sandy has been supported steadfastly by Sarah and their two children, Hamish and Laura.

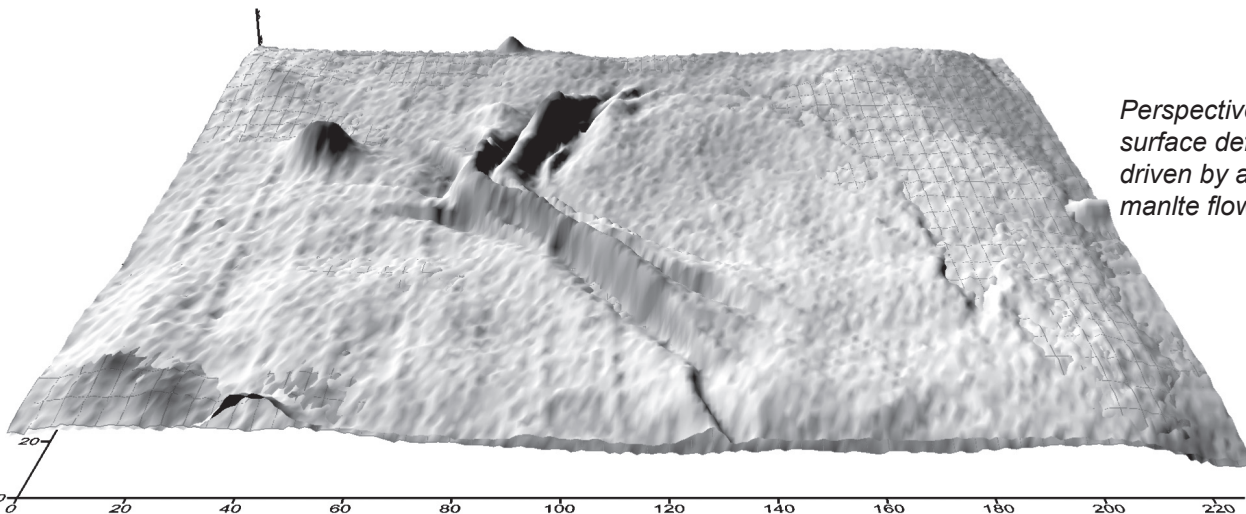
In his first 10 years at the UofT Sandy's research group focused on mechanisms of granitic magma transport and emplacement, Precambrian tectonics and the structural geology of southern Ontario. During this time he completed major field projects in the Sierra Nevada (California), the Slave Province (NWT), the Abitibi Greenstone Belt (ON) and in the Kenora-Red Lake region of the Western Superior province. The latter two projects were part of Canada's Lithoprobe program, during which Sandy had opportunities to make key contributions to the interpretation of deep seismic reflection data collected for the Abitibi-Grenville and Western Superior transects. During this period Sandy also got involved in ore deposits research, working with graduate students and post-docs on the structural geology of the Campbell (Red Lake) and Giant-Con (Yellowknife) gold deposits and the Voisey's Bay Cu-Co-Ni deposit.

Around 1999 Sandy decided to return to his research roots in geodynamics and began to set up an analogue modeling laboratory. This shift was driven by a number of outstanding questions that arose from the previous decade of research. For example, deep seismic reflection profiling and field studies in the Superior Province and younger orogens raised questions such as, how can vertical structures in the upper crust be reconciled with horizontal fabrics in the middle and lower crust; how does orogen parallel flow influence strain fabrics at different crustal levels; and how does mid-crustal magmatism change the rheology and structural response in orogenic belts? Today, the University of Toronto Tectonic Laboratory is at the forefront of developing three-dimensional physical models of crustal to lithospheric-scale deformation. In collaboration with **Russ Pysklywec**, the lab has developed an integrated approach in which two-dimensional thermomechanical numerical experiments are combined with three-dimensional scaled analogue models to address a wide range of first-order questions in geo-



Members of the Tectonics Lab from l-r: David Boutelier, Christoph Shrank, Sandy Cruden and Richard Crowe.

dynamics. At present, the lab is managed by PDF **David Boutelier**, who is doing innovative experimental research on the dynamics of subduction zones and the discovery of new analogue modeling materials. PhD student and Connaught scholar **Christoph Shrank** has recently begun an experimental program investigating feedback mechanisms between erosion and three-dimensional deformation fields in convergent orogens, building on his previous work at the Free University, Berlin on strain localization processes. **Richard Crowe** just completed a MSc project in the lab modeling the relationships between mantle downwellings and crustal deformation on Venus, and is now back on Earth studying and modelling the formation of intracratonic basins and arches. With the recent delivery of a sophisticated three-dimensional Particle Imaging Velocimetry system the modeling group is now looking forward to carrying out the next generation of physical experiments on a wide variety of tectonic processes.



Perspective view of surface deformation driven by a downgoing mantle flow.

Graduates and Award Winners

Graduating Undergraduates:

James Caldwell	Farisa Mohammed
Matthew Earle	Guido Serafini
Ehi Ero	Julia Taylor
Paul Jago	Adrian Van Rythoven
Cassandra Koenig	Andrei Yakovenko

Undergraduate Award Winners

The Coleman Gold Medal in Geology

Cassandra Koenig

The H.V. Ellsworth Undergraduate Award in Mineralogy

Cassandra Koenig

The Alexander MacLean Scholarship in Geology

Paul Jago

The Garnet W. McKee-Lachlan Gilchrist Scholarship

Jessica Reeves

NSERC Undergraduate Student Research Awards

Catherine Crawley	Herbert Maier
Yi-Ju June Chao	Susan Mattson
Anne Griffith	Michelangelo Sciortino
Michael Lazorek	Lisa Tutty

The Frederick W. Schumacher Scholarship

Cassandra Koenig

The Edward Blake Scholarship in Earth Sciences

Laurent Roy

The Wesley Tate Scholarship in Geology

Cassandra Koenig

The Don Salt Award in Geophysics

Cassandra Koenig
Adrian Van Rythoven

Dean's List

Adrian Van Rythoven

Graduating Graduate Students

M.Sc.

