The Geochemical News

Newsletter of The Geochemical Society

in cooperation with The European Association of Geochemistry

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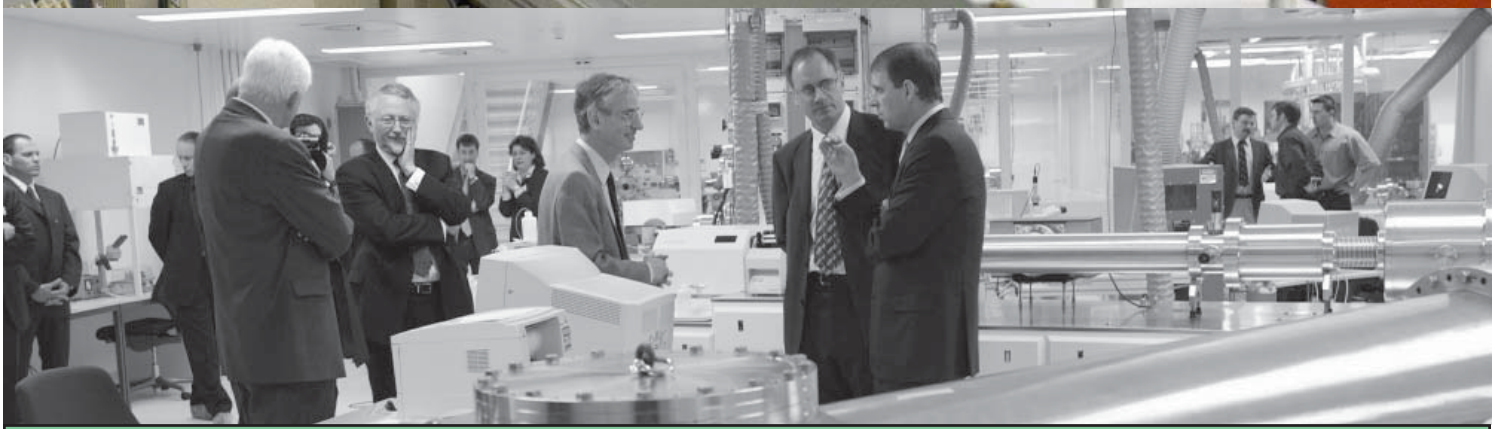
HRH Prince Andrew launches the ETH Radiogenic Isotope Geochemistry Laboratory (see page X)



2002 V. M. Goldschmidt Conference - *From Stars to Life*

Davos, Switzerland - 18-23 August 2002

The Geochemical Society

The **Geochemical Society** is a nonprofit scientific society founded to encourage the application of chemistry to the solution of geological and cosmological problems. Membership is international and diverse in background, encompassing such fields as organic geochemistry, high- and low-temperature geochemistry, petrology, meteoritics, fluid-rock interaction, and isotope geochemistry. The Society produces a ***Special Publications Series***, ***The Geochemical News*** (this quarterly newsletter), the ***Reviews in Mineralogy and Geochemistry Series*** (jointly with the Mineralogical Society of America), the journal ***Geochimica et Cosmochimica Acta*** (jointly with the Meteoritical Society), and co-publishes the electronic journal ***G³*** (jointly with the American Geophysical Union: AGU); grants the ***V.M. Goldschmidt***, ***F.W. Clarke*** and ***Clair C. Patterson Awards***, and, jointly with the European Association of Geochemistry (EAG), the Geochemistry Fellows title; sponsors the V.M. Goldschmidt Conference, held in North America in odd years and elsewhere in even years, jointly with the EAG; and co-sponsors the Geological Society of America annual meeting and the AGU spring meeting. The Society honors our first President, F. Earl Ingerson, and our first Goldschmidt Medalist, Paul W. Gast, with the ***Ingerson*** and ***Gast Lectures***, held annually at the GSA Meeting and the V.M. Goldschmidt Conference, respectively. The Geochemical Society is affiliated with the American Association for the Advancement of Science and the International Union of Geological Sciences.

Members of the Organic Geochemistry Division are individuals with interests in studies on the origin, nature, geochemical significance, and behavior during diagenesis and catagenesis of naturally occurring organic substances in the Earth, and of extraterrestrial organic matter. GS members may choose to be affiliated with the OGD without any additional dues. The OGD presents the **Alfred E. Treibs Award** for major achievements in organic geochemistry, and **Best Paper** awards (student and professional) in organic geochemistry.

The Geochemical News
July 2002

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COVER: ZRIGL OPENS

Upper photo: Uwe Wiechert demonstrates ultraviolet wavelength laser ablation to His Royal Highness Prince Andrew The Duke of York. In this GN issue Alex Halliday describes the facility and explains some of its special features. Photo credit: Reuters News Service.

Lower photo: His Royal Highness Prince Andrew The Duke of York (seen here talking with Dr. Phil Freedman who designed the Nu 1700) opened ZRIGL on the 21st March 2002.

Postmaster: Send address changes to The Geochemical Society, Dept of Earth and Planetary Sciences, Washington University, One Brookings Drive, St. Louis, MO 63130-4899, USA.

From the President:

The 2002 Goldschmidt Conference —"From Stars to Life"

Summertime has arrived in Switzerland. The season of long summer evenings with endless twilight is upon us. High up in the alpine valleys, the meadows are full of wildflowers, and the melodic sound of cowbells echoes from each and every alp. Rushing melt water cascades down the mountainsides providing the background accompaniment for this pastoral concert. Indeed, Nature's preparations are well underway to provide an ideal setting for the upcoming 12th Annual Goldschmidt Conference to be held in Davos, Switzerland from 18 to 23 August 2002.

Additionally, Paul Beattie, Cambridge Publications, informs me that the scientific and technical preparation for the Conference is well on track. A total of 1750 abstracts were submitted by the 1st May deadline. 58 general and special symposia, set up by more than 45 teams of geochemists, have been scheduled to accommodate the large number of abstracts, almost double that of previous years. There will be 1175 oral presentations scheduled daily into 10 parallel sessions, as well as 575 poster presentations. All oral and poster presentations will be located in the same building of the Davos Congress Centre. This arrangement

will permit easy movement between talks and poster displays. Talks will be held in comfortable lecture theaters with modern technical facilities. The scientific program will include more than 75 keynote speakers and 150 invited speakers. About 10 selected presentations will be published as special "EPSL Frontiers" papers.

Highlights of the conference will include four plenary lectures: (1) EAG Presidential Lecture: Francis Albarède, "A New Era for Isotopic Analysis", (2) Gast Lecture: Patricia Dove, "Deciphering the Physical Basis of Biomineralization through the Lens of Mineral Assembly", (3) Goldschmidt Medallist Lecture: John Hayes,""Isotopic Order, Biogeochemical Processes, and Earth History", and (4) Urey Medallist Lecturer: Grenville Turner,""In Praise of Idleness".

Scientific exchange will not be limited to time spent at the Davos Congress Centre. Delegates will have the opportunity to interact on 2 pre-conference and 6 post-conferences field trips. A range of options for activities is planned for the free Tuesday afternoon. Further, there will be a conference banquet and Traditional Swiss Alpine evening on Rinerhorn, as well as an opening "apéro" or ice-breaker, drinks during poster sessions and (most importantly for those who stay through to the closing sessions) a farewell party.

Cambridge Publications will publish the abstracts as a special supplement to *Geochimica et Cosmochimica Acta*. Delegates will be given a copy of this volume, as well as receiving the printed program volume and the abstracts and program on CD-ROM. And, as a special gift, a Rubik's Cube will be included with each registration package. If you have not, as yet, registered, the deadline for the reduced price registration is 18th July. Afterwards, it will still be possible to register, but at a higher price, and a one-day registration will be available on site at the Conference. The registration procedure has been amended to allow delegates to join GS/EAG, without paying the journal rates, over the website (http://www.goldschmidt-conference.com/2002/gold2002/). All of the above, combined with the beautiful Swiss alpine environment and the friendly hospitality found in Davos, will surely make your participation in the 12th Annual Goldschmidt Conference a memorable scientific and cultural experience.

Thanks to Outgoing Committee Members

The 1st of July is the date when new members join the various committees of The Geochemical Society, replacing those who have completed their 3-year terms. The new composition of the committees is published on page 7 of this issue of the Newsletter. To the retiring committee members:

David Lambert and Lisa Pratt, F.W. Clarke Award Committee
Laura Sigg and Bernard Wood, V.M. Goldschmidt Award Committee
Harry Elderfield and Lynn Walter, Clair C. Patterson Award Committee
Richard Murray and Eva Valsami-Jones, Nominations Committee
Patrick Brady, David Cole and John Kaszuba, Program Committee

I would like to take this opportunity to recognize your important service to the geochemical community and thank you for the time and effort you have devoted to the activities of your respective committees. For those of you who would like to more actively participate in The Geochemical Society and have not, as yet, been tapped to serve on one of the committees, remember to express your interest on next year's dues form.

Geochimica et Cosmochimica Acta

I am most pleased to announce that Frank Podesk's position as the Executive Editor of *Geochimica et Cosmochimica Acta* will be renewed for a second 3-year term starting January 1, 2003. Since assuming the editorship, Frank has revolutionized the GCA editorial office, greatly improved the efficiency of the manuscript handling by instituting electronic manuscript handling and has had a superb editorial record, being always consistent and fair. In view of his considerable service to the both geochemical and cosmochemical communities, the Board of Directors of the Geochemical Society and the Council of the Meteoritical Society have voted overwhelmingly to endorse his reappointment as Executive Editor. And, Frank has willingly volunteered to carry on for another term! I am sure you will concur with me that we are most grateful for his agreement to a reappointment for 3 more years and wish him continued energy and enthusiasm to undertake this immense and important task.

The State of Geochemistry

In closing, I would like to call your attention to the article by Alex Halliday on pages 9 - 13 of this issue, in which he outlines the exciting multi-facetted approach to scientific problems using radiogenic isotopes that is currently applied in the laboratory he heads at the ETH-Zürich. His list of problems for which isotopes, i.e. geochemistry, can offer solutions appears to be unlimited. Indeed, the scientific activities underway in the Zürich lab are just a reflection of the extensive breadth of topics to be covered at the 2002 Goldschmidt Conference. The large number of abstracts on a wide range of geologic problems that have been submitted for the Conference by geochemists from around the world is most encouraging. It is a strong indication that the field of geochemistry, whether low, high or intermediate, is alive and well. I am personally looking forward to an exciting Conference and to meeting you in Davos. I wish you a pleasant journey.

With best wishes,

Judith A. McKenzie
GS President

Editor's Corner...

In honor of this year's V. M. Goldschmidt Conference venue in Switzerland, this issue of GN features the new **ETH Radiogenic Isotope Geochemistry Laboratory (ZRIGL)** in Zürich, Switzerland. This new state-of-the-art research facility opened on 21 March 2002, in an official ceremony presided over by His Royal Highness Prince Andrew The Duke of York. As a member of the ETH constellation of premier science laboratories, the new ZRIGL promises to set a new standard in cutting-edge radioisotope geochemistry. This month in GN we offer an introduction to ZRIGL by Alex Halliday.

Alongside ZRIGL, this GN issue showcases melt and fluid-inclusion research at Vrije Universiteit, Amsterdam, The Netherlands. Melt inclusions are informative windows into the petrogenetic history of igneous rocks; their snapshots of melt chemistry at the time of bulk crystallization allow petrologists to deconvolve the evolution of their enclosing matrix. Until his recent retirement Jacques Touret led pioneering melt inclusion research at Vrije Universiteit. His legacy at Vrije Universiteit and that of his co-workers and students occupies this month's feature **Bubbles in Amsterdam, b**y associate GN editor Angelina Souren.

We hope to see many of you at the 2002 GoldschmidtConf erence in Davos. Please don't hesitate to seek us out if you have any suggestions for GN articles or improvements.

Regards,

Johnson R. Haas
Carla Koretsky
Editors

Mineralogical Society of America

Short Courses

Phosphates: Geochemical, Isotopic, and Materials Importance. October 26-27, 2002, Golden, CO - preceding the 2002 GSA Denver Meeting. Convenors: *John M. Hughes, Matthew Kohn, and John Rakovan.*

Plastic Deformation of Minerals and Rocks. December 4 and 5 2002, Emeryville, CA - preceding the 2002 American Geophysical Union Meeting. Convenors: *Shun-ichiro Karato, Hans-Rudolf Wenk.*

More information about these short courses and online registration are available from the MSA website (www.minsocam.org) or from the 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.

The Mineralogical Society of America

is extending its deadline for nominations for the 2003 MSA Award

www.minsocam.org/MSA/MSA_Award.html

Please send all nomination materials by June 15 to the MSA Award Committee Chair:

Kathryn L. Nagy
University of Colorado at Boulder
Department of Geological Sciences
399 UCB
Boulder, CO 80309-0399
USA

e-mail: nagyk@spot.colorado.edu
Ph.: (303) 492-6187
fax: (303) 492-2606

The Mineralogical Society of America (MSA) Award is intended to recognize outstanding published contributions to the science of mineralogy by relatively young individuals or individuals near the beginning of their professional careers. The work must have been accomplished either [1] before the age of 35 or [2] within 7 years of the awarding of the terminal degree. If the former, the candidate must be younger than 37 on January 1 of the year the award is decided. If the latter, the award must be decided prior to December 31 of the seventh year past the terminal degree.

Mineralogy is broadly defined and the candidate need not qualify as a mineralogist nor be a member of the MSA. Rather, her/his published record should be related to the mineralogical sciences and should make some outstanding contribution to them.

Nominations for the award consist of the completed Nomination Checklist, a cover letter from the nominator outlining the candidate's qualifications in light of the criteria for the award, and a full list of the nominee's publications. The Nomination Checklist is available either online as an html , text , pdf , or MicroSoft Word file that you may copy from the screen or download to complete, or by mail from the MSA Business Office. Supporting letters from at least three (3) but no more than five (5) other individuals are required and should focus on how the candidate meets the criteria of the award. Supplementary materials, such as an abbreviated curriculum vitae and a selected bibliography of 20 titles or less that bear on the award criteria may also be submitted. The completed nomination package must be received by June 1 for consideration by the Committee for the following year's award. Nominations can be carried over to following years if the sponsor updates the nomination package. Any nomination not renewed after 2 years will be not considered further.

The next award will be decided on in 2002. Thus the awardee's birth date must be on or after January 1, 1965 or the terminal degree must have been awarded on or after January 1, 1996.

We would appreciate if the nominator, and all individuals writing letters of support, would send one original and a readable electronic version of their correspondence to the Committee Chair. In that way much of the committee work can then be done by e-mail. This makes it easier and less expensive for the committee members, who are increasingly international, to do their work. Otherwise, the original and 7 copies of the complete nomination package should be sent to the Committee chair.

Geochemical Society Business Office News

Membership

New memberships and late renewals are tapering down as the year advances. Currently there are 1,482 active members. If you have associates that are going to the Goldschmidt conference in Davos, please remind them that they get a registration fee discount if they are members of the Geochemical Society.

Subscription

It appears that many subscribers did not receive GCA v.66 issue 6 (March 2002). After some investigation with Elsevier Science, we uncovered and corrected some discrepancies between the labels being submitted and those that were mailed. Two of these were special character omissions (like Université de Genève would have appeared like Universit de Geneve) and the other was that the length of the postal code/city line was limited to 15 characters (thus, DK-1350 Copenhagen would have appeared as DK-1350 Copenha), or in some cases this line had been omitted all together.

If you are missing some of your GCA issues please let me know as soon as possible so I can get the back issue requests in to Elsevier and get this problem resolved quickly. In the meantime, all GCA subscribers have access to GCA on-line, so you still have access to all the latest issues.

Publication

Special Publication Volume 7 is in stock and pre-orders have been filled. If you'd like to order your copy send in the order form appearing elsewhere in this newsletter.

Website

Do not forget to check back with the GS website regularly for announcements, conference listings, membership directory, and more. We are still working to have a secure on-line system in place for membership and publications, and hope to have that running in the near future.

Conferences

Yet another reminder that Goldschmidt 2002 in Davos, Swizterland is just around the corner. The conference website is:

http://www.goldschmidt-conference.com/2002/gold2002/.

Also, if you have a conference that you'd like listed in GN or on the website, please be sure to include a web site for conference announcements. Only conferences with web sites will be posted on the website conference listings page.

Please let me know if you have any questions or comments regarding your Society.

Cheers,

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Letters to the Editors

Geochemistry in a Sustainable World

The amount of the geochemical work pursued today is very great. To be convinced, one need look only at the flagship publication of this society: 24 issues and 4,596 pages in GCA vol. 65 (2001). Members of the Society and all readers of Geochimica can recognize the quality of the technical work that goes into these and the many other geochemically-related publications now available. The level of both "pure" and "applied" science is high, and much of it is important to the myriad problems that might be classified as related to "sustainability".

