The conference buildings on the campus of Eötvös Loránd University

The 20th General Meeting of the International Mineralogical Association took place between 21 and 27 August in Budapest, Hungary. It was a great success, and I and everyone I spoke to seem to have thoroughly enjoyed themselves, not least because of the high standard of many of the presentations. The IMA General Meetings take place in different, interesting cities every four years, and the organizers always make a genuine effort to be truly international. These meetings have a feel that is different, more characterful, than many of the other big meetings I’ve attended. IMA 2010 was the biggest mineralogical meeting ever, with about 1700 participants from 74 countries. The organization was headed by Tamás Weiszburg from Hungary (Chairman of the International Organizing Committee), Ekkehart Tillmanns from Austria (General Chairman and Chairman of the Scientific Programme Committee) and Dana Pop from Romania (Secretary General). They orchestrated a consortium representing the mineralogical or geological societies of Austria, Bulgaria, Croatia, Czech Republic, Hungary, Poland, Romania, Serbia, Slovakia and Slovenia. That in itself was a considerable feat of organization, and it’s good to see that mineralogy is thriving in countries that until not long ago had the misfortune to be behind the Iron Curtain.

The meeting took place in two huge, comfortable, modern buildings of the Eötvös Loránd University, on the west bank of the Danube (Duna in Hungarian). They were close together and it was easy to commute between them. The meeting was very efficiently run and had a number of special touches that made it memorable. Name badges to hang round your neck that were double-sided were a touch of genius. There was a small army of students, from many countries, in yellow ‘Can I help you?’ T-shirts, and the poster sessions were accompanied, not only by beer, but by live musicians. A young man played Bach and (I think) Bartok on the piano beautifully, and there was a wonderful soprano. An IMA 2010 Conference Choir performed at the ceremonies, and participants were invited to join them. On each day a very professionally produced full-colour news-sheet was handed out, commenting on the events of the previous day and highlighting the day’s forthcoming events. There were all manner of sporting events to attend and a big programme of popular field trips.

High spots of the scientific parts of the meeting were the two daily plenary lectures, all of which were well attended. Six were ‘Elements 5’ talks, to mark this magazine’s fifth year of publication. Five of these were given by young(ish) guest editors or contributors to successful issues, the sixth by Rod Ewing, the founding father and prime mover of Elements. A contingent of distinguished American mineralogists greeted his ascent to the rostrum with an outburst of whistles and whoops, which added to the festive feel. A second series of IMA plenaries, by household names in the world of mineralogy, included the presentation of the 2009 IMA Medal to Frank Hawthorne and the EMU Research Excellence Medal to Max Wilke. Olgeir Sigmarsson gave a beautifully illustrated account of the 2010 Eyjafjallajökull eruption, which caused much disruption in European airspace but obligingly went back to sleep in time for IMA.

The mighty Duna is impressive, with an endless succession of immense barges transporting coal and goods across Europe. You can enter the Rhine from the North Sea at Rotterdam, and thanks to some relatively short connecting canals, emerge from the Danube on the Black Sea at Sulina, 3500 km away. I’m sorry to have to report, however, that the Danube at Budapest is not blue! I enjoyed a week of good meals with good friends in very pleasant restaurants, and as I walked unsteadily back to my hotel late at night it was good to see young people on the streets with no sense of threat or hostility. To a Briton, services seemed cheap and efficient, and my hotel, where a pianist played Mozart on a white grand piano in the lobby, was modern and comfortable. For me, a final meal with the officers of the IMA, in the grand Hotel Gellért, was to be transported back to the elegance and style of the Austro-Hungarian empire, a memorable end to the meeting.

As a one-time president of IMA, I would like to end by thanking all the organizers, and their yellow-shirted helpers, for their immense amount of hard work and for providing us with such an imaginative, well-run meeting. As a past Elements editor, I’d like to thank them also for giving our plenary lecture series such prominence. As I write, the delicate swallows and house martins in my garden are swooping about, preparing to make their great autumn journey to South Africa. In 2014 we can make the same journey, in our clumsy jets, to the next IMA meeting. If I’m spared, I’ll be there!

Ian Parsons
University of Edinburgh, UK

Maryse Ohnenstetter relaxes at an IMA gala dinner with husband Daniel at the end of her term of office as IMA Secretary

Austro-Hungarian grandeur

Attila Demeny and Amir Mortezo in discussion during a poster session
The 11th International Platinum Symposium (IPS) was held in June 2010 on the Laurentian University campus in Sudbury, Ontario (Canada) and was attended by 295 participants (244 professionals and 51 students) from 26 countries. It was hosted by the Mineral Exploration Research Centre and Department of Earth Sciences at Laurentian University (LU) and by the Ontario Geological Survey (OGS).