Christopher Charles	Richard Crowe
Mark Idziszek	Michael Kerr

Graduating Graduate Students

Ph.D.

Kevin Gostlin	Penny Morrill
Jacob Hanley	Clayton Peskelway
Dan Layton-Matthews	Lars Weiershaeuser

Graduate Award Winners

Alexander R. Cameron Award from the Canadian Society for Coal Science and Organic Petrology

Sarah Hirschorn

The American Association of Petroleum Geologists Student Research Grant

Silvia Mancini

P.C. Finlay, Q.C. President's Fellowship

Nurcahyo Basuki Tudorel Ciuculescu

The Geological Society of America Student Research Grant

Silvia Mancini

Dr. Norman Keevil President's Fellowship in Geology

Sergio Gelcich Oguz Gogus

NSERC Post Graduate Scholarships

Sarah Hirschorn Rachel James

NSERC Canada Graduate Scholarship

Jennifer McKelvie Adrian Van Rythoven

NSERC Post Doctoral Scholarships

Jacob Hanley

Ontario Graduate Scholarships

Natalie Caciagli	Christopher Omelon
Steve Denyszyn	Lesley Rose
Sarah Hirschorn	Malcolm Shaw
Silvia Mancini	Kerry Tokaryk

Ontario Graduate Scholarships in Science and Technology

Christopher Charles	Jennifer McKelvie
Natasa Drakulic	Leanne Mallory
Michael Lazorek	Bianca Perren

Connaught Fellowship

Christoph Schrank

Advancement in Geology

The term advancement has been adopted by the University of Toronto (and numerous other institutions) for a range of activities that include alumni relations, fund raising and stewardship. Our department has three advancement projects, in addition to this Newsletter, all focused on improvements to the student experience of both undergraduate and graduate students. Extraordinary levels of student debt and the absence of discretionary funds within individual departments have received considerable press over the past two years. In earlier years our students could help pay their costs and gain invaluable professional experience through summer jobs as junior geologists, often starting at the end of first year. Sadly, these jobs are greatly reduced in number and both the department and students themselves are finding alternative, but costly, ways in which to gain field experience. See, for example, the undergraduate and graduate student initiatives mentioned earlier in the Chair's Message.

Our first project is to greatly enhance the CHAPMAN FUND, established in 1998 and named after our first department head. Its purpose is to assist with costs of student activities, principally those that are fieldwork related. Tax deductible contributions can be made to the capital (endowment) or the expendable account.

The second project is the Department of Geology Share Pledge Program. This new and unique program has been developed from an initiative of alumnus Dr. Laurie Curtis (Ph. D. 1975), President Intrepid Minerals Corp. In brief, an individual can pledge to make a future donation of shares owned by them when such securities reach a named value. Donated shares are sold by the university and appropriate capital and income tax considerations accrue to the donor. This program will have particular appeal to principals of small and medium size companies who have confidence in the future growth of their enterprise. Full details of this program and its benefits are available from Monica Lin, Faculty of Arts and Science Advancement Office (416 946 5616; mlin@artsci.utoronto.ca).

The third project is a new matching funds program to establish endowed named graduate student scholarships. Any individual, group of individuals or organization who contributes \$50,000 or more will have their donation matched by the provincial government.

We invite you to support the coming generation of U of T geologists by contributing to one or more of these programs. To find out more about these programs please contact Sandy Cruden (416 978 3021), Jeff Fawcett (416 654 3608) or Monica Lin (see above). Contributions can be sent directly to Prof A.R. Cruden at the address below.

Sandy Cruden, Jeff Fawcett

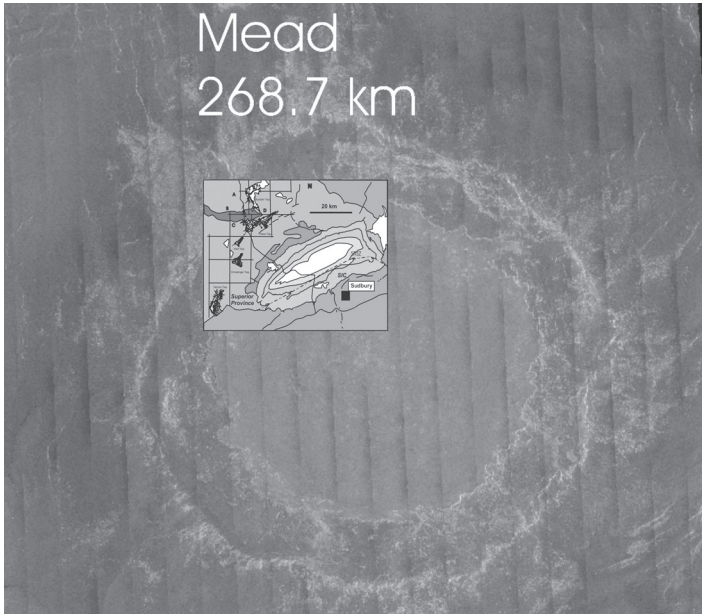
Department of Geology
University of Toronto
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Toronto ON
M5S 3B1

Acknowledgement of past year's donors

The Department is grateful to the following for their recent gifts (to November 2005):
Mr. Derek Lee, Miss Kathryn David, Dr. Greg Stott, Mr. and Mrs. John Riley,
Dr. Eric Mountjoy, Mr. Kevin Shaw, Prof. J. J. Fawcett.