Yet there is an issue that we do not seem to address often or openly: how is geochemistry being carried to parts of the world that do not have access to financial resources that most - or all - of us assume as part of our daily lives? Why raise this question now? There are two triggers: The recently announced pre-publication price of the Treatise on Geochemistry: US$3675. Final plans are being made to meet for the 2002 Goldschmidt Conference in Davos. I have communicated with Elsevier about publishing costs; Mr. L. Friso Veenstra can explain the cost quite clearly in terms of the size and unit elements of such an undertaking. And I enjoy meeting in nice places as much as anyone. And yet ...

Consider for a moment a single country that I happen to know a bit and like very much: Indonesia. Currently, the Rupiah stands at about R.10,000 to US$1. (Incidentally -but also importantly - in 1995 it was approximately R.2000/US$1.) Travel to Switzerland for a week is simply not plausible, and, at that exchange rate, the Treatise would cost R. 37 Million. Forget exchange rates: by the time one gets into a million units of any currency, we're talking about real money. This certainly is beyond the means of any individual in Indonesia (and probably of any student anywhere in the world). Even a fine university, such as Institut Teknologi Bandung, probably would be pushed beyond its limits to make such a purchase for its library. Much the same could be said for dozens of countries from Bolivia to Papua New Guinea, and for not a few even outside the South.

Is the world economy the responsibility of the Geochemical Society? Obviously not. But ought we to (a) discuss among ourselves the implications of our actions, and (b) see if amongst our various resources - intellectual and otherwise - we geochemists can fashion some ways of working in the broader world? Now that's quite a different question, but also, at least arguably, a part of possible meanings of sustainability.

Here are a few suggestions:

Could the Society negotiate an arrangement with Elsevier that would allow an individual member to sponsor a new member in a Third World country and allow that new member to donate her membership-copy of GCA for library use?

Could the Executive Committee explore ways of generating funds to support Third World members, especially students?

Could the Society consider holding Goldschmidt Conferences under more modest circumstances than in several recent years, for both symbolic and practical purposes?

Respectfully submitted,

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Division Name Compromise Applauded

I am writing to acknowledge with thanks Keith Kvenvolden's Letter to the Editors in the January 2002 Issue of the Geochemical News. I applaud his compromise suggestion that the Organic Geochemistry Division of the Geochemical Society be renamed the Biogeochemistry Division. However, to make sure that such a name change is not simply cosmetic, I think a Council to advise the Chair should be established by the Division that is representative of the wide spectrum of interests in Biogeochemistry today. The question now is, how are any such changes to be implemented?

Harold Helgeson
Department of Earth and Planetary Science
307 McCone Hall, MC4767
College of Letters and Science
Berkeley, CA 94720

Special Session Announcement

Microbial Sulfur Transformations Throughout Earth's History: Development, Changes, and Future of the Biogeochemical Sulfur Cycle

Topical Session (T30)

Geological Society of America
Annual Meeting
27-30 October, 2002
Denver, Colorado

Contact:

Jan Amend
amend@levee.wustl.edu

Katrina Edwards
kedwards@whoi.edu

GEOCHEMICAL SOCIETY NEWS:

COMMITTEE MEMBERSHIPS: All proposed new members and chairs have agreed to serve.

F.W. Clarke Award Committee - Peggy Delaney to continue as chair

New members:

Janet S. Herman
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Continuing Members:
M. L. Delaney
A. N. Halliday
C. M. Bethke
P. van Cappellen

V.M. Goldschmidt Award Committee - Lee Kump to take over as chair

New members:

Richard W. Carlson
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Continuing Members:
R. A. Berner
S. R. Hart
L. R. Kump
F. Albarède (President EAG)

Nominations Committee - Jan Veizer to take over as chair

New members:

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J. Veizer
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Program Committee - Marty Goldhaber to take over as chair

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Clair C. Patterson Award Committee - Erwin Suess to take over as chair

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Continuing Members:
K. Kornhauser
C. Lee
F. Millero
E. Suess

NEW FROM THE GEOCHEMICAL SOCIETY

SPECIAL PUBLICATION NO. 7

Water-Rock Interactions, Ore Deposits, and Environmental Geochemistry: A tribute to David A. Crerar

edited by R. Hellmann and S.A. Wood

This volume is now available to members of the Geochemical Society at the bargain price of $55 ($80 for non-members). Only a limited number of volumes have been published so don't miss out! An order form is available elsewhere in this newsletter. The volume includes the following papers:

William J. Ullman and Susan A. Welch: Organic ligands and feldspar dissolution

Art F. White, Alex E. Blum, Marjorie S. Schulz, Thomas G. Huntington, Norman E. Peters, and David A. Stonestrom: Chemical weathering of the Panola granite: solute and regolith elemental fluxes and the weathering rate of biotite

Sherry D. Samson and Carrick M. Eggleston: Nonsteady-state dissolution of goethite and hematite in response to pH jumps: the role of adsorbed Fe(III)

Clarence D. Chang, Cynthia T.-W. Chu, and John L. Schlenker: Corrosion forms and twinning in zeolite ZSM-5 crystals

Nathan P. Mellott, Susan L. Brantley, and Carlo G. Pantano: Topography of polished plates of albite crystal and glass during dissolution

Dirk Bosbach: Linking molecular scale barite pricipitation mechanisms with macroscopic crystal growth rates

Steven R. Higgins, Andrew G. Stack, Kevin G. Knauss, Carrick M. Eggleston, and Guntram Jordan: Probing molecular-scale adsorption and dissolution-growth processes using nonlinear optical and scanning probe methods suitable for hydrothermal applications

R. Hellmann, Peter J.N. Renders, Jean-Pierre Gratier, and Robert Guiguet: Experimental pressure solution compaction of chalk in aqueous solutions Part 1. Deformation behavior and chemistry

R. Hellmann, Patrick Gaviglio, Peter J.N. Renders, Jean-Pierre Gratier, Samir Békri, and Pierre Adler: Experimental pressure solution compaction of chalk in aqueous solutions Part 2. Deformation examined by SEM, porosimetry, synthetic permeability, and X-ray computerized tomography

Greg M. Anderson: Stable and metastable equilibrium: The third constraint.

Christopher H. Gammons, Scott A. Wood, and Youning Li: Complexation of the rare earth elements with aqueous chloride at 200°C and 300°C and saturated water vapor pressure.

R. Ding and Scott A. Wood: The aqueous geochemistry of the rare earth elements and yttrium. Part X. Potentiometric determination of stability constants of acetate complexes of La^{3+}, Nd^{3+}, Gd^{3+} and Yb^{3+} at 25-70º C and 1 bar.

Scott A. Wood, Donald A. Palmer, David J. Wesolowski, and Pascale Bénézeth: The aqueous geochemistry of the rare earth elements and yttrium. Part XI. The solubility of $Nd(OH)_3$ and hydrolysis of Nd^{3+} from 30 to 290º C at saturated water vapor pressure with *in-situ* pH_m measurement.

William E. Seyfried, Jr., Kang Ding, and Bin Rao: Experimental calibration of metastable plagioclase-epidote-fluid equilibria at elevated temperatures and pressures: applications to the chemistry of hydrothermal fluids at mid-ocean ridges.

A.E. Williams-Jones, Art. A. Migdisov, S.M. Archibald, and Z. Xiao: Vapor-transport of ore metals.

C. Wahrenberger, T.M. Seward and V. Dietrich: Volatile trace element transport in high temperature gases from Kudriavy volcano (Iturup, Kurile Islands, Russia).

B. A. MacMurray and Greg M. Anderson: A fluid-inclusion study of the drusy quartz of the Potosi Dolostone, Southeast Missouri.

Christopher J. Tadanier, John C. Little, Duane F. Berry, and Michael F. Hochella, Jr.: Microbial acquisition of nutrients from mineral surfaces

Jeremy B. Fein: The effects of ternary surface complexes on the adsorption of metal cations and organic acids onto mineral surfaces

Peter R. Jaffé, Sookyun Wang, Peter L. Kallin, and Sherwood L. Smith: The dynamics of arsenic in saturated porous media: fate and transport modeling for deep aquatic sediments, wetland sediments, and groundwater environments

David M. Tuck: Primary drainage of NAPL governed by time-dependent interfacial properties.

Uta Gabriel, Laurent Charlet, and Carl W. Schläpfer: In situ speciation of uranium(VI) at the silica-water interface: A combined TRLIFS and surface complexation study

C.M. Hansel, M. J. La Force, S. Sutton, and S.E. Fendorf: Ecosystem dynamics of zinc and manganese within a mine-waste impacted wetland.

ZRIGL - The ETH Radiogenic Isotope Geochemistry Laboratory in Zürich, Switzerland

by Alex Halliday

ZRIGL is a large, new, multi-facetted isotope geochemistry laboratory with a substantial team and research program studying a considerable array of scientific problems ("from stars to life"). A part of the Department of Earth Sciences at ETH Zürich, it represents further expansion of the pioneering research programs of Peter Signer and Ruedi Steiger, now retired. The new laboratory occupies more than 600 square meters. An experienced team of scientists plus support staff share responsibility for running ZRIGL. With PhD students included the facility has about 40 people. Furthermore, the facility is "networked" with the research of more than 50 collaborators worldwide. Particularly strong collaborations exist within Switzerland. In addition to the collaborations with other ETH scientists, ZRIGL has very close links with EAWAG (the Swiss water resources unit), with geologists at the University of Geneva and with glaciologists, environmental physicists and space physicists at the University of Bern.

Expansion of isotope geochemistry

Recently, there have been major technological developments in isotope geochemistry, in particular in the field of multiple collector ICPMS. ZRIGL is taking the lead with some of this development. A few years ago laboratories like ZRIGL had the ability to extract useful information from a few elements. Now virtually the entire isotopic periodic table is being exploited. Also, isotope geochemistry is being used to address an ever-broader range of scientific issues. ZRIGL scientists study problems as different as the origin of the sun, mantle volatiles, sea level change, and the migration of Ötzi, the Neolithic ice man.

Expansion of isotope geochemistry at ETH

Three distinct mass spectrometric methods are deployed:

Thermal ionization mass spectrometry (TIMS) – for analyzing small quantities of elements or compounds that ionize easily (such as alkalis and alkaline earths). Our TIMS instrument is used for a mixture of conventional geochronology and for negative ion osmium (Os) and tungsten (W) isotopic research.

Static gas source mass spectrometry (NOGMS) – for the analysis of noble gases, using unique high sensitivity and selective sampling techniques. There are 6 noble gas mass spectrometers for a range of studies from the early solar system to climate and water resources. Most of these instruments are designed and built by ZRIGL.

Multiple collector inductively coupled plasma mass spectrometry (MC-ICPMS) – for analyzing elements with high first ionization potential, and for certain in-situ techniques using laser ablation. The development of MC-ICPMS represents a kind of analytical *revolution* in mass spectrometry. It is in fact the biggest change in decades in our ability to measure the isotopic composition of most elements. ZRIGL houses two Nu Instruments Nu Plasma mass spectrometers and one Nu 1700 – the world's first large geometry MC-ICPMS.

With the development of MC-ICPMS the scientific focus of much of isotope geochemistry has been evolving rapidly…new areas of environmental, planetary and biological research are being developed worldwide. To take advantage of these opportunities the mandate of ZRIGL also has expanded and is now focussed in many different directions. The main areas are the origin of the solar system, planetary science, ocean chemistry, erosion and climate, lakes and groundwater, sea-level and ocean circulation and natural isotopic fractionation in heavy elements. However, ZRIGL also has research programs studying the early earth, tectonics, biogeochemistry, magma chambers and the development of civilization.

The construction of modern chemistry and mass spectrometry laboratories for ZRIGL was completed by August 2000 and has led to a considerable improvement of the analytical environment. The clean chemistry laboratories occupy ~ 200 m^2, and are comprised of class 10,000 rooms with better than class 10 in the laminar-flow workbenches. The contiguous mass spectrometry labs include a rare-gas section (160 m^2), TIMS (60 m^2 with class 100,000) and an ICPMS section occupying 175 m^2 in a class 100,000 environment. All mass spec laboratories are temperature-stabilized to better than ± 0.5º C.

Although under the overall direction of Alex Halliday, much of the responsibility for the running of ZRIGL is shared with a substantial team, as follows.

• Rainer Wieler is the primary leader in developing the NOGMS research programs. His main research interests are in cosmochemistry, the solar wind and cosmogenic nuclides in both terrestrial and extraterrestrial samples.

• Heiri Baur runs the NOGMS facility. He provides unique expertise in ion optics and computing. He designed and built the famous "Baur-Signer Source" used in many commercial noble gas instruments but always constructed at ETH.

• Felix Oberli maintains an active research program in U-Pb dating and is the main individual responsible for running TIMS. He has

Urs Schaltegger, recently appointed Professor at U-Geneva carefully loads a filament for TIMS analysis.

Veronika Heber has just completed her PhD studying noble gases in the solar wind and testing target materials for the Genesis mission.

been responsible for planning, construction and commissioning of ZRIGL labs and their instrumentation. He is now involved in MC-ICPMS and software development.

• Mark Rehkämper and Claudine Stirling play a pivotal role in the running and development of MC-ICPMS instrumentation and chemistry. Der-Chuen Lee also has provided skilled support but leaves for a permanent position in Taiwan this year.

• Uwe Wiechert has been the main individual setting up laser ablation methodologies and Mg isotopes.

• Claudine Stirling, Nadya Teutsch, Martin Frank, Sylvain Levasseur, Don Porcelli (recently appointed as a professor at Oxford) and Mark Rehkämper have been the main individuals responsible for research programs in erosion, ocean chemistry, climate change, sea-level change, rivers and groundwater.

• Nadya Teutsch, Sylvain Levasseur and Helen Williams have been the primary individuals responsible for developing transition metal stable isotope geochemistry.

• Sarah Woodland, Ghylaine Quitté, Der-Chuen Lee and Mark Rehkämper have been the primary individuals overseeing the new MC-ICPMS techniques in cosmochemistry.

• Rolf Kipfer and Werner Aeschbach-Hertig (both based at the Swiss water resources unit EAWAG) lead the use of noble gases and other tracer applications in groundwaters and lakes.

• Ingo Leya leads the theoretical modeling of production of cosmogenic nuclides.

• Ghylaine Quitté, Sylvain Levasseur, Martin Meier, Wolfgang Mueller (recently moved to ANU), Felix Oberli and Urs Schaltegger (recently appointed a professor at Geneva) have developed TIMS for small samples and negative ion methods.

• Martin Frank has been developing our collaborations with the ETH accelerator (under Martin Suter) on ^{10}Be.

• Darrell Harrison who will lead much of the application of noble gases to U-He chronology and mantle geochemistry is replacing Chris Ballentine (recently appointed a professor at Manchester University).

Expanded research programs

ZRIGL goals are several and changing rapidly; two main current ones are to determine how the planets formed and what determines the earth's recent natural behavior. As such, the programs have broadened significantly in the past few years with less emphasis on long-term crustal evolution.

Cosmochemistry. ZRIGL maintains an active program using the noble gases to understand nebular components. However, ZRIGL scientists also now measure the isotopic compositions of elements like Li, Mg, Fe, Ni, Zr, Ag, Te, W, Tl and U to extremely high precision. These provide short-lived chronometers, isotopic fractionations and nucleosynthetic isotopic anomalies that permit elucidation of early solar system history. ETH has been a primary contributor to the definition of the composition of the Sun and solar wind using on-line acid etching of lunar samples and meteorites in gold extraction lines. We also have been studying the suitability of various target materials for the Genesis sample return mission, which will bring targets back containing solar wind ions.

Manuela Fehr is a PhD student using MC-ICPMS to measure tellurium isotopic compositions of early objects in a search for extinct^{126}Sn.

The early earth. Zircon is perfect for Hf isotopic studies of the continental crust. Hafnium isotopes provide an indication of the preponderance of depleted mantle in the very early Earth and the proportion of new crust that was involved in granite melting. ZRIGL scientists collaborate with Dr. Y. Amelin (Royal Ontario Museum) in studying the Hf isotopic composition the oldest terrestrial zircons.

Mantle geochemistry.

This has been a relatively minor part of the ZRIGL research program that has been focussed largely on the history of volatiles, such as the noble gases. Major new experiments that are being planned include the measurements of krypton isotopes and the simultaneous determination of both the light and the heavy isotopes of xenon, using a purpose built multiple multiplier mass spectrometer.

Magmatic processes. ZRIGL has ongoing interests in quantifying the rates of crystallization and differentiation in silicic magma chambers. In particular, we have been refining U-Th-Pb chronometry techniques and using accessory minerals (allanite, zircon) to study the history of crystal growth and differentiation in long-lived deep-seated and shallow-level magma chambers. A new area of research is Fe isotope fractionations in igneous systems.

Tectonics. ZRIGL has strong links with others in the ETH Department of Earth Sciences (Philip Allen, Jean-Pierre Burg, Neil Manktelow, Fritz Schlunnegger (recently hired as a Professor at U-Bern), Diane Seward, Alan Thompson, Peter Ulmer) and supports their research programs by providing collaboration on various projects. These include Rb-Sr microsampling and U-He geochronology.