Three premeeting workshops were held: PGE in Mantle Melts, organized by Steve Barnes (CSIRO) and Marco Fiorentini (U Western Australia); PGE–Chromite Connection, organized by Jim Mungall (U Toronto); and Layered Intrusions, organized by Jim Miller (U Minnesota Duluth) and James Scoates (U British Columbia).

The three and a half days of technical sessions included 86 morning and afternoon oral presentations and 57 late-afternoon poster presentations. They were arranged according to the following themes: PGE Deposits (organized by Dave Peck, Consultant, and Gordon Chunnett, U Witwatersrand); Ni–Cu–(PGE) Deposits (Michael Lescher, LU, and Peter Lightfoot, Vale); PGE Geochemistry (Sarah-Jane Barnes, UQAC, and James Brenan, U Toronto); and PGE Mineralogy and Beneficiation (Michelle Huminicki, Brandon U, and Paul Sylvester, Memorial U). The meeting was opened by Christine Kaszycki (Ontario Assistant Deputy Minister of Mines and Minerals), and keynote speakers included Tony Naldrett (U Toronto/U Witwatersrand), Jean-Pierre Lorand (CNRS-Paris), Ed Ripley (Indiana U), and Louis Cabri (Consultant). Ray Goldie (Salman Partners) gave an evening public lecture. The meeting was dedicated in honour of Reid Keays, who coorganized the first IPS in Melbourne and who has been a world leader in PGE research.

Nine pre- and post-meeting field trips, organized by Michael Easton (Ontario Geological Survey) and Dave King (Quadra-FNX), were held: Levack Mine and North Range of the Sudbury Intrusive Complex (SIC), led by Steve Dunlop, Steven Gregory, and Renée Parry (Quadra-FNX) and Walter Peredery (Consultant); McCredy West Mine and North Range SIC, led by Roger Lighty, Mynyr Hoxha, and Thomas Maxwell (Quadra-FNX) and Walter Peredery (Consultant); Podolsky Mine and Whistle Offset, led by Judd Fee and Chelsey Protulipac (Quadra-FNX); Sudbury Foottula Deposits, planned by Jake Hanley (St Mary’s) and led by Mike Sweeny (Xstrata) and Attila Pénat (Wallbridge); Sudbury Contact and Offset Deposits, led by Paul Golightly (Consultant) and Ed Pattison (Consultant); Abitibi Komatiites and Ni–Cu–(PGE) Mineralization, led by Michel Houlé (Geological Survey of Canada), Sonia Préfontaine (OGS), and Brian Atkinson (OGS); Lake Superior Ni–Cu–(PGE) and PGE–(Cu)–(Ni), led by Jim Miller (U Minnesota Duluth) and Mark Smyk (OGS); and River Valley PGE–Cu–Ni, led by Mike Easton (OGS), Richard James (LU), and Scott Jobin-Bevans (Caracle Creek).

Laboratory tours were also given: Ontario Geoscience Laboratories (OGL), led by Ed Deibicki and Marcus Burnam (OGL); MIRARCo 3D Virtual Reality Theatre, led by Bob Anderson and Pavel Vasak (MIRARCo); and the LA-ICP-MS Geochemical Fingerprinting Laboratory, led by Balz Kamber and Thomas Ulrich (LU); and the Xstrata Process Support facility, led by Lori Kormos.

Readers interested in receiving information about future PGE and Ni–Cu–(PGE) meetings should contact Sarah-Jane Barnes (sarah-jane@uqac.ca), who manages the MAGSUL_L list server.

**Michael Lescher** and **Pedro Jugo**
Laurentian University, Sudbury, Canada

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The AquaTRAIN project, funded by the European Union, focuses on geogenic chemicals. These elements are naturally found in groundwaters and soils. Despite their “natural” origin, the concentrations of these geogenic chemicals, notably arsenic, selenium, fluoride, and manganese, can be high enough to cause significant environmental and health risks. For example, in many parts of circum-Himalayan Asia, over one hundred million people have been chronically exposed to arsenic-bearing groundwater, used extensively for drinking, irrigation, and cooking, with devastating health consequences. In Europe, exposures are generally lower but there are still significant concerns. It is important, therefore, to understand the occurrence, and the controls on the occurrence, of geogenic chemicals and to explore remediation options and the implications for policymakers and regulators. These key aspects fall within four major work areas within the AquaTRAIN Marie Curie Research Training Network as well as other groups in Europe and elsewhere.