Recent Sudbury Research at the University of Toronto

Faculty and students in Geology at the University of Toronto are lucky to have the Sudbury Structure in our backyard. It presents arguably the world's best-exposed examples of features resulting from several geological processes, including bolide impact, magmatic differentiation, and sulfide ore genesis. In this article I briefly describe some of the things we have learned recently about this fascinating feature.



A geological map of a portion of the Sudbury Structure superimposed on a radar image of the Mead crater on Venus, which is supposed to have been about the same size and shape as the multi-ringed Sudbury crater when it first formed. One can see that the present extent of the Sudbury Igneous Complex is but a small fraction of what it must once have been. The original center of the basin, and the basement rock underlying the original transient cavity, have probably been destroyed by subsequent tectonic events.

The Sudbury Structure was formed at 1849 Ma due to the impact of a large comet onto what was at the time probably a passive margin on the southern edge of Laurentia. The impact caused the formation of a temporary hole - the transient cavity - approximately 100 km in diameter and 30 km deep, which collapsed within a few minutes to form a multi-ring basin somewhere between 200 and 300 kilometers in diameter. This basin was partially filled by an ocean of shock-melted continental crust two to five kilometers deep and perhaps as wide as the entire basin, now recognized as the Sudbury Igneous Complex. The magma filling this basin contained sufficient sulfide to be oversaturated with immiscible sulfide liquid. Since the valuable metals Ni, Cu, Co, Pt, Pd, and Au are all strongly concentrated by sulfide melt when it is at equilibrium with silicate melt, the droplets of sulfide melt were highly enriched in

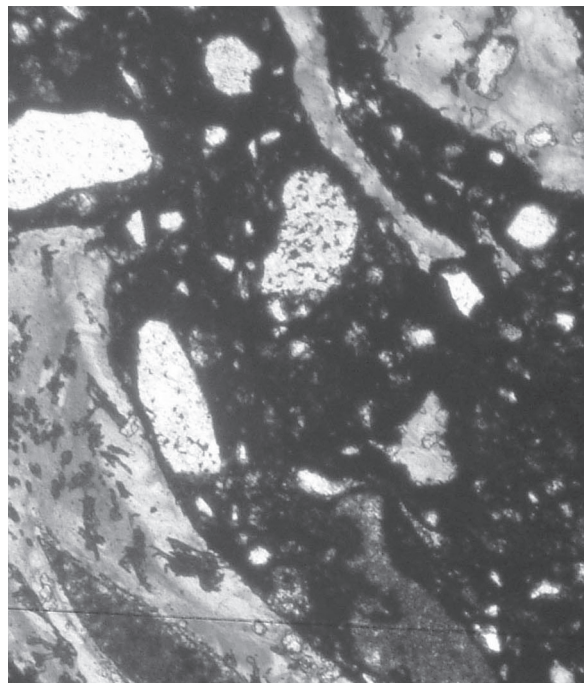
these metals despite the fact that the bulk magma was ordinary continental crust. Due to its high density the sulfide liquid rained out to the bottom of the magma body and collected in depressions. The resulting masses of sulfide can be thought of as resulting from a fire assay of tens of thousands of cubic kilometers of the crust. They constitute one of the two largest concentrations of Ni deposits in the world, second in value only to the Noril'sk deposits in Russia. After the segregation of the sulfide liquid, the remaining silicate magma differentiated to form mafic cumulate rocks capped by a granitic residuum - this process probably took place within about one hundred thousand years. Within a few tens of millions of years the entire structure was over-ridden by an advancing mountain front in the Penokean orogeny, folded into a crustal-scale syncline, and metamorphosed to upper greenschist or amphibolite facies assemblages. The Sudbury structure has undergone at least three orogenic events, the last of which was the Grenville Orogeny, and we are now left with only a small scrap of its northwest corner. Folding and erosion have robbed us of most of the Sudbury Structure, however, they have also left us with an exceptionally well-exposed crustal section through the impact stratigraphy from basement right up to the post-impact sedimentary column. By combining careful field observations with the results of experimental studies and numerical models we have been able to constrain or refine existing concepts on several fronts.

One key observation that we have made is that the arcuate pattern of outliers of Paleoproterozoic metasediments of the Huronian Supergroup that bounds the Sudbury Structure to the northwest is actually defined by a system of pseudotachylite bodies that collectively form a ring-fault. This fault system was active once, and only once, during the collapse of the transient impact cavity, and accommodated dip-slip motions of several kilometers. We argue that it may represent one of the rings of the original multiring basin. In light of the fact that this fault system cuts older isoclinal folds in the Huronian metasediments, we have also argued that the Huronian Supergroup of the Southern Province had already undergone a major orogeny before the time of the impact at 1849 Ma. The material that fell back into the crater includes abundant clasts of carbonaceous mudstone similar to the sediments that are known to have been present in Wisconsin and Minnesota (impacrites correlative with the Sudbury Structure have recently been identified in Minnesota). We therefore infer that the impact occurred into a shallow marine setting similar to the present South China Sea after peneplanation of the earlier orogeny that we tentatively ascribe to the poorly defined Blezardian event.