Erosion rates are being studied using cosmogenic noble gases, in collaboration with the AMS group at ETH, who study cosmogenic radionuclides and in collaboration with various Quaternary geologists.

Ocean circulation and fluxes deduced from ferromanganese crusts and leached sediments. Proxy records such as the Hf, Nd and Pb isotopic compositions preserved in time-calibrated ferromanganese crusts provide long-term records of change in erosion and circulation. A new project is dedicated to the use of Nd and Pb isotopes as tracers on much shorter time scales. The archives used for this project are pelagic marine sediments with high proportions of biogenic carbonate (forams).

Ocean chemistry. A number of important issues in ocean chemistry have not been satisfactorily resolved but can now be addressed with MC-ICPMS. For example, we are studying the behavior of Hf in rivers and seawater, never measured successfully before, to evaluate the importance of hydrothermal, eolian and riverine inputs to the ocean. In a parallel study we are making Os isotope measurements of ocean and river waters using negative ion TIMS. Finally the thallium isotope geochemistry of the ocean system is being explored for the first time.

Rivers. Characterizing global riverine fluxes requires analyzing a large number of major rivers. There are two complementary approaches; obtaining samples from numerous major rivers that represent large continental drainage areas, and characterizing restricted basins to quantify the effects of lithology, climate, and relief that can then be extrapolated to wider areas. We are engaged in both approaches to determine Hf and Os fluxes to the oceans.

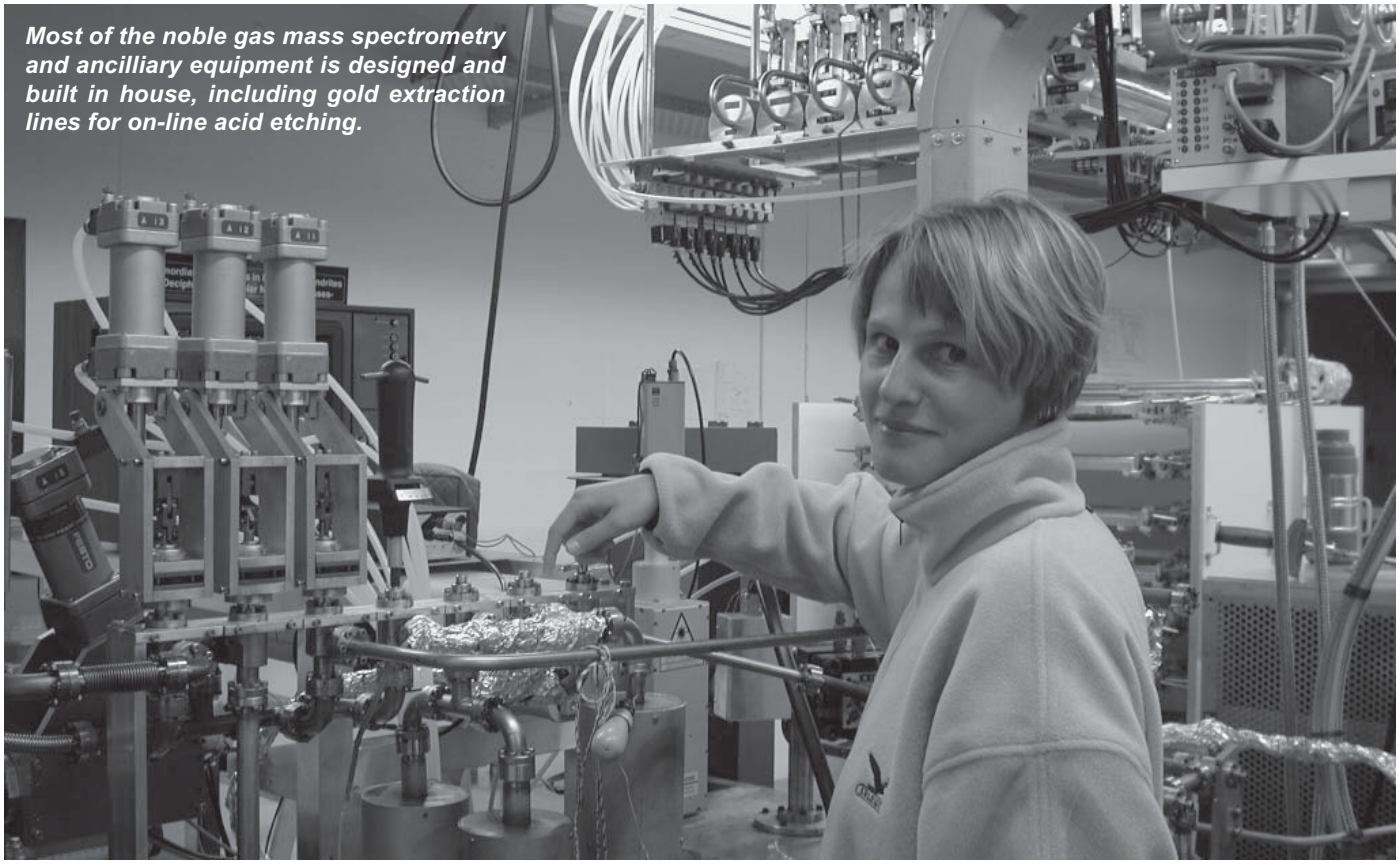
Dust. It has been unclear what aspects of ocean chemistry reflect contributions from loosely bound components in dust and ash. One approach to addressing this issue is to deploy the well-mixed composition of Asian loess and Pacific surface sediments to track eolian inputs. We are now extending this work to high-resolution small-sample isotope studies of dust from ice cores.

Uranium series chronology of inter-glacials and sea level change. The Milankovitch climate model needs to be tested with coral reefs that formed during earlier inter-glacials than have so far been dateable. Henderson Island, a remote, elevated atoll near Pitcairn Island in the equatorial Pacific has unusually well preserved reefs. This combined with our ability to push high precision U-series chronology back beyond >500 Kyrs forms the basis of a major ongoing project that includes a new expedition to Henderson Island in 2003.

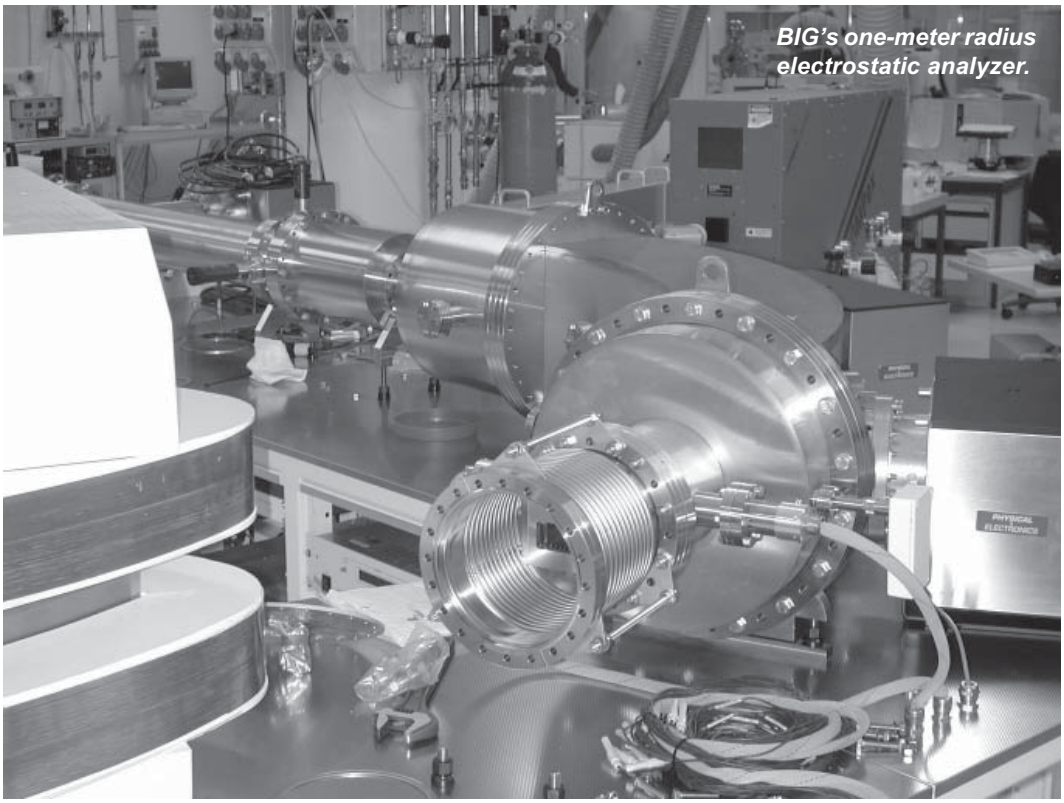
Speleothems. We are developing the techniques for *in situ* U-Th measurements of speleothem samples that record glacial-interglacial climate changes in Europe during the Quaternary.

Geomicrobiology. We are conducting new studies of isotopic fractionations in transition metals induced by microbial processes. Much of this work is in collaboration with colleagues in the group of Judy McKenzie.

Paleoanthropology. We use Sr isotopic measurements on enamel extracted from teeth of the Alpine Iceman ("Ötzi") as well as bone material in order to constrain his migration during his lifetime.



Most of the noble gas mass spectrometry and ancilliary equipment is designed and built in house, including gold extraction lines for on-line acid etching.



BIG's one-meter radius electrostatic analyzer.

A major portion of our effort is devoted to MC-ICPMS development. Currently we are experimenting with interface design to improve sensitivity.

BIG, the new Nu Instruments high resolution MC-ICPMS (Nu 1700) was delivered in March 2002. It was designed to our first order specifications for measuring small amounts of low mass elements like Mg, Cr, Fe and Ni without the interferences that plague smaller machines.

In addition to mass spectrometry developments we have three laser systems. Uwe Wiechert recently has completed a 193nm Excimer laser system for producing a very uniform energy distribution across ablation pits, permitting less matrix effects during laser ablation MC-ICPMS measurements. Some of our laser development builds upon designs and ideas previously pioneered by Detlef Guenther and Christoph Heinrich at ETH.

Groundwater and deep fluids. ZRIGL uses noble gases to trace groundwaters and measure tritium ages, this involving a very successful and close collaboration with the scientists at EAWAG (notably Dr. Rolf Kipfer). Similar work is now being conducted in limnology. We are widely using the noble gas paleothermometer in groundwaters to study glacial climate. Now we also use Fe isotopes to study contamination problems in drinking water.

A Key to ZRIGL Programs - Infrastructure and Long-term Support for Technically Difficult Development

ZRIGL has its own electronics and mechanical workshops and technical staff. These workshops are critical to the success of the operations. Having such individuals and facilities allows us to build our own mass spectrometers, electronics and sample preparation and extraction

systems.

For example, as a consequence of having these workshops the noble gas lab is able to achieve new levels of sensitivity and precision on terrestrial measurements. *Heiri Baur* recently completed the world's first compressor source for noble gases, achieving two orders of magnitude increase in sensitivity for He and Ne. This permits the measurement of pre-bomb tritium or the analysis of very small samples for Ne, with negligible interference corrections (a major problem limiting mantle noble gas measurements for example). Baur is now developing the world's first multiple multiplier noble gas instrument designed for simultaneous measurement of all the isotopes of Kr or Xe. This will permit the precise determination of the abundances of the light isotopes of Xe on the same small aliquots for which the (conventionally studied) heavy isotopes are being determined. This should provide clues to the origin of the Earth's atmosphere.

Conferences

Our group is heavily integrated with the local and international scientific community in the organization of conferences. In recent years these have included The Origin of the Earth and Moon Conference (LPI), Monterey December 1998. This year we are convening the Goldschmidt Conference (European Association of Geochemistry and Geochemical Society) in Davos (August 18th - 23rd). We are planning to host one of the forthcoming meetings of the Meteoritical Society Meeting. Further plans are afoot to establish a perennial Gordon style conference on Solar Systems (to alternate with the US one) in collaboration with the astronomers in Geneva and the dynamicists in Bern.

Publishing

Similarly, our group is heavily involved in scientific publishing. Porcelli, Ballentine and Wieler are just finishing a new book entitled "Noble gases in geochemistry and cosmochemistry" which will be a mammoth volume of *Reviews in Mineralogy and Geochemistry.* Halliday is an Editor of *Earth and Planetary Science Letters*, and is on the Board of Reviewing Editors for *Science*. Wieler is an Associate Editor of *Meteoritics and Planetary Science* and of *Geochimica et Cosmochimica Acta*.

Collaborations

General

Over the past 5 years we have consistently built and maintained close collaborations with EAWAG (Kipfer) – the Swiss water resources unit, the Bern glaciologists (Schlüchter) and with the

accelerator lab here at ETH (Suter). Space does not allow us to include the list of more than 50 other research collaborators worldwide.

STOPFEN

We have now established the 1.3 million Euro, EU-Network STOPFEN (Sea level, Temperature and Ocean circulation, Past and Future: a European Network), networking with Edouard Bard (Marseilles), Gareth Davies (Amsterdam), Harry Elderfield (Cambridge), Gideon Henderson (Oxford) and Thomas Stocker (Bern). The idea behind this network is to build a stronger community of European-based scientists who integrate more closely their technical developments in isotope geochemistry with climate models. The ZRIGL individuals leading this are Halliday, Martin Frank and Claudine Stirling.

PLANET-Z

We are in the early stages of building a new network PLANET-Z, which will extend out to Europe once it is established at ETH. The idea behind this network is that we need to co-ordinate and strengthen planetary science research within ETH in cooperation with others in Switzerland such as Willy Benz (Bern) who works on the dynamics of accretion and Michel Mayor in (Geneva) who discovered the first extrasolar planet. Currently our activities are fragmented within ETH and across Switzerland.

The Future

His Royal Highness, Prince Andrew Duke of York, officially opened ZRIGL on 25th March this year. Of course this served as a nice springboard to foster stronger international links. Over 40 scientists from outside Switzerland alone came to view the new facility. We anticipate many new collaborations in Europe and elsewhere.

Over the next few years at ETH we will be focusing our efforts on exploring new areas of research using the special technology we have been developing. In particular the high sensitivity noble gas source, multiple multiplier noble gas instrument and BIG

– the high resolution MC-ICPMS offer lots of scope for exploring the gamut of earth, environmental and planetary geochemistry. However, there is, in addition, plenty to do with the more conventional instrumentation and we look forward to discussing a lot of these new developments with colleagues from around the world with the 30 presentations we are making at the forthcoming Goldschmidt Conference in Davos. See you there!

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8. **Leya, I., Wieler, R. and Halliday, A.N.** 2002 The influence of cosmic-ray production on extinct nuclide systems, Geochim. Cosmochim. Acta, in press.
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11. **Porcelli D, Ballentine C, Wieler R** 2002. Noble Gases in Geochemistry and Cosmochemstry. Reviews in Mineralogy and Geochemistry, vol. 46, in press.
12. **Porcelli, D. and Halliday, A.N**. 2001 The possibility of the core as a source of mantle helium, Earth Planet. Sci. Lett, 192, 45-56.
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14. **Rehkämper, M., Schönbächler, M. and Stirling, C.H.** 2001 Multiple collector ICP-MS: Introduction to instrumentation, measurement techniques and analytical capabilities. Geostandards Newsletter, 25, 23-40.
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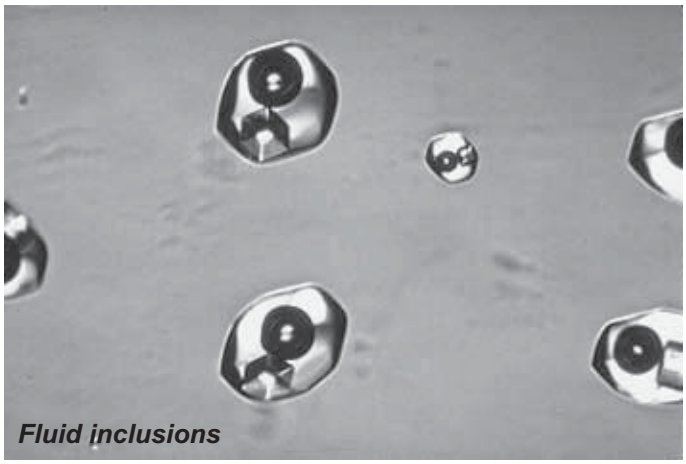
His Royal Highness Prince Andrew The Duke of York with a special magic ball needed to open ZRIGL.

Bubbles in Amsterdam

melt and fluid inclusion research at the Vrije Universiteit

When Jacques Touret, professor of petrology, mineralogy and ore geology, was about to retire from the Vrije Universiteit, my alma mater, I asked around for a contribution about his research. Jacques responded by asking me to drop by. "Why don't you write it?" suggested Jacques and he introduced me to his colleague Igor Nikogosian. Igor then introduced me to melt inclusions.

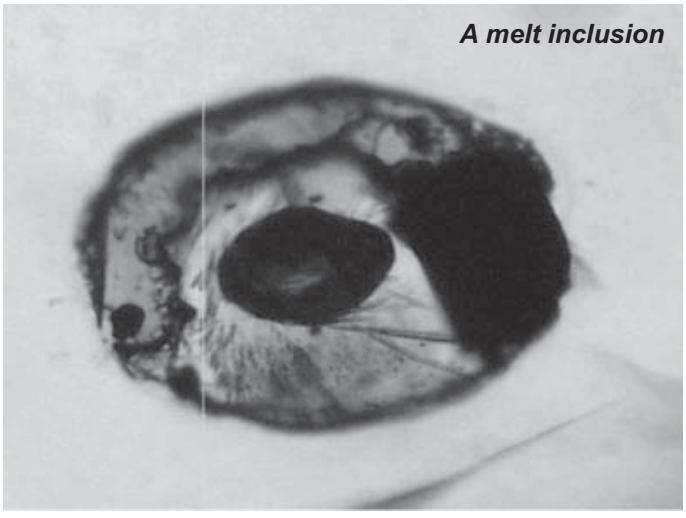


Fluid inclusions

On March 29, 2001, the University of Liège in Belgium awarded an honorary doctorate (*Docteur Honoris Causa*) to Jacques Touret. On September 19, 2001, the VU organized a symposium in Jacques's honor: *Fluids at depth*. In addition, the journal *Lithos* dedicated an entire issue to Jacques. Jacques Touret, having reached the Dutch retirement age, was leaving. He has bought a house in France and moved back to his home country, where his wife works as a mineralogist and curator at the Musée de Mines of the École des Mines in Paris. After the recent graduation of Bin Fu, Jacques still has one Ph.D. student left in Amsterdam (Eduardo Campos). Jacques Touret is also a member of the Royal Netherlands Academy of Sciences and as such is currently concerned with documenting the history of the earth sciences. So instead of traveling back and forth to France, he now travels back and forth to The Netherlands, where he will always be very welcome. The Dutch like Jacques, not only because of his scientific contributions but also because of his friendly nature. Jacques is well known for his appreciation of the finer things in life, his enthusiasm, his French charm, and his sense of humor.

Fluid inclusion research at the VU

Jacques Touret joined the Vrije Universiteit in 1980, as a full professor in petrology, mineralogy and ore geology, freshly imported from France. He quickly established a fluid inclusion research lab, which became a reference for this type of research. Jacques's fluid inclusions students came from many countries and have taken their expertise to many countries: Germany (Fons van den Kerkhof), Italy (Maria Luce Frezotti), South Africa (Jan Marten Huizenga), China (Bin Fu and Cong Yuexiang) and soon Chili (Eduardo Campos). Other Ph.D. students have also spread the news about Amsterdam, for instance in Indonesia (Jan Sopaheluwakan) and Zimbabwe (Hielke Jelsma, now in South Africa).



A melt inclusion

Ernst Burke - the Belgian mineralogist, Raman probe specialist and head of the Microanalysis lab at the VU earth science department - and his coworker Wim Lustenhouwer must be mentioned as well in this respect. Their role was and continues to be essential. Ernst, Wim and their colleagues enable top-notch quality analysis of inclusions.

Brief history of fluid inclusion research

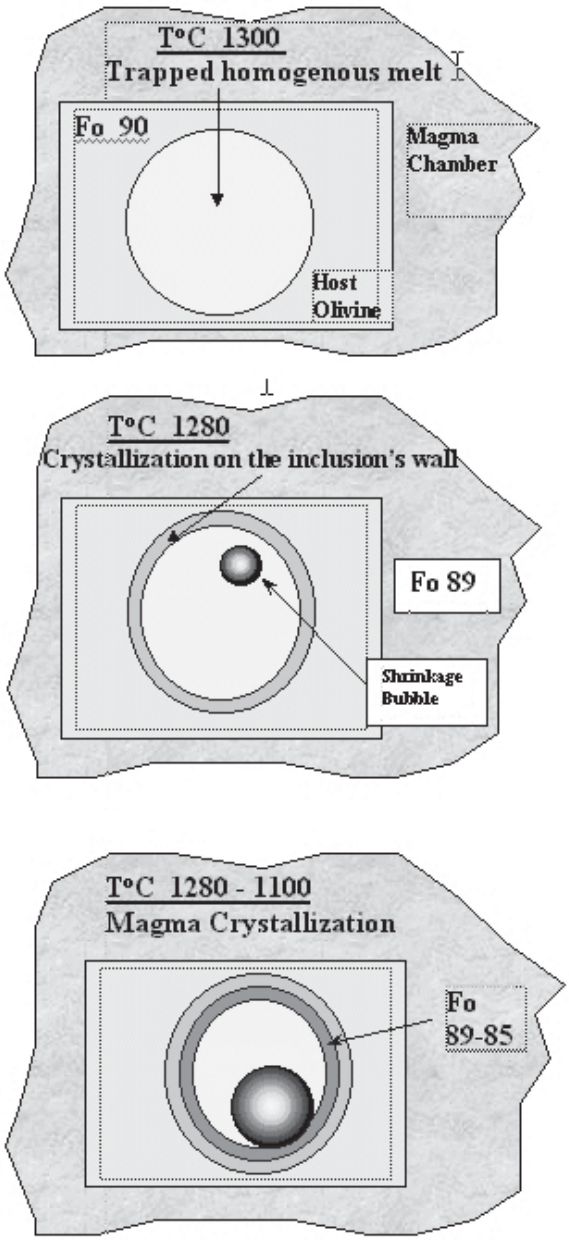
Fluid inclusions were already recognized at the beginning of the eighteenth century and later became a regular part of petrography. H. Vogelsang - professor of petrology at the University of Delft more than a century ago - demonstrated that fluids found in granitic minerals such as beryl, topaz and quartz, were in fact supercritical CO_2. During the first half of the twentieth century, interest in fluid inclusions waned. Only scientists in the former Soviet Union continued to study them and later became a source of expertise for the west.

Fluid inclusion research initially was largely - but not solely - the domain of metamorphic petrology. Certain high-grade metamorphic rocks that were initially considered rare oddities turned out to be important components of the continental crust. These rocks are called granulites. In the 1970's, granulites were discovered to contain many CO_2-rich fluid inclusions and this spawned renewed interest in the topic. Granulites are one of Jacques Touret's favorite research topics and that was his angle for studying fluid inclusions.

They are tiny cavities in crystals and can contain three phases (solid, liquid and gas). Fluid inclusions in igneous rocks may represent the volatile phase of a magma. Fluid inclusion research entails the use of a heating-freezing stage with which homogenization temperatures can be determined. The Raman probe is another prominent player in fluid inclusion research: it's an often-used analytical tool. Vital in the work on fluid inclusions is the assumption that the inclusions have not leaked any of their contents. (See also Touret, 2001.) It may come as a surprise to

earth scientists in other subdisciplines that fluids at depth (H_2O, CO_2, CH_4, N_2, He) may well exceed by many orders of magnitude the mass of fluids contained in the outer layers of the terrestrial system.

The original fluid inclusion research now appears to be overtaken by one of its categories: melt inclusions. GeoRef turned up 73 results for "melt inclusions" in publications between 1985 and 1970, 52 for publications between 1985 and 1990 and the number has been rapidly increasing since. The 1995 AGU Spring Meeting included a session called "Melt inclusions and petrogenetic indicators in igneous environments". Vol. 4, No. 3 of the journal *Petrology* contains material that was presented at that symposium.



This is what happens to a melt inclusion as it cools. The reverse happens on a heating stage during a microthermometric run. Courtesy Igor Nikogosian.

Melt inclusion research at the VU

About four years ago, Jacques Touret decided to install melt inclusion facilities at the VU. "*Jacques was always telling me that most petrologists were missing half the excitement by not looking at inclusions*", writes Tim Elliott who used to work in Amsterdam but is now at Bristol. Jacques then contacted Alex Sobolev who proposed that Igor Nikogosian help him set up the equipment and methods. The VU already had a Linkam stage for melt inclusion work, but it did not allow quenching to glass at equilibrium conditions. Igor came to Amsterdam and set up the stage, with the help of Ernst Burke and particularly his colleague Wim Lustenhouwer. Of course, Igor did not just come to Amsterdam to install the stage. He set up the entire methodology and has been actively boosting melt inclusion research since, particularly by his own contributions to the field.

Brief history of melt inclusion research

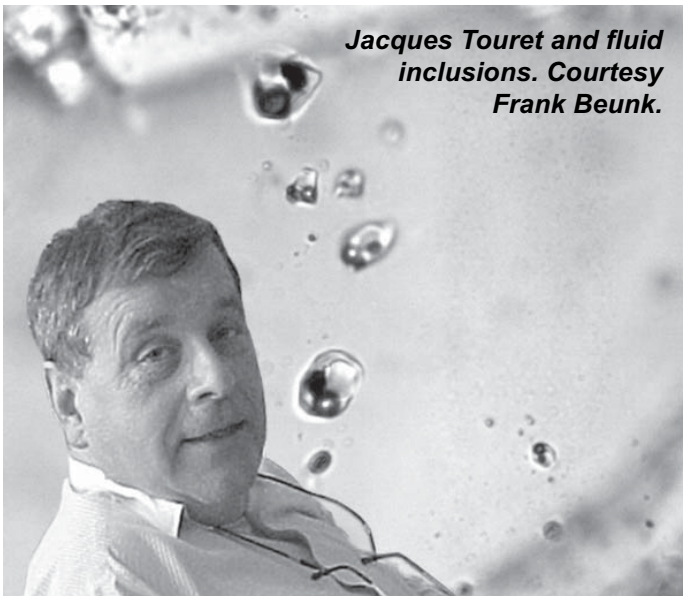
The history of melt inclusion research resembles that of fluid inclusions in general. Melt inclusions had already been noticed in the eighteenth century, but in the 1970's, only Sobolev's group in the Soviet Union and a few other groups (in Japan, China and the DDR) were actually studying them. It was the Russian group that created a crucial breakthrough: the development of the Vernadsky stage. The Vernadsky stage not only enabled heating to high temperatures, but also rapid quenching. Igor Nikogosian was part of Sobolev's group of Ph.D. students in the former Soviet Union. These Russian students have all swarmed out to the west, just as Touret's former fluid inclusion students did. Andrey Gurenko used to work at the GEOMAR research center in Kiel, but has recently moved to Potsdam where he joined Ilya Veksler. Maxim Portnyagin is now in Kiel. Vadim Kamenetsky and Leonid Danyushevsky are both working at the University of Tasmania in Australia. In 2001, the Alexander von Humboldt Foundation gave a Wolfgang Paul Award to Alex Sobolev, then at the Vernadsky Institute of Geochemistry and Analytical Chemistry in the Russian Federation. As a Humboldt awardee, he currently works in Mainz, Germany. While fluid inclusion research appears to have been the domain of metamorphic petrology (not exclusively!), melt inclusions are particularly impacting igneous petrology. Simplified, one could say that petrologists study all aspects of a rock and then try to say what exactly made the rock into what it is now. While this may sound trivial, this kind of information forms the pieces of a puzzle. The assembled puzzle would show the workings and details of the system know as the solid earth, and of part of the hydrosphere and atmosphere as well.

What are melt inclusions and why are they special?

Melt inclusions are tiny blobs of magma trapped within crystals (phenocrysts). At room temperature, they are solid (unlike "regular" fluid inclusions). Their typical size is 1 to 50 µm but they can be considerably larger as well. They can be completely glass, partly glass and partly crystalline, or wholly crystalline. Glassy melt inclusions may contain a shrinkage bubble. Primary melt inclusions are the most important as they contain the magma in which the crystal formed. Secondary melt inclusions form after crystallization of the host mineral and are less important, but

can for instance yield important insights in the nature of metasomatic fluids (see Schiano *et al*., 1994).

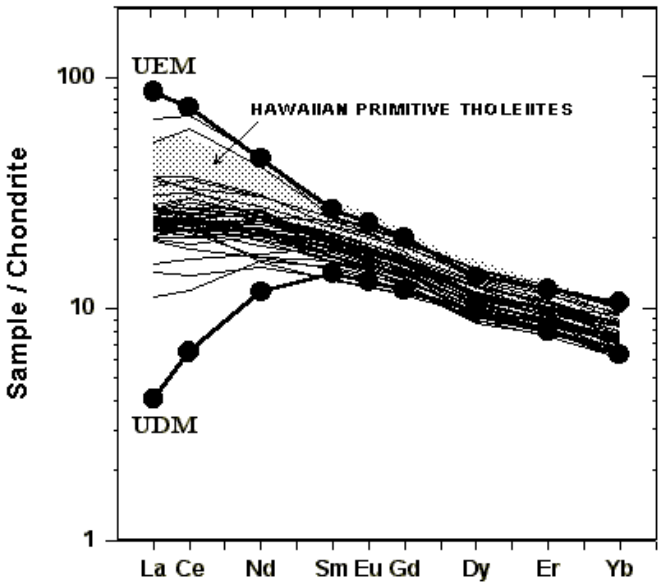
What is so special about melt inclusions is that, ideally, they constitute a time machine. They allow us to look back in time. The processes that (metamorphic and) igneous petrologists study tend to wipe out each other's results. Any rocks we see at the surface of the earth have been subjected to a wide range of processes. All we see is end products. We would like to know how they started out. Were they originally part of one magma in a magma chamber or are they the result of the mixing of several magmas? Did they melt again at some point and assimilate other rocks at that point? Did they assimilate other rocks before they first crystallized? Have they been recycled through the big magma machine and have parts of them been exposed to atmospheric conditions before? Often, we don't know. All we know is that most rocks have come a long way.



Jacques Touret and fluid inclusions. Courtesy Frank Beunk.

Melt inclusions, ideally, are tiny samples taken along that road. They allow petrologists to travel back in time vicariously and take a snapshot of physicochemical conditions of certain points along that path. It won't get any better than that because humans do not live long enough and can't survive high temperatures and high pressures. Humans cannot jump into a subduction zone and witness these processes firsthand, but melt inclusions make good proxies. High-PT experiments are the only other thing that comes close. If you do an 'old-fashioned" whole-rock analysis, you get the chemical result of a series of processes. With supplementation from other data, such as mineral analyses and geothermobarometry, you hope to be able to reconstruct at least some of the rock's history. By using data from melt inclusions in phenocrysts you may end up with a complete PTt (pressure-temperature-time) trajectory and a very good idea of the processes along that trajectory. Melt inclusions are magmatic information agents.

Does it always work this way in practice? Of course not. The ideal scenario is based on the assumption that the melt inclusion is a chemically closed system and has been since the time of entrapment. Melt inclusions tend to become trapped at sites of



Rare earth element compositions of melt inclusions in olivine from Hawaiian tholeiites, including range of whole-rock data. These data are not only normalized to chondrites but also to 10 wt.% Al_2O_3 of primary melt from Sobolev and Nikogosian (1994). These ultra-depleted (UEM) and ultra-enriched (UDM) melt components were completely unknown until they were found in these inclusions trapped in high-Mg olivines. This indicates the co-existence of very different magmas in an efficiently mixing magma conduit.

crystal defects (energetically favorable). These are, of course, also sites of potential diffusion routes. The degree to which a melt inclusion was closed or not is linked to element concentrations, concentration gradients and diffusion coefficients. The larger the chemical contrast between melt and host mineral, the better the isolation (Sobolev, 1996). Danyushevsky *et al*. (2002) recently outlined some of the complications of melt inclusion research. Nielsen and coworkers described earlier how to check the integrity of melt inclusions (1998).

Methodology

As indicated earlier, the high-temperature heating/quenching stage is paramount in this work. First, phenocrysts with melt inclusions are selected and separated from the rock, mounted in epoxy and polished. Second, if the inclusions are fully vitreous, the composition of the glass can be determined without any problems. If the inclusions are partly of wholly crystalline, the inclusion first needs to be melted and then quenched (to prevent crystal formation), after which the glass can be analyzed. High-temperature microthermometry - the heating/quenching stage - allows the petrologist to determine the equilibrium conditions and crystallization temperatures for the inclusion and its host. Briefly, the inclusion is heated in a pure He atmosphere until it melts. Kinetic experiments - basically consisting of a series of thermometric runs in which the heating rate is varied and the inclusion carefully observed under the microscope - are carried out to determine the best conditions. The run is the reverse of the natural cooling process: the phases in the inclusion disappear

one by one until the contents of the inclusion are completely homogenized. Without visual control, one can only guess what happens in the inclusion and may well end up with false results. It would, for instance, be impossible to quench at the right moment, without visual control.