The magma that filled the basin was produced by the passage of the impact-generated shock wave through the crust. Whereas normal seismic disturbances suffer little attenuation as they propagate, the pressure increase during shock compression does irreversible damage to the material through which it passes, adding entropy by closing pore space and transforming crystals into disordered high density solids, melts, or even vapours. The reversible (adiabatic) decompression that immediately follows allows the material to return to its pre-shock pressure, and the entropy that has been added by the shock wave is expressed in a rise in temperature. The impactor itself, as well as the target rocks closest to the point of impact, are generally assumed to have vaporized and exploded violently out of the crater, whereas the shock-melted or pulverized rocks of the target were accelerated outward to form the transient crater. We have compared the composition of dikes of impact melt radiating from the present outcrop area of the Sudbury Igneous Complex with the composition of the continental crust as well as the composition of crater-filling Onaping formation. We find that the shock-melted rock that formed the Sudbury Igneous Complex was strongly enriched in transition metals (including Pt and Pd) and strongly depleted in lithophile elements relative to the bulk continental crust. The impact melt corresponds closely in composition to the lower crust and we therefore suggest that the shock-melted upper crust was ejected from the cavity, leaving only the deep-rooted lower crustal melt to fill the final crater and form the Sudbury Igneous Complex. There is no discernable trace of a mantle component in the impact melt, indicating that shock melting did not occur below the Moho and putting an important upper limit of about 300 km on the size of the final crater.

The origin of the overlying Onaping formation has been extremely contentious for many years, because it is composed of a rock type unique on Earth, combining aspects of pyroclastic materials, sedimentary rocks, and impact breccias. Our investigations have shown that the matrix to the Onaping Formation can be understood as a mixture of 30% shock-melted lower crust and 70% pulverized or liquified carbonaceous mud with a minor additional flavour of chondritic impactor. The lower crustal component is present as devitrified shards of vesicular glass; the mudstone is present as a ubiquitous very fine-grained black carbonaceous matrix, and the impactor is present as an invisible dusting of Ir and Ru, representing at most about 0.1% of CI chondrite. The strength of the Ir anomaly contributed by the impactor increases upwards through the Onaping Formation, consistent with the usual view that it was vaporized by the impact and deposited gradually as it recondensed from the cooling impact fireball.

The sulfide ores that represent the sulfide magma segregated



A photomicrograph of a sample of the Onaping formation, showing a devitrified shard of lower-crustal shock melt in a matrix of black carbonaceous mud containing traces of Ir derived from the impactor. It was the recognition of the essentially pyroclastic nature of the vesicular glass in the Onaping Formation that led many researchers to consider this rock to be volcanic in origin. Any theory of the impact origin of the Sudbury Igneous Complex must include an explanation of the presence of these products of explosive vesiculation of the impact melt.

at the base of the Sudbury Igneous Complex have long been known to have been differentiated after they collected. We have recently shown that a surprising amount of this differentiation occurred after the silicate magma had solidified, requiring that the late-stage sulfide liquid was able to migrate distances of several hundred meters through solid silicate rock. The large-scale geochemical signature of this process is a pronounced enrichment of Cu, Pt, Pd and Au in veins and disseminations below the original lower contact of the impact melt. This late process of sulfide melt migration was accompanied by the formation and migration of a variety of fluid phases including halide melts, hypersaline brines, and carbonic fluids. Newly discovered deposits of Pt, Pd and Au in rocks showing virtually no visible sulfide mineralization have led to a tremendous resurgence in exploration around the periphery of the Sudbury Igneous Complex. The relative importance of the various mobile phases in concentrating and transporting the ore metals to form low-sulfide precious metal deposits at Sudbury remains an open question, which continues to drive research at the University of Toronto and elsewhere as we continue the search for new ore deposits in a geological setting that never seems to run out of surprises.

Jim Mungall
mungall@geology.utoronto.ca

U of T Geology at Scarborough

Professor Nick Eyles and graduate students Michael Lazorek and Lisa Tutty are currently involved in a variety of projects including glaciology, seismic stratigraphy of lake basins, near surface environmental investigations and detailed lake floor substrate mapping.

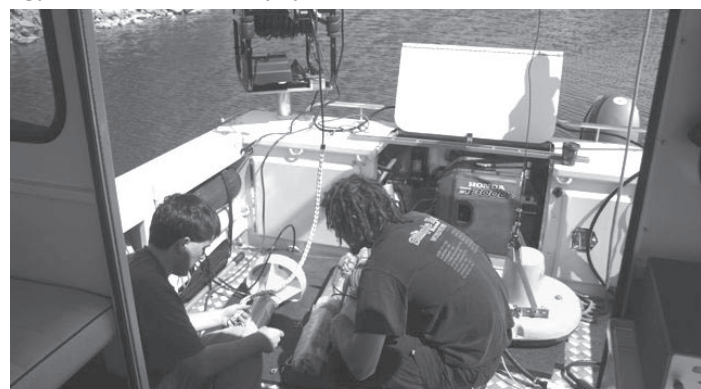
Many of these investigations require detailed information on the subsurface geology to apply the data to disciplines such as mineral exploration, hydrogeology, sedimentology and paleolimnology.

With the generous support of NSERC and the Ontario Innovations Trust UTSC has been able to acquire key geophysical equipment to pursue research in these complex environments.

UTSC is now well set up to conduct geophysical investigations in marine and terrestrial settings. Marine work is based around a custom-built 26-foot research vessel equipped with GPS, radar, X-Star sub-bottom profiler, magnetometers and 600 and 900 kHz sidescan sonars. Terrestrial investigations are supported by a 24 channel OYO seismograph and a recently acquired RAMC Ground Penetrating Radar system which includes both a shielded 250 MHz antenna and a newly developed 50 MHz 'all terrain' antenna which can be used both for land and marine applications.