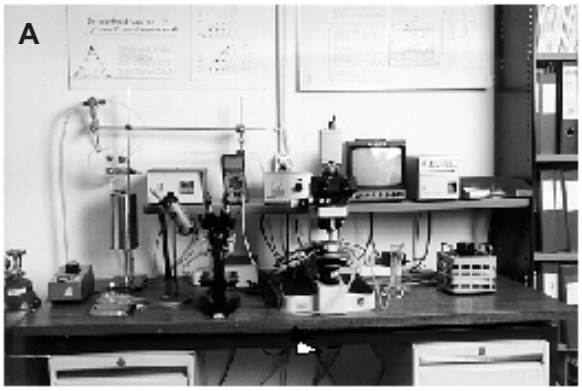
EPMA, LA-ICP-MS, FTIR spectroscopy, ion probes for trace elements and H_2O, and SYXRF are some of the analytical tools used in melt inclusion research. The microbeam developments lifted melt inclusion research out of its cradle after the development of the Vernadsky stage. The analytical data can be fed into mathematical models and the results of the microthermometric runs can then be compared to the calculated data.

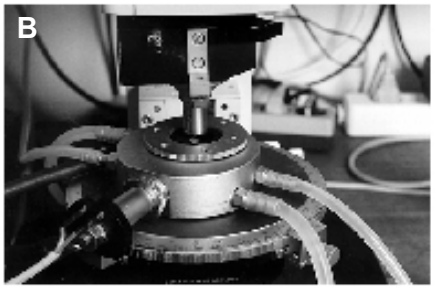
However, working with melt inclusions is not as easy at it may initially sound. If you heat inclusions too slowly, re-equilibration at conditions not representative of trapping will occur. If you heat inclusions too rapidly, the actual conditions in the inclusion are those of a lower temperature. Overheating (above homogenization) is not necessarily a problem as long as you immediately quench the inclusion. "*But if you overheat a clinopyroxene host by 25 to 50 degrees, you end up with a completely different composition of the melt inclusion*", warns Igor Nikogosian."*Especially for Si, Ca, Al, Ti and Na. It is difficult to make corrections for those*." During these experiments, the host crystal may influence the inclusion, while originally, it was the magma that determined the host mineral. Pressure effects can also play a role: the host mineral is not at its original pressure. That is why it is also very important to rapidly quench a melt inclusion once it has homogenized. See also Danyushevsky *et al*. (2002).

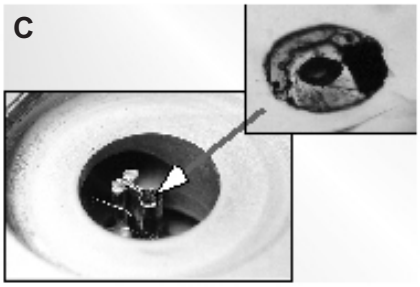
In addition, melt inclusion work can be very painstaking. What you hope to find are so-called exotic inclusions: the ones that have retained very deep parent magmas. No more than about 5% of all the melt inclusions in a rock are exotic. You may end up studying literally hundreds and hundreds of inclusions before you strike pay dirt. The rewards are worth the effort: you may find that the rock you have is not the result of the mixing of three but of five magmas. It is the nature of those magmas that reveals a great deal of information about the processes in the deep earth.

Examples of melt inclusion work

Melt inclusions enable determination of the oxygen fugacity at the time of magma crystallization, on the basis of the Fe^{2+}/Fe^{3+} ratio in spinel and the composition of the associated olivine (see Danyushevsky and Sobolev, 1996).







A. General view of the Vernadsky-Institute type high-temperature set-up with controlled He atmosphere and video display at the VU.

B. Detail of the high-temperature heating stage at the VU (up to 1500 degrees C).

C. General view of the heating/quenching element of the Vernadsky stage at the VU; arrow indicates the position of the melt inclusion. The quenching time is 1-2 seconds.

Much work has focused on volcanic rocks such as those of Mount Shasta and in Italy and particularly on intraplate magmatism, such as of Hawaii. It is widely accepted that mantle plumes contain recycled oceanic crust. Melt inclusions contain the information to prove this (Sobolev *et al*., 2000).

A recent development is the determination of the isotope composition in melt inclusions. (See Sobolev, 1996.) Some researchers have, for instance, used $^{40}Ar/^{39}Ar$ data from melt inclusions in quartz to determine residence time scales of silicic magma chambers, but there are some complications related to the question whether these inclusions can be regarded as a closed system with respect to ^{40}Ar (Winick *et al*, 2001). Will isotope work on melt inclusions refute earlier findings? "*While determining isotope compositions of melt inclusions will not dramatically upset earlier findings, I do expect it to reveal new knowledge about the isotope systems*", replies Igor Nikogosian.

Boron - isotope composition - in melt inclusions is a good tracer for a crustal component diluted with mantle material and indicates that arc magmas also contain an oceanic crust

component (Rose *et al.*, 2001; Gurenko and Chaussidon, 1997).

A spin-off from the work with the Vernadsky stage is that it also enables new fluid inclusion work. Previous fluid inclusion work did not involve heating to over 500 degrees C. Now with the Vernadsky stage, fluid inclusions can also be taken to much higher temperatures that may be much closer to their formation conditions (see Campos *et al.*, 2002).

melt inclusions can preserve their original trace element concentrations over time, the same cannot be said of some elements in plagioclase-hosted inclusions.

LEFT: Jacques Touret during the ceremony in Liège (front row, third person on the left). Seated on the far right, front row, is His Majesty King Albert II of Belgium. Courtesy Pascale Scarpa. Copyright TILT PHOTOGRAPHY LIÈGE - www.tilt-photographie.be.

BELOW: Jacques Touret receives the honorary doctorate from the Université de Liège (March 29, 2001). Courtesy Pascale Scarpa. Copyright TILT PHOTOGRAPHY LIÈGE - www.tilt-photographie.be.

Other geoscientists about melt inclusions

Of course, Jacques Touret and Igor Nikogosian are not the only petrologists dedicated to inclusion research. Rumor has it that Dan McKenzie became obsessed with them and that Al Hofmann is also a real convert. So what do you hear if you ask around?

Liz Cottrell is a Fulbright Scholar working on her Ph.D. at Lamont, where she now studies core formation as an experimentalist with David Walker. Liz has used melt inclusions in her research and attended a melt inclusion workshop in Grenoble in March of 2000 (cosponsored by Elsevier Science). She writes:

"*While melt inclusions provide one unique tool for understanding petrogenesis, it is easy to misinterpret the data they provide by failing to take into account diffusional processes. Exciting new work focuses on the trace element contents of melt inclusions. However, some trace elements may diffuse rapidly enough to obscure the original information content of the melt inclusions. We tried to quantify this in Cottrell et al. (2002) by demonstrating that diffusion will have different but predictable effects in different host phases. For example, while it appears that olivine-hosted*

Based on the study by Cottrell et al. (2002), there are several ways in which the melt inclusion community could improve the quality of both the data and the interpretations of melt inclusions. Every effort should be made to gather data from a variety of phenocryst types from the same location. The partitioning of trace elements varies among crystal hosts, so looking at inclusions in more than one type of phenocryst might unravel any diffusional overprinting of the original concentrations. If only one host type is available, then it is especially important to look at the statistical distribution of trace element concentrations in order to spot the potential effects of diffusion. I believe there is also an untapped wealth of information in the trace element zoning around melt inclusions. With the proper microanalytical work, trace element

zoning in the crystal surrounding the melt could provide information about the timing and evolution of inclusion compositions.

The bottom line is that melt inclusion work has an exciting future, but care needs to be taken to unravel the modifications caused by diffusion. This can best be accomplished if high quality trace element data are collected from melt inclusions from multiple hosts from one location and the information compared to model predictions. In this manner, post entrapment diffusion can be quantified and subtracted so that the real information about primary liquids can be elucidated."

Danyushevsky *et al*. (2002) appear to concur with Liz. They also argue that many articles pay a great deal of attention to interpreting the composition of inclusions, whereas there is little regard for the processes that affect inclusions after trapping.

Roger Nielsen (Oregon State): "*First and foremost - we as petrologists need to get past the prejudice that melt inclusions are "secondary" sources of petrologic information relative to sources we are more familiar with such as bulk rock or lava chemistry. The data obtained from melt inclusions have their own set of interpretive criteria quite apart from "normal" data. However, that does not mean that they are inferior in any way. We will gain our greatest leverage when we can fully integrate all data types. That will require us to abandon hearsay criticism of melt inclusion data and obtain reliable, reproducible experimental constraints on the important processes that can effect the composition of trapped melts.*"

Roger agrees that melt inclusions are essentially the only way to obtain data from earlier stages in the differentiation of a volcanic suite. "*This is particularly true with regards to volatiles*." He cautions: "*When interpreting inclusion data, or any small scale geochemical data such as zoning, we must remember that the scale of the features we are measuring are 8-10 orders of magnitude smaller than the environments we are using the data to interpret.*"

Tim Elliott (University of Bristol, U.K.) is also highly enthusiastic and emphasizes that he's certainly not the only one. "*The fantastic range in compositions you see in individual olivine crystals (Sobolev et al., 2000) blew everyone's mind. This put some bewildering constraints on melting and mixing processes. I believe that Marc Spiegelman has recently come up with a model that at last can explain some of this in a reasonably physically plausible manner.*" According to Tim, melt inclusion research is revolutionizing the understanding of melting and volatile budgets in subduction zones. "*For this, the heating stage does not come into its own as self-quenched inclusions are best. But, such glassy inclusion provide a record of pre-eruptive volatile contents that can't be obtained in any other way.*" Tim emphasizes that he admires Igor and considers him a great scientist: working very hard, very skilled and also quite successful at forging international collaborations.

Adam Kent (Dansk Lithosfærecenter, Copenhagen, Denmark) adds: "*I think that the really exciting thing about melt inclusions is that they are making geochemists and petrologists think about the processes that produce igneous rocks in new ways - principally because inclusions provide a record of the tremendous diversity of magma compositions that occur in different igneous environments, such as mid ocean ridges, island arc volcanoes and so on. In many cases our understanding of geochemical processes is largely based on variations between various geochemical components, so something that can help us image these differences in much greater detail is of tremendous value.*

Although there are still questions regarding the processes that trap and subsequently modify inclusions, advances in analytical techniques promise to provide even more insight in the future. In particular, and in contrast to Igor, I think that development and wide application of techniques for isotopic analyses of melt inclusions will produce important results (and in fact they already have), allowing us to see through melting-related processes and take a fresh look at the nature of the mantle and crustal rocks from which magmas ultimately derive."

Future of the inclusion group at the VU

Amsterdam is one of the few places in the world with a fully operational Vernadsky stage. Vernadsky stages are also up and running in Australia (Hobart), Norway (Oslo), and France (Saclay). Vernadsky stages have been, are being, or will be installed shortly in Italy (Siena), the US (Woods Hole and Blacksburg), and Germany (Mainz and Kiel).

The Amsterdam group is involved in many international cooperations and always has been. It is currently rapidly turning out papers based on melt inclusion work. A recent issue of *Chemical Geology* focused completely on melt inclusions and contains the results of the Grenoble workshop. Three papers in that issue are based on work conducted at the VU. A recent issue of *Tectonophysics* also contained a contribution from the VU melt inclusion group. However, these are only a few examples. The group certainly has proved its right to exist and the search for Jacques's successor has started.

A factor that will play a huge role in the future developments at the VU is whether the VU will continue to attract enough earth science students. As in many other countries, this is becoming a problem in The Netherlands. The recent number of applications to the Dutch earth science Master's programs shows a drop of 40 percent (that also happened, for instance, to chemistry). In that light, it is interesting to hear what Liz Cottrell writes about her own career: "*My decision to become an earth scientist stems from the many wonderful mentors I've had in the field. They have offered me guidance, encouragement, and funding.*" This demonstrates the importance of individual earth scientists. They can and must inspire students, so that there continue to be opportunities for excellent young scientists - like Liz Cottrell - who can take over in the future. It's not just matters like the number of high-quality publications and the amount of acquired funding, which make a great scientist. It includes the integrity, enthusiasm and power to attract, inspire and keep good people.

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Associate Editor for The Geochemical News
Angie@smarterscience.com

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Short Course Announcement

The Geochemical Society and the Mineralogical Society of America present:

Applications of Synchrotron Radiation in Low-Temperature Geochemistry and Environmental Science

Dec. 4 and 5, 2002 (before Fall AGU meeting)
DoubleTree Hotel - Monterey, California

Reception Tuesday evening, Dec. 3; short course Wednesday and Thursday, Dec. 4 and 5, 2002. The 2002 Fall Meeting of the American Geophysical Union is in San Francisco from Dec. 6-10, 2002.

Conveners:

Paul Fenter, Argonne National Laboratory (fenter@anl.gov)
Mark Rivers, University of Chicago(rivers@cars.uchicago.edu)
Neil Sturchio, University of Illinois at Chicago (Sturchio@uic.edu)
Steve Sutton, University of Chicago (Sutton@cars.uchicago.edu)

Registration: Registration will be handled by The Geochemical Society Business Office. The cost will be $200 per professional registrant (reduced to $100 per student) for registration before October 15, 2002. An application form is available elsewhere in this newsletter. Complete it and mail, fax, or snail-mail to:

Seth Davis, Business Manager
The Geochemical Society
Washington University / EPSC, One Brookings Drive, CB 1169
St. Louis, MO 63130-4899 USA
phone: 314-935-4131 / fax: 314-935-4121 / email: gsoffice@gs.wustl.edu

Registration fee includes short course sessions, refreshments at Tuesday evening reception, breakfast, lunch, and refreshments at breaks on Wednesday and Thursday, Wednesday evening banquet, and a copy of the Reviews in Mineralogy and Geochemistry volume. Transportation will be arranged to the Fall AGU meeting in San Francisco after the short course for those who request it. Short course participants should arrange their stay at the DoubleTree Hotel-Monterey (http://www.doubletreemonterey.com/) Tuesday and Wednesday night, where a block of rooms is reserved at a special rate for the short course.

The powerful applications of synchrotron radiation in geochemistry and environmental science began to be realized about two decades ago. With the advent of third-generation synchrotron radiation sources in Europe, North America, and Japan, significant progress has been achieved in the development and application of synchrotron methods to geological and environmental materials. There has been exponential growth in the number of synchrotron users from the earth and environmental science communities. This Short Course is designed to fill the need for a comprehensive, in-depth review of the underlying theory and applications of various synchrotron radiation methods as they pertain specifically to geochemical and environmental science applications.

Speakers:

Mark Rivers, University of Chicago
Gordon E. Brown, Jr., Stanford University
Paul Fenter, Argonne National Laboratory
Michael J. Bedzyk, Northwestern University
Glenn A. Waychunas, Lawrence Berkeley National Laboratory
Carol Hirschmugl, University of Wisconsin at Milwaukee
Satish Myneni, Princeton University
Paul M. Bertsch, Savannah River Ecology Laboratory
Alain Manceau, University of Grenoble
Steve Sutton, University of Chicago

Sponsors: U. S. Department of Energy and Argonne National Laboratory

Short Course Registration Form

The Geochemical Society and the Mineralogical Society of America

Applications of Synchrotron Radiation in Low-Temperature Geochemistry and Environmental Science

Dec. 4 and 5, 2002 (before Fall AGU meeting), DoubleTree Monterey, California

Complete and return this registration form to the Geochemical Society Business Office via e-mail, fax, regular mail, or by telephone. An electronic version of the form can be obtained through links on the short course web page (http://cars.uchicago.edu/shortcourse2002). Registration is limited to 100 people. Payment must accompany this form, which will be fully refunded if cancellation is received in writing by November 1, 2002.

Short Course Registration
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St. Louis, MO 63130-4899

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☐	Professional registration	$200	$250	$
☐	Student registration	$100	$150	$
			Amount Due	$

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Your credit card will be charged when the registration form is received in the amount of $

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☐ check here if you need transportation to San Francisco, Thurs. Dec. 5

Postdoctoral Opportunities

Postdoctoral position in modelling of marine biogeochemistry

The Laboratoire des Sciences du Climat et de l'Environnement is seeking a highly motivated postdoctoral fellow for 24 months. The work will contribute to a project sponsored by the EC focusing on the quantification of biogeochemical processes in the water column and surface sediments of the global ocean (project ORFOIS). The position is opened for a model study of biogeochemical dynamics in surface sediments of the global ocean. Dynamics of sedimentary processes will be investigated using existing and developed models at a variety of time scales (season to millennium) in close cooperation with the NIOO in Yerseke (NL). A time-dependent model of silica diagenesis will be developed in cooperation with the University of Brest. The candidate should have an experience in computer programming and should preferentially be trained in ocean biogeochemistry. To apply send a letter of interest, a curriculum vitae and the names of three references to C. Rabouille.

Contact: Christophe Rabouille (rabouill@lsce.cnrs-gif.fr)
Laboratoire des Sciences du Climat et de l'Environnement
UMR CEA-CNRS 1572
CE Saclay, Orme des Merisiers Bât.709
91191 Gif sur Yvette, FRANCE

Expected start: September 2002.
Monthly salary: 2000 to 2500 EURO proportionate to experience

Ocean Biogeochemical Modeling ESSIC/University of Maryland

Postdoctoral Fellow or Assistant Research Scientist, commensurate with qualifications with two years of funding (possibility of year 3). The candidate will work with an existing biogeochemical model coupled to an OGCM with data assimilation and will be involved in the model simulations/analyses, parameter sensitivity physical and/or biogeochemical modeling and data analyses in a UNIX/FORTRAN environment, and ability to work with a team of investigators.

Applications consisting of a curriculum vitae, statement of professional goals, and the names of three references should be sent to:

Earth System Science Interdisciplinary Center (ESSIC)
224 Computer and Space Sciences Building, Room 2207
University of Maryland
College Park, MD 20742-2425

See also http://www.essic.umd.edu/

POST DOC IN EXPERIMENTAL PETROLOGY UNIVERSITY OF TROMSØ, NORWAY

At University of Tromsø, Norway, there is a vacant post doc position in experimental petrology. The position is attached to the Department of Geology at the Faculty of Science, and is restricted to female applicants.

The appointment for a post doc position is for a term of 3 years. Appointments in a post doc position at Norwegian universities and colleges are meant to qualify for permanent positions as professor. For a post doc position a Norwegian doctor's degree or equivalent is required.

The Faculty consists of the departments of Biology, Chemistry, Computer Science, Geology, Mathematics/Statistics, and Physics. The Department of Geology have 11 faculty members, 4 post doc/researchers, 9 research fellows and a technical/administrative staff of 8. The department is located on the periphery of the Main University Campus.

TROMSØ (cont'd)

The research activity in the Department of Geology is within hard rock geology (petrology and structural geology), marine geology and geophysics, and sedimentology/quartenary geology. The department is equipped with modern research facilities.

The vacant position is attached to the research group in hard rock geology, which has 4 faculty members. This group is responsible for teaching courses at lower as well as higher levels. The research is mainly focussed on experimental petrology, Precambrian and Caledonian tectonic and petrologic evolution in Troms and western Norway, and tectonic evolution of the continental shelf off northern Norway and Svalbard. Much of the research activity is centered about a laboratory in experimental petrology. The laboratory houses three end-loaded piston cylinder apparatuses (two 'small' table mounted apparatuses and one large apparatus) and a 1-atmosphere Deltech furnace. The piston cylinders can maintain a pressure of at least 35 kbar and in the large press we have reached a temperature of 2000º C. Temperature is controlled by Eurotherm 808 and 2408 regulators, while the pressure is monitored by digital gauges. Temperature and pressure readings are transferred to a PC and the operator can check the experiments from anywhere. The 1-atmosphere furnace has attached to it a gas-mixing module for controlling fO_2. The laboratory is equipped with all facilities necessary for pre and post preparation of cells and samples (lathe, low-speed saw, welder, polisher etc). Experimental run products are examined and analyzed on the JEOL 6200 SEM at the University of Tromsø. We will soon also have on-line access to a new Cameca SX100 EMP located at the University of Oslo.

Our research philosophy is to reproduce natural mineral assemblages in the laboratory based on observations in natural rocks. Main focuses for our research have been on partial melting and subsolidus-relations in deep crustal rocks. The vacant position is attached to the experimental petrology laboratory. 100% of working time should be devoted to research, research-related activities and research administration.

The applicant should include a project description and a progress plan for the project that she wishes to carry out during the three-year contract, including name(s) of professional counselor(s). For a post doc position a Norwegian doctor's degree or equivalent is required. The applicant should be able to document skills in magmatic and/or metamorphic petrology. A post doc is paid according to the Norwegian State salary scale, code 1352.2% of the gross salary is deducted for the compulsory state pension scheme.

A committee will judge the qualifications of the applicants. The main emphasis will be on the publications sent in by the applicant. Information and material to be taken into account in the evaluation must be submitted by the application limit. Names of references may be given.

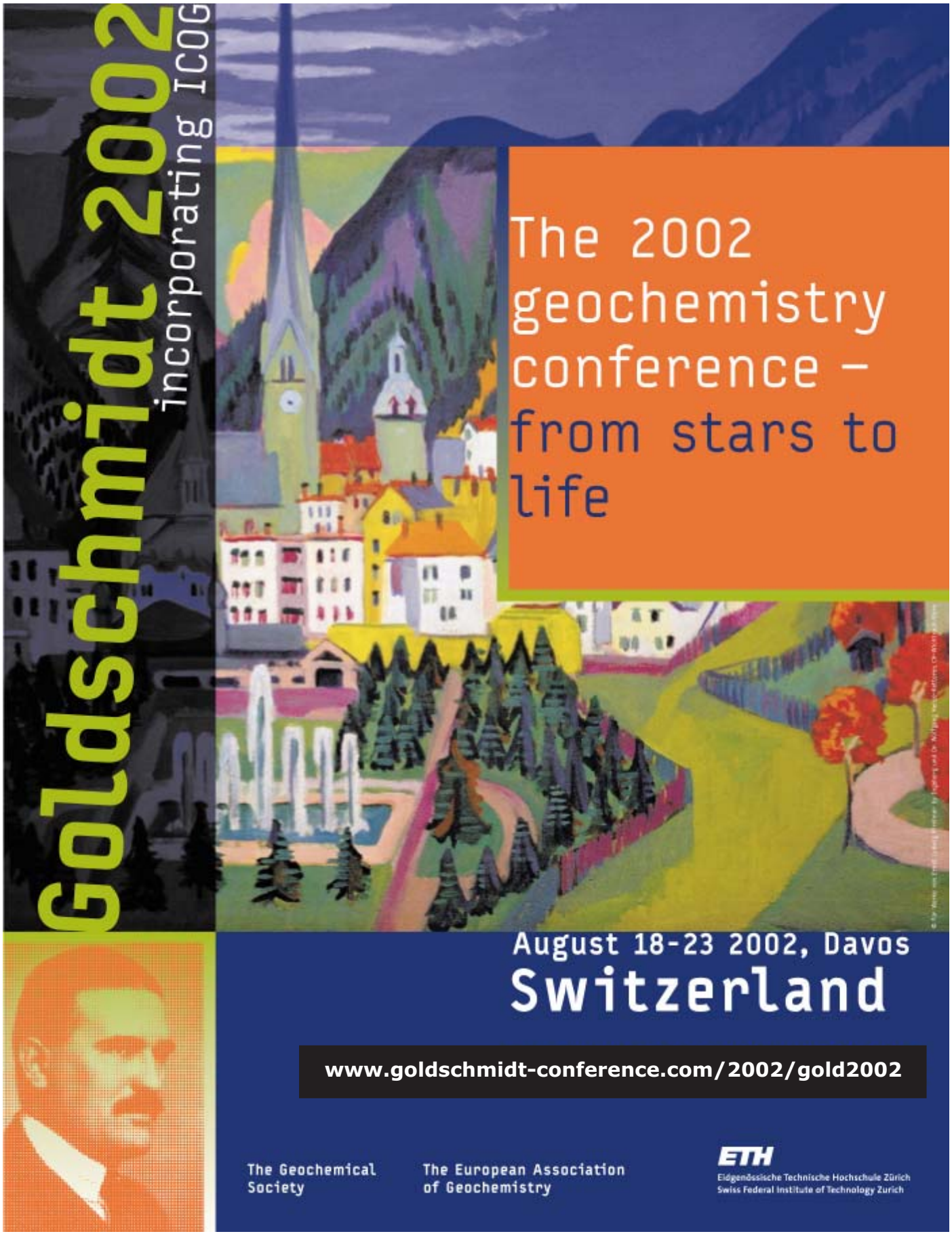
The University of Tromsø wishes to recruit women for research. This position is restricted to female applicants.

The applicants must send in a list in five copies of all her scientific papers saying whether they have been published or not, and if yes where they have been published.

The application, including the curriculum vitae, testimonials, certificates, and the list of publications should be sent in 5 copies to:

THE UNIVERSITY OF TROMSØ
DEPARTMENT OF GEOLOGY
N-9037 TROMSØ
NORWAY

For further information of the Department of Geology, University of Tromsø, visit http://www.ig.uit.no/


Goldschmidt 2002
incorporating ICOG
The 2002 geochemistry conference – from stars to life
August 18-23 2002, Davos
Switzerland
www.goldschmidt-conference.com/2002/gold2002
The Geochemical Society
The European Association of Geochemistry
ETH
Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Meetings Announcements

Goldschmidt 2003

First Circular - July 2002

The Goldschmidt Conference is now the premier annual meeting for geochemistry. The conference covers a wide range of topics in geochemistry and cosmochemistry, including cosmic substances and the solar system, early earth, substances and processes in the earth's interior, material circulation on the earth's surface, climate change, earth's environment, biogeochemical processes, and technological advancement. The past Goldschmidt Conferences have been organized through the collaboration of the Geochemical Society and European Association of Geochemistry. In 2003, the Geochemical Society of Japan will join this collaboration, and the 13th Goldschmidt Conference will be held in Kurashiki, Japan, from September 7th to 12th. For the first time, the meeting will be held in the western Pacific region.

Kurashiki, where you will meet old Japan

The city of Kurashiki is located approximately 200 km west of Osaka, easily accessible by the bullet train (*Shinkansen*) from Tokyo, Osaka, or Fukuoka. Kurashiki was a local trading center in western Japan in the 17th to 19th centuries, preserving the medieval Japan atmosphere in its old town area. Many attractive tourist cities such as Kyoto, Nara, Himeji, Okayama, and Hiroshima can be reached by *Shinkansen*.

Visit an active volcanic arc

Japan is a good place to see not only historical monuments but also geology of island arcs. A post-conference field trip to Kyushu is being organized, where you will see active volcanoes, thermal springs, and mineralization. Mid-session optional tours include a visit to Japanese gardens and old castles in the Okayama and Himeji areas. A cruise in Seto Inland Sea is also planned.

Indication of Interest

Further announcements will be made on our web-site, and important updates and reminders will be announced by email. To be included in the mailing list, please send e-mail with Registration of interest in the subject line to gold2003@ics-inc.co.jp, or register your interest on the web-site www.ics-inc.co.jp/gold2003/.

Call for Special Sessions

Proposals for special sessions can be submitted to the appropriate member of International Program Committee or Japanese Program Committee listed below. The deadline for session proposals is October 31, 2002. Please include the following information in your proposal.

(1) Title of special session
(2) Short description of the subject and scope (approximately 120 words)
(3) Chair persons (two persons)
(4) Keynote speaker(s) (30 min. talk)
(5) Invited speakers (15 min. talk which is the same as that for general presentation)
(6) Estimate of the proportion of oral and poster presentations
(7) Estimate of the session units you need (one unit is half-day, consisting of about 10 talks)

The chairpersons of approved sessions will be notified by Japanese Program Committee by the end of January, 2003. The special sessions will be advertised on Goldschmidt 2003 website (http://www.ics-inc.co.jp/gold2003/) and on 2nd circular.

International Program Committee

Jun-ichi Matsuda (Chairman) (matsuda@ess.sci.osaka-u.ac.jp); Yoko Furukawa (Secretary) (yoko.furukawa@nrlssc.navy.mil)

Task Group Chairs

Aquatic geochemistry - *Tasuku Akagi (akagi@cc.tuat.ac.jp); Bernhard Wehrli, (bernhard.wehrli@eawag.ch)*
Biogeochemistry - *Noriyuki Suzuki (suzu@ep.sci.hokudai.ac.jp); David M. Karl (dkarl@soest.hawaii.edu)*
Atmosphere and oceans - *Kimitaka Kawamura (kawamura@lowtem.hokudai.ac.jp); Bernd R. T. Simoneit (simoneit@oce.orst.edu)*
Cosmochemistry - *Mitsuru Ebihara (ebihara-mitsuru@c.metro-u.ac.jp); Herbert Palme, (Palme@min.uni-koeln.de)*
Early earth - *Takafumi Hirata (hrt1@geo.titech.ac.jp); Janne Blichert-Toft (Janne.Blichert-Toft@ens-lyon.fr)*
Fluids in the crust - *Hiroshi Shinohara (shinohara-h@aist.go.jp); Christoph A. Heinrich (heinrich@erdw.ethz.ch)*
Geochronology - *Ichiro Kaneoka (kaneoka@eri.u-tokyo.ac.jp); Ken Farley (farley@mail.gps.caltech.edu)*
GERM - *Hikaru Iwamori (hikaru@eps.s.u-tokyo.ac.jp); Roberta Rudnick (rudnick@geol.umd.edu)*
Mantle - *Eiji Ohtani (ohtani@mail.cc.tohoku.ac.jp); Carl Agee (carl.b.agee1@jsc.nasa.gov)*
Origin of life - *Tatsushi Murae (murae@geo.kyushu-u.ac.jp); Andre Brack (brack@cnrs-orleans.fr)*
Subduction zones - *Yoshiyuki Tatsumi (tatsumi@jamstec.go.jp); Julian Pearce (pearceja@Cardiff.ac.uk)*
Surface and low temperature geochemistry - *Iwao Kawabe (kawabe@eps.nagoya-u.ac.jp); Neil C. Sturchio (sturchio@uic.edu)*
Techniques - *Keisuke Nagao (nagao@eqchem.s.u-tokyo.ac.jp); Mark Rehkamper (markr@erdw.ethz.ch)*

Japanese Program Committee

Isotope geochemistry - ***Jun-ichi Matsuda (Chairman) (matsuda@ess.sci.osaka-u.ac.jp)***
Planetary physics - ***Yutaka Abe (ayutaka@eps.s.u-tokyo.ac.jp)***
High Pressure Geochemistry - *Eiji Ohtani, (ohtani@mail.cc.tohoku.ac.jp)*
Mineral chemistry - *Hiroyuki Kagi (kagi@eqchem.s.u-tokyo.ac.jp)*
REE geochemistry - *Iwao Kawabe (kawabe@eps.nagoya-u.ac.jp)*
Organic geochemistry, atmospheric geochemistry - *Kimitaka Kawamura (kawamura@soya.lowtem.hokudai.ac.jp)*
Marine chemistry - *Toshitaka Gamo (gamo@ep.sci.hokudai.ac.jp)*
Cosmochemistry - *Noriko Kita (noriko.kita@aist.go.jp)*
Atmospheric chemistry - *Yutaka Kondo (kondo@atmos.rcast.u-tokyo.ac.jp)*
Petrology, magmatology - *Yoshiyuki Tatsumi (tatsumi@jamstec.go.jp)*
Isotope biogeochemistry - *Masao Minagawa (mas@ees.hokudai.ac.jp)*
Stable isotopes, global change - *Naohiro Yoshida (naoyoshi@depe.titech.ac.jp)*

Important Dates

July, 2002
1st Circular (website and hard-copy)

August 18-23, 2002
Goldschmidt 2002 in Davos, Switzerland
October 31, 2002
Deadline for special session proposals

January, 2003
2nd Circular (website)
Call for papers, pre-registration

May, 2003
Deadline for e- abstract submission

September 7-12, 2003
Goldschmidt 2003 in Kurashiki, Japan

MEETINGS CALENDAR

July 2-3, 2002: 14th meeting of The British Organic Geochemical Society, NRG, University of Newcastle, UK. Contact: Dr Helen M. Talbot, Fossil Fuels and Environmental Geochemistry Newcastle Research Group (NRG), Drummond Building, University of Newcastle, Newcastle Upon Tyne, NE1 7RU, UK; Phone: +44 (0)191 222 6605; Fax: +44 (0)191 222 5431; E-mail: h.m.talbot@ncl.ac.uk . Web site: http://nrg.ncl.ac.uk/bogs/bogs.html

July 9-11, 2002: Microscience 2002, ExCel Conference and Exhibition Centre, London, UK. Contact: Carole Staniford, Catalyst Communications; Phone: +44 (0) 207 932 2500 or +44 (0) 1767 600716; Fax: F: +44 (0) 207 932 2519; E-mail: carole@staniford.fsworld.co.uk or Rebecca Morden, MicroScience 2002 Conference Enquiries, Royal Microscopical Society; Phone: +44 (0) 1865 248768; Fax: +44 (0) 1865 791237; E-mail: E: rebecca@rms.org.uk

July 14-17, 2002: Fifth International Conference on arsenic exposure and health effects, San Diego, California, USA. Society for Environmental Geochemistry and Health. Web site: http://www.cudenver.edu/as2000/

July 21-25, 2002: 9th International Platinum Symposium, Holiday Inn - Grand Montana, Billings, MT, USA. By the IGCP 427/SEG/SGA. Contact: Roger Cooper, Dept. of Geology, Lamar University, P.O. Box 10031, Beaumont, TX 77710, USA; Phone: +1 409 880 8239; E-mail: cooperrw@hal.lamar.edu. Web site: http://www.platinumsymposium.org/.