Our lab is equipped with both REFLEX 3D and Seismic Unix for processing GPR and seismic data. We are also pleased to announce a recent major grant from Seismic Micro-Technology Inc., which includes a three-year license for Kingdom Suite, the industry leading Windows-based seismic interpretation package. This will greatly facilitate visualizing and interpreting complex GPR and seismic data acquired in our field programs.

Further information can be obtained at: <http://www.geology.utoronto.ca/facultyeyles.htm>



Mike Doughty and Vik Terlaky preparing the sidescan sonar equipment on the custom research vessel pictured above.

The Stable Isotope Laboratory

The Stable Isotope Laboratory had a busy year in 2005. Several of our students deserve congratulations on their prestigious awards and scholarships.

Good News

Silvia Mancini - Ontario Graduate Scholarship, the American Association of Petroleum Geologists Student Research Grant, and a Honourable Mention from the Geological Society of America Student Research Grant Competition

Jennifer McKelvie - Canadian Graduate Scholarship, the National Groundwater Association/American Petroleum Institute Award, and the American Petroleum Institute and the National Ground Water Association Scholarship

Sarah Hirschorn - Ontario Graduate Scholarship

Michelle Chartrand - National Groundwater Association/American Petroleum Institute Award

In addition, past Stable Isotope Lab members made us proud, with Dr. **Penny Morrill** taking up a Carnegie Institution of Washington Postdoctoral Fellowship and Dr. **Greg Slater** the Tier II CRC Chair in Isotope Geochemistry at McMaster University.

Farewells and Welcomes

Dr. **Jon Telling** joined the lab this year to pursue research on deep subsurface microbiology in a project funded jointly by the Canadian Space Agency and the NASA Astrobiology Institute. He has delivered two lectures at prestigious conferences.

Dr. **Martin Elsner** will be leaving us in January 2006 for a tenure-track position with the Young Investigators Group of the Helmholtz Association at the GSF (National Research Center for Environment and Health) in Muenchen, Germany. Martin will develop and apply compound specific isotope analysis (CSIA) for the investigation of pesticides and related organic contaminants in the environment. Martin's article "A New Concept Linking Observable Stable Isotope Fractionation of Organic Pollutants" was highlighted on the cover of the September 15th issue of the journal "Environmental Science and Technology."

U of T Geology Secures Place on IODP Expedition 311

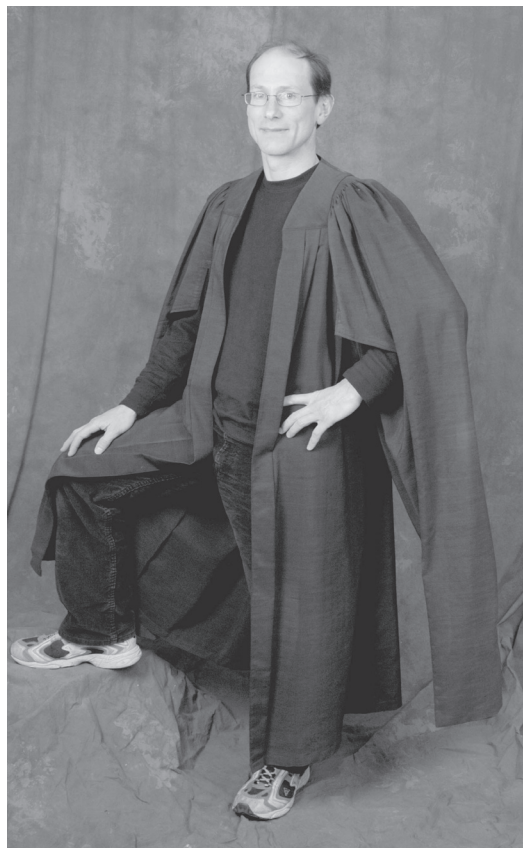
Uli Wortmann was part of an international team of scientists supported by the Integrated Ocean Drilling Program (IODP, Expedition 311) that completed a unique research cruise aimed at recovering samples of gas hydrate, an ice-like substance hidden beneath the seafloor off Canada's western coast. Gas hydrate, a mixture of water and mostly methane, is believed to occur under the world's oceans in great abundance, but it quickly "melts" once removed from the high pressure and cold temperatures of its natural environment, making it very challenging to recover and analyze. More than 1,200 meters of sediment core samples were recovered from beneath the seafloor during this 37-day expedition.

Among the discoveries of Expedition 311 was a thick section of gas hydrate lying near the seafloor surface beneath an active vent site, known as the 'bull's-eye vent,' where methane gas naturally seeps from the seafloor. This vent site is one of many similar sites observed along the Cascadia Margin and scientists are just starting to understand their role in the overall history of the margin. The episodic nature of the venting and the potential link to earthquake activity, as well as the possible impact on gas release into the ocean and atmosphere, will be researched for many years to come, when future drill site observatories will be linked with the NEPTUNE cable observatory system.



Uli Wortmann and Marta Torres (U of Oregon) showing the longest interstitial water sample in ODP history. Squeezing this 1.5 long sample, yielded about 10 ml pore water.

The Peacock Gown



James Brenan in the Peacock gown.

Martin A Peacock (1898-1950) was a professor of mineralogy in our department from 1937 until his untimely death from cancer in 1950. His international reputation derived mainly from his mastery of morphological and X-ray crystallography. The mineral pavonite (Latin pavo = peacock) was named in his honour. He was also an accomplished igneous petrologist. His impact on our science was recognized in 1962 by the publication of a GSA Memoir X-Ray Powder Data for the Ore Minerals; the Peacock Atlas, by L G Berry and R M Thompson. The Peacock Index of igneous differentiation was widely quoted in petrological texts and research papers and gave rise to the enduring term calc-alkaline. Former head/ chair Les Nuffield was Peacock's scientific executor and came into possession of his academic gown. Les gave it to Jeff Fawcett in 1980 who passed it on to James Brenan in 2002.

News of Former students and Friends of the Department

1940's

Bill Little (B.A.Sc. 1949)

As a 49 Mining Geology graduate I much enjoy Alumnni News. I have another Digger story.

Around 1951 an Australian graduate student in mineralogy came to U of T with a suite of specimens from an Australian tin mine, hoping to do a Ph.D. on them. Included were crystals of an unusual honey coloured "cassiterite" which Digger liked to use on mineral spotting tests - nobody got it right. Eventually a bright undergraduate called it "scheelite", was marked wrong, complained about it and got Digger to do an x ray powder test. It was scheelite. Digger continued to use it on spotting tests - nobody called it scheelite either.

I was working on fluid inclusions at the time under Prof. F.G. Smith comparing filling temperatures by the heating stage and decrepitation methods. The honey coloured "cassiterite" gave temperatures of about 140 C by both methods and the results were included in a note in Economic Geology. There were nasty comments. Since everyone knew that cassiterite was a "high temperature" mineral this proved that filling temperatures were meaningless. Subquent work showed that there were two stages of mineralization at this deposit - brown cassiterite, quartz and wolframite gave temperatures of about 350 C but fluorite and scheelite were in the 150 C range.

1960's

Graeme Bonham-Carter (1962-1966, M.A. and Ph.D. from U .of T., supervised by Frank Beales)

After spending 3 years as a post doc at Stanford, working on computer simulation models of sedimentary processes, I spent the next six years teaching at University of Rochester, working mainly on lake circulation models. Then followed 5 years of dairy farming in England and later in Prince Edward County, a complete break from my professional career as a geologist! I moved to Ottawa in about 1980 where I spent nearly 25 years working in the Mineral Deposits Division of GSC before retiring in April 2005. Besides journal papers, I wrote two textbooks (1970 and 1994) on computer topics. I see Eric Grunsky regularly, and he will shortly take over from me as Editor-in-Chief of Computers & Geosciences. In 1998 I received the Krumbein Medal from the International Association of Math-

ematical Geologists. This past summer I helped to organize an IAMG conference that was held at Hart House, U of T, which attracted about 250 participants from 40 countries.

I am now looking forward to spending time woodworking and traveling with my wife Gwendy Hall. I am blessed with a large family consisting of six children and twelve grandchildren, and counting.

Mike Katz (Ph.D. 1967 - Moorhouse)

I believe I was one of Wilson Moorhouse's last Ph D students before he passed away in 1960 but I kept in contact with his wife for several years.

On graduation I got a taste of the exotic by a Canadian Colombo Plan assignment at the Department of Geology, University of Ceylon where I stayed till 1970. As I say the rocks were very familiar (like the Grenville metamorphic rocks I studied) but the people and place were completely alien but became more friendly as I acquired a liking for the hot curries, cold beer and local culture. I have still retained interests in that part of the world from my Australian base, now as a part time consultant for the University of New South Wales Mining School, developing mining professional training programs in the Asia Pacific region.

1970's

Gordon Bird (Ph.D. 1971 – Fawcett) is an example of how flexible geologists are in making a career. After completing a Ph.D. thesis in experimental petrology, Gordon landed a job in the Chemistry Department of Victoria University in Wellington New Zealand as a Mineral Scientist – Geochemist. He returned to Canada six years later and worked for Atomic Energy of Canada in the Canadian Nuclear Waste Disposal Program. He then went to the Alberta Research Council where for 18 years, he conducted research in thermal heavy oil recovery and environmental technologies; eventually migrating into research management. With the exception of a short stint as an Adjunct Professor in Geology (unpaid of course!) at the University of Alberta, he never managed to land a job that was in a Geology Department. His career provided many opportunities for business travel and he worked on private sector or government sponsored projects in some 16 different countries. In 2000, he took early retirement and moved to Prince Edward Island where he and his wife Jan started a Bed and Breakfast (www.peisland.com/birdseyeview). Retirement was not very suitable to his personality and two years later he went to back to work at the University of Prince Edward Island as the Technology Transfer and Industry Liaison Manager.

Joe Arengi (M.Sc. 1974-77; P. Geo. Supervisor: Frank Beales)

My professional career began with an 8 year stay with Derry, Michener, Booth and Wahl followed by a few years as a roving consulting geologist based out of Toronto. I made a brief career shift to hydrogeology during the exploration downturn in the early 1990's but was born again in 1995. Since that time I have worked mainly in Latin America getting acquainted with Tertiary epithermal gold systems. I am currently working for Aur Resources looking for acquisition opportunities in northern South America, Central America and the Caribbean with occasional forays into the southwest US, Africa and Europe. My fondest memory was meeting and working with Frank Beales. My worst memory – too many nights at the Brunswick Tavern.