July 21-26, 2002: 20th Anniversary Conference of the International Humic Substances Society, Northeastern University, Boston, USA. Contact: Elham A Ghabbour, The Barnett Institute of Chemical and Biological Analysis, Mugar Hall, Northeastern University, Boston, MA 02115-5000, USA; Phone: +1 617 373 7988; Fax: +1 617 373 2855; E-mail: e.ghabbour@neu.edu; Web site: http://www.hagroup.neu.edu/IHSS11.htm

July 22-26, 2002: The Earth System and Metallogenesis - 11th Quadrennial IAGOD Symposium and GEOCONGRESS 2002, Windhoek, Namibia. Main theme: Sedimentary and magmatic responses to compressional and extensional tectonics and the associated ore-forming processes. Hosted by: The Geological Society of Namibia, the Geological Society of South Africa, The Geological Society. Contact: IAGOD / Geocongress 2002 Conference Secretariat, P.O. Box 9870, Windhoek, Namibia; Phone: + 264 61 251014; Fax: + 264 61 272032; E-mail (Alice Kaukuetu-Hue): geoconference2002@conferencelink.com.na. Web site: www.geoconference2002.com.

July 22-26, 2002: 65th Annual Meeting of the Meteoritical Society, UCLA DeNeve Plaza Conference Center, Los Angeles, CA, USA, the Meteoritical Society, Lunar and Planetary Institute. Contact: Paul H. Warren, Institute of Geophysics, UCLA, Los Angeles, CA 90095-1567, USA; Phone: +1 3108253202; E-mail: pwarren@ucla.edu; Web site: http://www.lpi.usra.edu/meetings/upcomingmeetings.html/

July 22-26, 2002: 5th Internatioaal Conference on Solvo-Thermal Reactions (ICSTR), East Brunswick, New Jersey, USA. Web site: http://www.icstr.rutgers.edu

July 29-Aug 2, 2002: Denver X-Ray Conference, Denver, USA. Contact: E-mail: maguire@icdd.com, web site: http://www.dxcicdd.com/02/

Aug 11-16, 2002: 2002 International Nuclear Atlantic Conference, Rio de Janeiro, Brazil. Web site: http://www.inac2002.com.br/

Aug 12-15, 2002: 12th Stockholm Water Symposium - Balancing Competing Water Uses - Present Status and New Prospects, Stockholm City Conference Centre, Stockholm, Sweden. Contact: David Trouba, SIWI, Sveav-gen 59, 113 59 Stockholm, Sweden; Phone: +46 8 522 139 89; Fax: +46 8 522 139 61; E-mail: sympos@siwi.org. Web site: http://www.siwi.org

Aug 14–21, 2002: World Congress of Soil Science, Bangkok, Thailand. For info: Contact o.sfst@nontri.ku.ac.th Web site: http://www.17wcss.ku.ac.th

Aug 17-21, 2002: Biogeomon 2002, University of Reading, Reading, UK. Main Themes: Catchment monitoring /manipulations /models - Stable and radiogenic isotopes in the environment - Nutrient and metal cycling in natural and restored ecosystems - Archives of global change on the continents - Scaling of biogeochemical processes Web site: http://www.rdg.ac.uk/biogeomon/

Aug 18-22, 2002; 224th ACS National Meeting, Boston, MA, USA. Geochemistry Division sessions: Metal Complexation in Natural Waters - The Biogeochemistry of Marine Organic Matter in the Contemporary Environment and Ancient Sediments (In Honor of Professor James G. Quinn) - Chemical Equilibrium Measurement and Modeling - Chemical Science Using Synchrotron Radiation. Web site: http://membership.acs.org/g/geoc/upcoming.html

Aug 18-23, 2002: Twelfth Annual V.M. Goldschmidt Conference, incorporating ICOG X, Davos, Switzerland. Contact: Cambridge Publications, P.O. Box 27, Cambridge CB1 8TR, U.K; E-mail: Gold2002@campublic.co.uk. Web site: http://www.goldschmidt-conference.com/2002/gold2002/.

Aug 23-25, 2002: Mineral Symposium, Sterling Hill Mining Museum, Sterling Hill Mine and Museum, Ogdensburg, NJ, USA. Contact: Dr. Andrew Sicree, Mineral Symposium, Penn State Mineral Museum, 112 Steidle Bld., University Park, PA 16802; Phone: + 1 814 865-6427: E-mail: sicree@geosc.psu.edu.

Aug 25-29, 2002: 12th International Conference on Small Angle Scattering, Venice, Italy. Contact: E-mail: sas2002@unive.it; web site: http://www.isf.unian.it/isf/SAS/Home_SAS.htm

Aug 26-29, 2002: High-Latitude Ocean Processes (AGU), L'Esterel Resort, L'Esterel, Quebec, Canada. E-Mail: meetinginfo@agu.org; web site: http://www.agu.org/meetings/meetings.html

Aug 26-28, 2002: HSE Workshop - Highly siderophile elements in terrestrial and meteoritic samples: implications for planetary differentiation and igneous processes, Nancy, France. Web site: http://www.crpg.cnrs-nancy.fr/NEWS/HSE-2002

Aug 26-31, 2002: MPMPS-6 High Pressure Mineral Physics Seminar, Verbania, Italy. Web site: http://www.hpmps.bgi.uni-bayreuth.de/

Aug 26-Sept 3, 2002: 4th International Workshop on Orogenic Lherzolites and Mantle Processes, Samani, Hokkaido, Japan. Web site: http://earth.s.kanazawa-u.ac.jp/LherzoliteWorkshop2002/

Aug 29-31, 2002: Natural Glasses 4, Lyon, France. For info: Contact Prof. Bernard Champagnon Email: natglasses@univ-lyon1.fr; Web site: http://natglasses.univ-lyon1.fr/

Aug 30-31, 2002: Pre-Conference Workshop - Advanced techniques and radionuclide speciation within radioecology, IAEA-MEL laboratory, Monte Carlo, Monaco. Max. number of participants: 40. Contact: Ole Christian Lind, Agricultural University of Norway, Dep. of Soil and Water Sciences, Environmental Chemistry Section, Isotope laboratory, P.O.Box 5028, 1432 Ås, Norway; E-mail: Ole-Christian.Lind@ijvf.nlh.no.

Aug 31-Sept 4, 2002: 8th FECS Conference on Chemistry and the Environment, Athens, Greece. Contact: Cambridge Publications, P.O. Box 27, Cambridge CB1 8TR, U.K; E-mail: Gold2002@campublic.co.uk. Web site: http://www.scientificjournals.com/espr/fecs/8thConf.2002

Aug 31-Sept 4, 2002: CSCOP-TSOP meeting - "Emerging Concepts in Organic Petrology and Geochemistry", Banff, Alberta, Canada. Abstract deadline: January 31, 2002. Web site: www.cscop-tsop2002.com

Sept 1-6, 2002: Mineralogy for the new millenium (IMA 2002), 18th General Meeting of the International Mineralogical Association, Edinburgh, United Kingdom. Contact: Mr K. Murphy, Executive Secretary, Mineralogical Society of Great Britain and Ireland, 41 Queen's Gate, London SW7 5HR, United Kingdom: Phone: +44 171 584 7516; E-mail: IMA@minersoc.demon.co.uk; Web site: http://www.minersoc.org/IMA2002

Sept 2-3, 2002: Transport and flow processes in shear zones, Joint International Research Meeting Tectonic Studies Group, Geological Society of London, Structural Geology and Tectonics Division, Geological Society of America, Geological Society of Australia. To be held at: Burlington house, Piccadilly, London, UK. Web site: http://www.st-and.ac.uk/academic/gg/html/tsg2001.html

Sept 2-7, 2002: Holocene environmental catastrophes and recovery, Brunel University, West London, UK. Co-sponsored by Brunel University, INQUA and PAGES. Contact: Contact: Prof. Suzanne A. G. Leroy, Department of Geography and Earth Sciences, Brunel University, Uxbridge, Middlesex UB8 3PH, (West London), UK; Phone: +44 1895 20 31 78; Fax: +44 1895 20 32 17; Phone secr: +44-1895-20 3215; E-mail: suzanne.leroy@brunel.ac.uk. Web site: http://www.brunel.ac.uk/depts/geo/Catastrophes/.

Sept 4-6, 2002: 20th European Conference - SEGH 2002 - Heavy Metal Contamination and the Quality of Life. Debrecen, Hungary. The Society for Environmental Geochemistry and Health. Web site: www.date.hu/rendez/segh2002

Sept 8-11, 2002: Hedberg Research Conference - The Hydrocarbon Habitat of Volcanic Rifted Passive Margins, Stavanger, Norway. Contact: Debbi Boonstra, AAPG Education Department, Post Office Box 979, Tulsa, OK 74101-0979, USA;Phone: +1 918 560 2630; Fax: +1 918 560 2678; E-mail: debbi@aapg.org; Web site: http://www.aapg.org/education/hedberg/index.shtml

Sept 8-13, 2002: Fifth International Conference on Subsurface Microbiology (ISSM02), Copenhagen, Denmark. Deadline abstracts: 15 March 2002. Contact: ISSM02, Helsingevej 23, DK-2830 Virum, Denmark; Fax: +45 4583 9727; E-mail: issm02@er.dtu.dk, Web site: http://www.er.dtu.dk/.

Sept 9–10, 2002: Geochemical speciation: determination, controls, significance - Mineralogical Society - Geochemistry Group Meeting, Salford University, UK. Mineralogical Society - Geochemistry Group Meeting. Contact: Dr Linda S. Campbell (Salford) and Dr Steven A. Banwart (Sheffield); E-mail: L.S.Campbell@salford.ac.uk or S.A.Banwart@sheffield.ac.uk. Web site: http://www.geolsoc.org.uk/template.cfm?name=Meeting_1

Sept 9–11, 2002: Iron Ore 2002, Perth Australia. Web site: http://www.ausimm.com. See also GN 110 (January 2002, page19).

Sept 9–11, 2002; Dreyer conference on global kaolin resources: exploration and development, Savannah, GA, USA. Contact; Society for Mining, Metallurgy and Exploration Inc.; E-mail: sme@smenet.org. Web site: http://www.smenet.org

Sept. 10–11, 2002: Uranium 2002 - Uranium deposits from their genesis to their environmental aspects, Prague, Czech Republic. Contact: Bohdan Kribek; E-mail kribeck@cgu.cz or Josef Zeman; E-mail jzeman@sci.muni.cz. Web site: http://xrd.cgu.cz/uranium.htm

Meetings Calendar

Sept 10-12, 2002: Conference on air quality III: mercury, trace elements, and particulate matter, Washington, DC, USA. Contact: Tom Erickson, Energy & Environmental Research Center, PO Box 9018, Grand Forks, ND 58202-9018, USA; Tel: +1 701 777-5153; E-mail: terickson@undeerc.org.

Sept 11-14, 2002: Geologica Belgica International Meeting "On the crossroads...", Leuven/Louvain, Belgium. Web site: http://www.kuleuven.ac.be/geology/leuven2002/

Sept 15-20, 2002: Uranium Mining and Hydrogeology III - International Mine Water Association. Symposium - Mine Water and The Environment, Freiberg, Germany. Contact: Prof. Dr. B. Merkel, Dr. Christian Wolkersdorfer, Lehrstuhl f¸r Hydrogeologie; Gustav-Zeuner-Str. 12; D-09596 Freiberg/Sachsen, Germany; Phone: +49 3731 39 3309; Fax: +49 3731 39 2720; E-mail: UMH@IMWA.de. Web site: http://www.IMWA.de and http://www.geo.tu-freiberg.de/umh/

Sep 16-18, 2002: International Conference on Tectonics and Metallogeny of Central and Northeast Asia, Scientific Hall, Russian Academy of Sciences, Academy Town, Novosibirsk, Russia. Contact: Alexander A. Obolensky, United Institute of Geology, Russian Academy of Sciences, Novosibirsk, Russia 630090; Phone: +7-3832-33-30-28; Fax: +7-3832-35-27-92; E-mail: obolensk@uiggm.nsc.ru; web site: www.uiggm.nsc.ru/uiggm/geology/admin/

Sep 17-21, 2002: Evolution of Karst: From Prekarst to Cessation, Karst Research Institute, Postojna, Slovenia. Contact: Dr.Franci Gabrovsek, Titov trg 2, 6230 Postojna, Slovenia; Phone: +386 5 700 19 33; Fax: +386 5 700 19 99; E-mail: gabrovsek@zrc-sazu.si; web site: http://www.zrc-sazu.si/evokarst

Sept 18-20, 2002: Environmental Radiochemical Analysis (ERA), Kent, UK. Web site: http://www.rsc.org/lap/confs/radiochem2002.htm

Sept 18-20, 2002: Conference on "Metallogeny of Precambrian shields", Kyiv, Ukraine. Web site: http://www.gl.rhbnc.ac.uk/geode/Kiev3.html

Sept 18-25, 2002: Atmospheric Chemistry in the Earth System, Crete, Greece. Contact: IGAC, E-mail: igac2002@chemistry.uoc.gr. Web site: http://atlas.chemistry.uoc.gr/IGAC2002

Sept 23-26, 2002: 2nd European Workshop on Clay Mineralogy, Jena, Germany. Contact: E-mail: bauer@ine.fzk.de; web site: http://www.uni-jena.de/chemie/geowiss/tagungen/clay2002/clay2002.html

Sept 26-30, 2002: Workshop/Short course Geochemical And Geophysical Monitoring Of Volcanic Systems: Melt Inclusion Techniques And Applications, Seiano di Vico Equense (Sorrento Peninsula, near Napoli) Italy. With a field trip to Vesuvius. Contact: Dr A. Sava, info@ersambiente.com.

Sept 30-Oct 3, 2002: Third Mediterranean Clay Meeting, Jerusalem, Israel. Web site: www.agri.huji.ac.il/clay_meeting/

Oct 3-5, 2002: Third International Conference on High Resolution Sector-Field ICPMS. Georgia State University, Atlanta, Georgia, USA. **www.cas.gsu.edu/hricpms**

Oct 3-4, 2002: 1st Boron Symposium, Dumlup-nar University, Kütahya, Turkey. Sponsored by Dumlup-nar University and the Chamber of Mining Engineers of Turkey. Web site: http://www.gl.rhbnc.ac.uk/geode/boron.html Contact: Dr. Kaan Erarslan,Phone: +90 274 265 20 62; Fax: +90 274 265 20 66; E-mail: erarslan@dumlupinar.edu.tr c.c: kaanerarslan@turk.net; web site: http://www.dumlupinar.edu.tr/boron.html

Oct 8-10, 2002: ECMP '02 - 3rd European Conference on Mineral Planning, Krefeld, Germany. Organized by Geological Survey NRW. Topic: "Raw-Materials Planning in Europe – Change of Conditions – New perspectives?" Contact: The Secretary ECMP02, Geological Survey NRW, De-Greiff-Strafle 195, 47803 Krefeld, Germany; Phone: +49 (0)21 51 8 97 - 2 64 / 3 32; Fax:+49 (0)21 51 8 97 - 5 35; E-mail: ecmp@gd.nrw.de; web site: http://www.gd.nrw.de/ecmp/

Oct 21-25, 2002: IAG International Symposium on Recent Crustal Deformations in South America and Surrounding Areas**,** Santiago de Chile, Chili. Web site: http://www.igm.cl/Espanol/Informacion/congreso/ProgramaIgles.htm

Oct 22-23: The 2002 William Smith Meeting - Life in earth: Energy, minerals, Mars and the deep biosphere, Geological Society, Burlington House, Piccadilly, London, UK. Convened by Steve Larter, Ian Head (University of Newcastle U Tyne, UK) and Heinz Wilkes (GeoForschungsZentrum Potsdam, Germany). Abstract deadline: May 1, 2002. Contact: steve.larter@ncl.ac.uk. Web site: http://nrg.ncl.ac.uk/news/news44.html

Oct 26, 2002: Setting Priorities in Solid Earth Sciences - A One-Day Workshop, Denver, CO, USA. Contact: Mike Brown; E-mail; mbrown@geol.umd.edu or Basil Tikoff; E-mail: basil@geology.wisc.edu.

Oct 26-27, 2002: Phosphates: Geochemical, Geobiological and Materials Importance, Golden, CO, USA. Short Course organizers: John Rakovan , Matthew Kohn, and John M. Hughes. At the Geological Society of America Meeting, sponsored by Mineralogical Society of America.

Oct 27-30, 2002: Geological Society of America Annual Meeting, Denver, Colorado, USA. Contact: GSA Meetings, Box 9140, Boulder, CO 80301-9140, USA. Phone: +1 303 447 2020, ext. 164; Fax: +1 303 447 1133. Web site: http://www.geosociety.org/meetings/2002/

Dec 2002: Plastic Deformation and Deformation Structures of Minerals, short course. Organizers: Shun-ichiro Karato and H.-R. Wenk. At the AGU Fall meeting. Sponsored by Mineralogical Society of America.

Dec 4-5, 2002: GS/MSA Short Course: Applications of Synchrotron Radiation to Low-Temperature Geochemistry and Environmental Science. DoubleTree Hotel, Monterey, California. Sponsored by the Geochemical Society, the U. S. Department of Energy, and Argonne National Laboratory. Web site: http://cars.uchicago.edu/shortcourse2002/Dec 6-10, 2002: AGU Fall Meeting, San Francisco, California, USA. Web site: www.agu.org.

Dec 9-12, 2002: International symposium - Clays in natural and engineered barriers for radioactive waste confinement, Reims, France. Contact: M. Klajman; Fax: +33 1461 18410; E-mail: meeting2002@andra.fr; web site: http://www.andra.fr/meeting2002.

Dec 11-14, 2002. 3rd European Meeting on Environmental Chemistry, Geneva, Switzerland. Contact: Dr. Montserrat FILELLA; E-mail: montserrat.filella@cabe.unige.ch. Web site: http://www.unige.ch/emec3/.

Dec 14-19, 2002: Geochemistry of Crustal Fluids: The Role and Fate of Trace Elements in Crustal Fluids, Seefeld in Tirol, Austria, by the European Science Foundation. Contact: Dr. J. Hendekovic, European Science Foundation, EURESCO Unit, 1 quai Lezay-Marnesia, 678080 Strasbourg Cedex, France; Phone: +33 388 76 71 35: Fax: +33 388 36 69 87; E-mail: euresco@esf.org. Web site: http://www.esf.org/euresco/02/lc02106

Jan 6-10, 2003: 10th International Symposium on deep seismic profiling of continents and their margins, Huka Village Conference Centre, Taupo, New Zealand. By the IASPEI; Royal Society of New Zealand, IGNS, Geoscience Australia. Contact: Dr Fred Davey, Institute of Geological & Nuclear Sciences; Phone: +64-4-570-1444; Fax: +64-4-570-4600; E-mail: seismix2003@gns.cri.nz. Web site: http://www.gns.cri.nz/news/conferences/seismix2003

Feb 4-5, 2003: Reservoir Geochemistry Conference, Petroleum Group Geological Society of London, to promote the latest advances in organic and inorganic geochemistry and their applications in the evaluation and study of reservoirs. Deadline for submission of formal abstracts was June 1, 2002. Contact: Dr. John Cubitt; E-mail: john-cubitt@es- information.demon.co.uk

Feb 8-14, 2003: American Society of Limnology and Oceanography (ASLO) Ocean Sciences Meeting, Salt Lake City, Utah, USA. Conference Theme: *The Earth's Eyes; Aquatic Sciences Through Space and Time*. See www.aslo.org/slc2003/ for more information.

Feb 16-21, 2003: Gordon Research Conference - Chemical Reactions At Surfaces, Holiday Inn, Ventura, CA, USA. Web site: http://www.grc.uri.edu/programs/2003/chemreac.htm

Mar 5-7, 2003: The Petrolem Geology And Hydrocarbon Potential Of East Africa, The Nairobi Safari Park Hotel, Nairobi, Nairobi, Kenya. ContactDr. N.C. Weggoro, P.O.Box 1096, Arusha, Tanzania; Phone: +257-27-2504253/8; Fax: +257-27-2504255; E-mail: weggoro@eachq.org.

Mar 23-27, 2003: 225th ACS National Meeting, New Orleans, LA, USA. Geochemistry Division Sessions: Organic Geochemistry in Contemporaneous Environments - Ancient Sediments and Laboratory Simulations (In Honor of Professor Earl W. Baker) - Ancient Biomolecules: New Perspectives in Archaeology and Palaeobiology. Web site: http://membership.acs.org/g/geoc/upcoming.html

Mar 24-27, 2003: Study of Matter at Extreme Conditions (SMEC), to promote the integration of mineral-physics, high-pressure chemistry/physics and materials science, Florida International University, Miami. Contact: Debby Arnold; E-mai: arnoldd@fiu.edu.

Mar 29-Apr 2, 2003: 3rd International Limnogeology Congress, Presidio Plaza Hotel, Tucson, AZ, USA. Contact: Andrew Cohen, Dept. of Geosciences, University of Arizona, Tucson, AZ 85721, USA; Phone: +1 520 621 4691; E-mail: acohen@geo.arizona.edu.

Apr 2-4, 2003: 18th Himalaya-Karakoram-Tibet Workshop (HKTW), Ascona, Monte Verita, Switzerland. Website: http://www.geology.ethz.ch/sgt/Himalaya/default.htm

Apr 6-11, 2003: EGS-AGU-EUG Joint Assembly, Nice, France. Http://www.copernicus.org/egsagueug

Apr 13-17, 2003: European Union of Geosciences (EUG) XII, Strasbourg, France. Contact: eug@eost.u-strasbg.fr; web site: http://eost.u-strasbg.fr/EUG

Apr 14-17, 2003: Uranium Geochemistry – 2003 - Ore deposits – Natural Analogy – Rehabilitation, Nancy, France. Contact: Uranium Geochemistry 2003 UMR-G2R - CREGU, Henri Poincare University, BP239, 54606 Vandoeuvre les NANCY Cedex, France; Fax: +33 - 3 83 91 38 01; E-mail: Michel.Cuney@g2r.uhp-nancy.fr. Web site: http://www.gl.rhbnc.ac.uk/geode/Registration.html

Apr 24-26, 2003: 15th Argentine Geological Congress, El Calafate, Santa Cruz Province, Southern Patagonia, Argentina. Contact: President Dr. Miguel Haller or Secretary Dr. Roberto Page, Asociacion Geologica Argentina, Maipu 645, 1 er Piso, Buenos Aires, Argentina; Phone: +54 11 4325 3104; Fax: +54 11 4325 3104; E-mail: haller@cenpat.edu.ar or fomicruz@internet.siscotel.com.

May 5-8, 2003: 3rd JGOFS Open Science Conference, Washington DC, USA. Contacts: Roger Hanson, JGOFS International Project Office, SMR, University of Bergen, PO Box 7800, 5020 Bergen, Norway; Phone: +47 555 84244; Fax: +47 555 89687 or Ken Buesseler, Department of

MEETINGS CALENDAR

Marine Chemistry and Geochemistry, WHOI, MS 25 Woods Hole, MA 02543, USA; Phone: +1 508 289 2309; Fax: +1 508 457 2193.

May 9, 2003: International Coalbed Methane Symposium, Tuscaloosa, AL, USA. Contact: College of Continuing Studies, University of Alabama, Box 870388, Tuscaloosa AL 35487-0388, USA; Fax: +1 205 348 9276; E-mail ghood@ccs.ua.edu.

May 12-17, 2003: GEOFLUIDS IV - on fluid evolution, migration and interaction in sedimentary basins and orogenic belts, University of Utrecht, Utrecht, The Netherlands. (Special Issue of Netherlands Journal of Geosciences: 'Geofluids in the Netherlands', early 2003. Deadline for manuscripts: January 15, 2002.) Contact: Mrs. Drs. J.M. Verweij, Scientific Organizing Committee (chair), Netherlands Institute of Applied Geoscience TNO -National Geological Survey, Department of Geo-Energy, PO Box 80015, 3508 TA Utrecht, The Netherlands; Phone: +31 30 256 46 00; Fax: +31 30 256 46 05; E-mail: j.verweij@nitg.tno.nl; Web site: http://www.nitg.tno.nl/eng/geofluid2.pdf

May 18-24, 2003: 39th Forum on the Geology of Industrial Minerals, John Ascuaga's Nugget Hotel & Casino, Sparks, Nevada, USA , by the Nevada Bureau of Mines and Geology, Nevada Division of Minerals, and Nevada Mining Association. Contact: Terri Garside, NBMG/MS 178, University of Nevada, Reno, NV 89557-0088; Phone: +1 775-784-6691 ext 126; Fax: +1 775-784-1709; E-mail: tgarside@unr.edu. Web site: http://www.nbmg.unr.edu/imf2003.htm

May 20-23, 2003: GERM 4, Lyon, France. Contact: Janne Blichert-Toft, Laboratoire de Sciences de la Terre (CNRS UMR 5570), Ècole Normale Superieure de Lyon, 46, Allee d'Italie, 69364 Lyon Cedex 7, France; Phone: +33 (0)472 72 84 88; Fax: +33 (0)472 72 86 77; E-mail: jblicher@ens-lyon.fr.

May 26-28, 2003: 2nd International Symposium on Contaminated Sediments: Characterisation, Evaluation, Mitigation/Restoration, Management Strategy Performance, Loews Le Concorde Hotel, Quebec City, Quebec, Canada. Contact: Helene Tremblay, Departement de Geologie et de Genie Geologique, Universite Laval; Phone: +1-418-656-2193; Fax: +1-418-656-7339; E-mail: 2sisc@ggl.ulaval.ca; web site: http://www.scs2003.ggl.ulaval.ca/

May 26-30, 2003: Applied Isotope Geochemistry Conference 5, Heron Island, Great Barrier Reef, Australia. Contact: Barry Batts; E-mail: bbatts@alchemist.chem.mq.edu.au.

May 29-June 1, 2003: Geology Without Frontiers: Magmatic and Metamorphic Evolution of the Central European Variscides, Blansko, Czech Republic. Web site: http://www.natur.cuni.cz/~cgs/nofrontiers/

Summer 2003: Ultra-high pressure metamorphism, 5th EMU School in Mineralogy, Roberto Compagnoni, Torino.

June 4-9, 2003: 17th Biennal European Current Research on Fluid Inclusions (ECROFI XXVII), Budapest, Hungary. Contact: Csaba Szabo, Lithosphere Fluid Research Lab, Department of Petrology & Geochemistry, Eotvos University (ELTE); E-mail: ecrofi17@geology.elte.hu; web site: http://ecrofi17.geology.elte.hu/

June 4-15, 2003: High-Pressure Crystallography, Erice, Italy. Contact: E-mail: katran@amu.edu.pl; web site: http://www.geomin.unibo.it/orgv/erice/highpres.htm

June 7–11, 2003: The Clay Minerals Society 40th Annual Meeting, Athens, Georgia, USA. Jointly held with the Mineralogical Society of America. Web site: http://cms.lanl.gov

June 8-13, 2003: Gordon Research Conference - Interior Of The Earth, Mount Holyoke College, USA.

June 9-12, 2003: Hedberg conference - Origin of Petroleum — Biogenic and/or Abiogenic and Its Significance in Hydrocarbon Exploration and Productions. Web site: http://www.aapg.org/education/hedberg/london/index.html

June 15-17, 2003: 7th international conference on the biogeochemistry of trace elements (7th ICOBTE), Uppsala, Sweden. Contact: ICOBTE7@slu.se; web site: http://www-conference.slu.se/7thICOBTE/index.htm

June 15-20, 2003: EUSTONE 2003 - Forum for Stone, Natural Stone Congress, University of Joensuu, Joensuu, Finland. Organization: Geological Survey of Finland. Contact; Mr Hannu Luodes, P.O.Box 1237, 70211 Kuopio, Finland; Phone: +358 20 550 3528; Fax: +358 20 550 13; E-mail: hannu.luodes@gsf.fi; web site: http://www.gsf.fi/events/eustone2003

June 15-20, 2003: Gordon Research Conference - Permeable Sediments, Bates College, Lewiston, ME, USA. Web site: http://www.grc.uri.edu/programs/2003/perm.htm

June 16-18, 2003: 5th International Conference on the Analysis of Geological and Environmental Materials, Rovaniemi, Finland. Web site: http://www.gsf.fi/geoanalysis2003

June 22–26, 2003: Euroclay 2003, Modena, Italy. Web site: www.unimo.it/euroclay2003/

June 22–27, 2003: 8th International Kimberlite Conference, Victoria, British Columbia, Canada. Contact: Dr. Roger H. Mitchell, Geology Department, Lakehead University, Thunder Bay, Ontario, Canada P7B 5E1; Phone: +1 807343 8287; Fax: +1 807-623-7526; E-mail: Roger.Mitchell@lakeheadu.ca. Web site: www.venuewest.com/8IKC.

July 20-25, 2003: Gordon Conference - Catchment Science: Interactions of Hydrology, Biology & Geochemistry - Water as a Mirror of the Landscape - How Valid and Useful is the hypothesis?, Colby-Sawyer College, New London, NH.Web site: http://www.grc.uri.edu/programs/2003/forest.htm

July 28-Aug 1, 2003: 66nd Annual Meeting of the Meteoritical Society, M¸nster, Germany. Contact: E-mail: ekj@nwz.uni-muenster.de (subject: 66MetSoc); web site: http://www.uark.edu/campus-resources/metsoc/index1.htm

Aug 2003: XVth International Congress on the Carboniferous and Permian (XV ICC-P) and 55th Meeting of the International Committee for Coal and Organic Petrology (55 ICCP). Web site: http://www.nitg.tno.nl

Aug 10-15, 2003: Chemistry at the interfaces, 39th IUPAC Congress and 86th Conference of The Canadian Society for Chemistry, Ottawa, Canada. Web site: www.nrc.ca/confserv/iupac2003

Aug 16-18, 2003: SCANDIUM 2003 - An International Symposium on the Mineralogy and Geochemistry of Scandium, Natural History Museums and Botanical Garden, University of Oslo, Norway.

Aug 24-29, 2003: 5th International Conference on f-elements (ICFe), Geneva, Switzerland. Web site: http://ereswww.epfl.ch/icfe/

Aug 24-30, 2003: ECM-21 - XXI European Crystallographic Meeting, Durban, South Africa. Web site: http://www.ecm21-africa.co.za/

Aug 31-Sept 5, 2003: The 16th International Mass Spectrometry Society Conference (IMSC), Edinburgh, Scotland, UK. Web site: http://www.imsc-edinburgh2003.com/

Sept 2-6, 2003: Fifth Hutton Symposium on the Origin of Granites, Toyohashi City, Japan. Contact: Hutton V office; E-mail Hutton-V@m.aist.go.jp; web site; http://www.gsj.jp/Info/event/hutton

Sept 2-6, 2003: ECNS 2003 European Conference on Neutron Scattering, Montpellier, France. Contact: E-mail: rene@ldv.univ-montp2.fr; web site:

Sept 7-11, 2003: 6th International Symposium on Environmental Geochemistry (ISEG), Edinburgh, UK. Contact: Dr. John G. Farmer, Department of Chemistry, University of Edinburgh, West Mains Road, Edinburgh EH9 3JJ, UK; E-mail: J.G.Farmer@ed.ac.uk.

Sept 7-12, 2003: 13th V.M. Goldschmidt Conference, Kurashiki, Japan. Web site: http://www.ics-inc.co.jp/gold2003/

Sept 8-12, 2003: 21st IMOG meeting, Krakow, Poland. Web site: http://www.eaog.org/meetings/imog2003.html

Fall, 2003: Biomineralization Short Course. Organizers: Patricia Dove , James J. DeYoreo and Steve Weiner. At the AGU fall meeting or MRS Fall Meeting. Sponsored by Mineralogical Society of America.

Oct 6-9, 2003: North Africa & Mediterranean Geoscience Conference, Tunis. Web site: http://www.eage.nl/conferences/index2.phtml?confid=15

Nov 2–5, 2003: Annual meeting GSA, Seattle, Washington. Web site: http://www.geosociety.org/meetings/index.htm.

Dec 7-9, 2003: International Congress of Chemistry and Environment ICCE-2003, Indore, India. Web site: http://www.chemenviron.com

Dec 8-12, 2003: AGU Fall Meeting, San Francisco, California, USA. Web site: www.agu.org.

Dec 12-13, 2003: ACE 2003 - 4th European meeting on environmental chemistry, Plymouth, UK. Contact: Dr. Mark Fitzsimons, Dept. of Environmental Sciences, University of Plymouth, Plymouth, PL4 8AA, UK; E-mail: mfitzsimons@plymouth.ac.uk.

May 17-21, 2004: joint meeting - 2004 AGU spring meeting and the Canadian Geophysical Union annual meeting, MontrÈal, Canada. Contact: meetinginfo@agu.org.

May 26-Juni 6, 2004: Polymorphism: Solvates and Phase Relationships, Erice, Italy. Contact: E-mail: Yoel@bgumail.bgu.ac.il; web site: http://www.geomin.unibo.it/orgv/erice/olderice/bernstei.htm

July 25-20, 2004: 7th INTECOL International Wetlands Conference, Utrecht University, Utrecht, The Netherlands. Web site: http://www.bio.uu.nl/INTECOL

Aug 20-28, 2004: 32nd International Geological Congress (IGC), Florence, Italy. Geochemical Society/IUGS. Web site: http://www.32igc.org/

Aug, 2004: 67nd annual meeting of the Meteoritical Society, Rio de Janeiro, Brazil. Contact: E-mail: congrex@congrex.com.br

Dec 2004: ACE 2004 - 5th European meeting on environmental chemistry, Bari, Italy. Contact: Dr. Michele Aresta, METEA Research Center, University of Bari, via Celso Ulpiani 27, 70126 Bari, Italy; E-mail: resta@metea.uniba.it

Dec 13-17, 2004: AGU Fall Meeting, San Francisco, California, USA. Contact : meetinginfo@agu.org.

2005: IAVCEI, Continental Basalt Volcanism, China.

Aug 2005: IUCr-20 - XX Meeting and General Assembly of the International Union of Crystallography, Florence, Italy.

July 2006: IMA-2006 - XIX General Meeting of the International Mineralogial Association, Kobe, Japan.

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