Hugh Willson (B.Sc. 1974, M.Sc. 1979)

Vice President – Exploration, Capstone Mining Corp. Hugh Willson, is a professional geologist with a M.Sc. from the University of Toronto. His 30 years of hands-on experience as an exploration geologist throughout the Americas, have given him extensive skills in the management of all phases of exploration for base and precious metals. The companies for which Mr. Willson has worked include Hanna Mining, Getty Minerals, Newmont Mining, FMC Gold, Hecla Mining, Magma Copper and Cyprus Mining. He was part of the three-man team that identified the exploration target that became the Peñon Mine. Mr. Willson supervises Capstone's exploration programs which are located in Mexico.

Paul Bennett (B.Sc. 1972, M.Sc. 1974 - Schwerdtner)

I walked over to the new Dept. recently – very impressive. I was in shock when I looked at the photo in the main hall of the Geology Staff – all but one of my professors is now “emeritus”! Must be getting old. Since I talked with you last I've retired from ExxonMobil – almost 31 years! I turned 55 in June and retired in August last year. I immediately started my own little oil and gas company – at least that's what it's supposed to be. It's turned out to be more of a geoscience consulting company, but what the heck – go with the flow eh. I'm also on the board of Uranium Participation Corp., a company affiliated with Denison Mines. that buys and holds U₃O₈. Paul J. Bennett, President and CEO, Energus Resources Ltd; paul.bennett@energus.ca

Craig Jowett (B.A.Sc. 1972 Geological Engineering; M.Sc. 1977 Geology; Ph.D. 1986 Geology - Robin)

Robin Jowett (B.Sc. 1970's)

Thanks very much for your kind words about our success with Biofilters, but as for the picture in the Star, air-brush-

ing is a wonderful invention that takes out all the rumples. Yes, Robin and I have had a good run at things over the years, and we're doing well, and it shows that a flexible U of T education provides you with the opportunity to change with the weather. Our daughter Katie just graduated from U of T (Victoria) in Architecture Specialty Fine Art major and is now working with an architectural company in Downsview. She went with me to Dubai for a trade show, and because she wanted to see all the wondrous architecture there. She will do something in the graduate school area, perhaps an MBA in real estate, or architecture or something. Chris is on his 5th co-op work term in Systems Design Engineering at Waterloo, and doing well in that difficult discipline, and is looking forward to being an ‘entrepreneur’.

1980's

Martin Head (PDF/RA 1985-1999 - Norris group)

Having spent 6 years in the Department of Geography at the University of Cambridge, Martin, his wife Sarah, and their two children, Jamie (9) and Caroline (6) are now back in southern Ontario where Martin has taken up a full professorship at Brock University in the Department of Earth Sciences. He maintains an active interest in Cambridge and holds honorary positions at Wolfson College and the Department of Geography. mjhead@brocku.ca.”

Shuji Yoshida (Ph.D. 1998 - Miall) has left the University of Texas (Austin) and has been appointed to a permanent position as Associate Professor at Chiba University in Japan.

John Thompson (M.Sc. 1978; Ph.D. 1982 - Naldrett)

82-91: BP Minerals, Kennecott and related companies – Australia, UK and USA
91-98: Director, Mineral Deposit Research Unit, UBC
98-05: Chief Geoscientist, Teck Cominco
05-: VP Technology, Teck Cominco

Memories: Geophysics-Geology soccer games (Geology won – I think!); clanking pipes above my desk in the Mining Building; Rock Festivals on Friday afternoon; people.

Anne Brackmann (Thompson): (M.Sc. 1984)

84-86: BP Minerals Australia
86-92: Independent consultant-researcher
92-: President, Petrascience Consultants
Memories: Frisbee; beer runs; finishing my thesis in a caravan in Western Australia (pre-internet!); people.

Eric Grunsky (B.Sc. 1973; M.Sc. 1978; Ph.D, Ottawa 1988)

During my career I have worked in a variety of capacities

including geological mapping, the application of statistical techniques for process recognition in geochemical data, radar satellite imagery for remote mapping and geoscience information management. I've had the opportunity to work for the Ontario, British Columbia and Alberta geological surveys all of which were great working experiences. I also worked for three years at CSIRO in Perth, Western Australia. Currently, I am situated in Ottawa with the Geological Survey of Canada. Earlier this year I was awarded the Felix Chayes prize for "Excellence in Research in Mathematical Petrology" by the International Association for Mathematical Geology in recognition of my work using statistical methods for identifying geological processes from geochemical data.

I was married to Jean Hubay in 1988 and we have two children, Kurt and Anna, two bright sparks in our lives.

My years at the Department of Geology were truly enriching. During my time at the department, the late Professor Gordon Smith acted as my mentor. Professor Smith, one of the pioneers of numerical applications in the geosciences had a great influence on the direction that I took in my career. I also benefitted from the support and encouragement from my M.Sc. supervisors, Professors Fried Schwerdtner, Pierre Robin and Dick Bailey. I made many lasting friendships while I was at the department and I look forward to meeting many of them at the PDAC in Toronto each year.
email: egrunsky@nrcan.gc.ca



Eric Grunsky

1990's

Elizabeth Turner (B.Sc. 1991)

To make it short... I completed a protracted but ultimately very productive Ph.D. at Queen's on Precambrian carbonates in 1999, and followed that with a post-doc at University of Alberta on peculiar carbonate dendrites forming in modern cold springs. (It's all about mucus.... mmmm, mucus.) In 2001, I accepted a position at the GSC's (then) new branch in Iqaluit (the Canada-Nunavut Geoscience Office), where

I worked on regional controls on base metal mineralisation in the Cornwallis (Polaris mine) and Borden Basin (Nanisivik mine) Zn-Pb districts. Predictably, fossils and carbonate lithofacies have a lot more to tell us about why carbonate-hosted base-metals are where they are than anyone ever expected! In January 2005, I joined the Department of Earth Sciences at Laurentian University in lovely Sudbury, where I am considered a paleontologist rather than an economic geologist.

Bruce Jago (Ph.D. 1991 - Gittins).

I began Ph.D. studies with Dr. Gittins in 1985 as a resident of a very cold basement office just outside of the High Pressure Lab. My office and the hallway soon became a second home to Seamus, the beautiful collie-lab mix that I am standing beside in the departmental newsletter photo published just before the PDAC last year. Sudbury became our next home with an exciting job working for Inco (1991-1998), one that ultimately was to take our family to Brazil for 1½ years, a move that would be cut short by Bre-X and historically low base metal prices. Lakefield Research soon beckoned (1998-2004); I currently work for Temex Resources managing their diamond projects in Nunavut and the Temagami area of Northeastern Ontario and reside in Peterborough, Ontario with my wife Mary and teens Caitlin and Emily.

Heather Macdonald (B.Sc. 1997; M.Sc. 1999 - Naldrett)

I attended UTM (general science program) 1991-1992, joined the geology department 1993-1997 for a B.Sc. and completed my M.Sc. in 1999 (1997-1999). **Troy Small** (M.Sc. geology department 1998-2000 with Grant Ferris) and I married in 2001 and we're currently living in Troy's hometown of Fredericton, NB. Troy and I both are working with CRA, an engineering and environmental consulting company based out of Waterloo, ON.

Fond memories of the department include the holiday potluck parties in the Rockfest room and the trips to Venezuela and Chile...a not-so-fond memory is breaking my foot while dancing at the semi-formal dinner/Tony Naldrett's (my M.Sc. supervisor) retirement party.

Gang Chai (Ph.D. 1992 - Naldrett)

1992-1994 Visiting Fellow: Geological Survey of Canada (Origin of Sudbury Ni-Cu deposits)
1994-Present: Business Consultant: Investment in China mining industry
1997 Founder & CEO: McVicar Minerals Ltd. (Listed in the TSX Venture Exchange)
April 2003 -2004: President: Hanfeng Evergreen Inc. (TSX) Events remembered: Rock-fest; Department field trips; I miss those exciting days in the department.

2000's

Vernon Phoenix (PDF 2001-2003 - Ferris)

Vern joined Grant Ferris's Microbial Geochemistry Group (www.geomicrobiology.ca) as a postdoctoral fellow in 2001, after completing a B.Sc. in geology at Aberystwyth (UK) and an M.Sc. and Ph.D. at Leeds (UK). Vern's research interests range from understanding the impact of bacteria on the geochemistry of natural environments, to investigating survival mechanisms utilized by phototrophs on the hostile early Earth. Vern is currently an RCUK Academic Fellow at the Department of Geographical and Earth Sciences, University of Glasgow (UK).

Flavia Nunes (B.Sc. 2002)

The prestigious journal Nature recently published a paper jointly authored by Flavia and her U of California San Diego supervisor Richard Norris on ocean circulation models.

<http://www.nature.com/news/2006/060102/full/060102-5.html>

Newsletter Prize

One of the most attractive features of a career in geology is the potential for worldwide travel and the likelihood of working anywhere in Canada and of living in almost any country in the world.

Where do you think our graduates now reside? This year's Newsletter prize will go to the person who can give the most accurate estimate (guess?) of the distribution of alumni between Canadian and non Canadian addresses.

Entries should be sent to the Newsletter editor at the address below. As usual, the prize of two free beers will be given to the winner at the U of T PDAC Reception, March 7, 2006.

Previous Prize Winners

In response to several queries the mystery photograph in Issue #13 was the disused outhouse at the Tweed Field Camp (winner Henry Halls) and Brenda Kerr (Geology Main Office) gave 80% correct identifications for last year's photo – the last geology residents of the Mining Building; Michele Cote and Lori Wilkinson combined to take second place.

In Remembrance

We note, with regret, the following:

Catherine Nigrini – (B.Sc. 1962; Ph.D. Cambridge 1966).

Eleanor Moorhouse, at age 90, wife of the late Professor Wilson Moorhouse who died in 1969. For many years Eleanor kept up an interest in the Department – particularly in the lives of her husband's contemporaries. She attended our 150th Anniversary Dinner in 1998 and, over the years, attended several of the lunches for retired faculty.

Walter Tovell



Walter, a former Director of the R.O.M., graduated in 1940 and went on to get his M.Sc. and Ph.D. from Cal. Tech. He was cross appointed to our department for many years, teaching a variety of undergraduate courses. Many former students will particularly remember him as an instructor at the Third Year Tweed Field Camp, together with Digger Gorman, Jack Currie and Peter Peach.

Following his retirement, Walter gave a great deal of his time to natural history and conservation groups of southern Ontario, especially those related to the Niagara Escarpment area.

Photo above: Walter Tovell in 1975 - with permission of the Royal Ontario Museum © ROM



1994 Group Photo on the courtyard steps of the Earth Science Centre.

The Alumni Newsletter was compiled and edited by Jeff Fawcett and prepared for printing by Karyn Gorra. We are grateful to Sandy Cruden, Jim Mungall, Nick Eyles, Barbara Sherwood Lollar, and Uli Wortmann for their contributions and to the various editors of FRED, our (sometimes) weekly newsheet that was the source for some information. Thanks, too, to the alumni who sent letters and biographical notes.

Comments and contributions are most welcome – especially news of former students. Send your contribution by regular mail or e-mail.

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