The objectives of this international conference, incorporating the final AquaTRAIN workshop, were:

1. To present state-of-the-art developments in these 4 aspects of geogenic chemicals in groundwaters and soils: speciation, occurrence, remediation and implications for policy
2. To enable exchange of ideas between European- and non-European-based researchers, for example, to see how remediation, mapping, microbiological and speciation methods developed in Europe can potentially be applied to other areas, and to explore how studies of highly impacted aquifers in Asia can inform studies in Europe
3. To identify key research questions and objectives and explore potential for collaborative research to address these objectives.

**Dr. Romain Millot** (BRGM, Orléans, France, r.millot@brgm.fr)
**Pr. David Polya** (University of Manchester, United Kingdom, david.polya@manchester.ac.uk)
**Pr. Laurent Charlet** (Université J. Fourier, Grenoble, France, laurent.charlet@obs.ujf-grenoble.fr)
A CENSUS OF MINERAL SPECIES IN 2010

Michael D. Higgins¹ and Dorian G. W. Smith²

Our census is an instantaneous view of the state of the population of mineral species. As in the case of a demographic census, it is necessarily subject to minor errors and omissions, but these do not change the overall picture. The census includes both unnamed minerals (new minerals but not sufficiently well documented to be officially named) and named species—those approved by the Commission of New Minerals, Nomenclature and Classification (CNMNC) of the International Mineralogical Association (http://pubsites.uws.edu.au/ima-cnmnc/). This community of unnamed minerals and named species has over 6000 members now, but it is continually growing and changing: new unnamed mineral species are validated; existing unnamed minerals are promoted by receiving a name; and existing minerals are renamed or discredited. The physical and chemical properties of each species also evolve as more data are added and the higher-level classifications of minerals are changed. The availability of databases of mineral properties puts us in a position to see a broad view of mineral properties and their variations much more easily and more accurately than at any time in the past. This census is based on the very substantial MinIdent-Win database (http://micronex.ca).

The development of mineralogy is mirrored by the discovery rate of new minerals (Fig. 1). The number of minerals known in antiquity (~30) had not increased substantially by 1760. During the next 50 years the discovery rate climbed to about 10 new minerals per year and stayed there until the end of the 1950s when analysis by electron beam instruments became possible. From then on, the discovery rate climbed rapidly, rising to about 100 per year, or one every 4 days, in the 1980s and has diminished only slightly since that peak. The growth of mineral numbers also reflects the advances in crystallographic techniques and instrumentation and in particular our new ability to determine site occupancies accurately. Another effect may be the relative ease of the modern two-stage process of mineral identification: first, definition as a valid, unnamed species and, second, promotion to a named species when more complete data become available. Currently about 25% of mineral species remain unnamed.

In a general way, the chemical compositions of minerals can be explored by looking at the elements in their formulae. O is the most common element, occurring in 76% of formulae, followed by H (53%), Fe (32%), Si (31%), Ca (27%), S (24%) and Al (23%). It is known that mineral formulae do not always reflect the actual composition of minerals, but how common is this? One way to explore this is to compare the number of minerals with an element in their formula with the number of minerals with that element as a significant component—here taken for simplicity as a mean analyzed composition greater than 1%. There is a very good 1:1 correlation between these measures, except for the rare earth elements heavier that Nd, which are commonly omitted from formulae.

Another way of looking at mineral compositions is by means of a graph of the number of minerals with the element in the formula versus crustal abundance (Fig. 2). More than two-thirds of the elements lie in a broad band across the diagram, indicating that the number of minerals that contain each element is correlated with the crustal abundance. That is, silicates are numerous because Si and O are abundant; minerals with Au are less numerous because this element is rare. This correlation also suggests that there are many more minerals of the less abundant elements waiting to be described. Within the correlation band, the non-metals (H, O, S, As and Te) are generally in more mineral formulae than metals, which is comforting as the broad classification of minerals is partly based on these elements (silicates, oxides, sulfides, etc.).

But what about the elements that lie beneath this band? They appear to lack their fair share of minerals. Some elements just below the correlation band form their own minerals, but these are not numerous: Mo, W, Th and N. Also, the presence of a number of rare earth elements in this part of the graph partly reflects the discrimination in formulae mentioned above, but it is also due to the great difficulty in determining REE accurately by microbeam techniques, resulting in their absence from many reported analyses. However, even if this is taken into account, REE minerals do seem to be less numerous than expected. The other elements below the band are a mixed bunch that seem to be genuinely camouflaged by similar but more abundant elements: Re, Hf, Rb, Ga, Sc, Br, I, In, Cs, Ge, Cd and Tl.

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FIGURE 1 Compilation by decade of the date of the first description of named and validated unnamed mineral species. The numbers of unnamed minerals are for species currently thus classified—clearly in the past some of the currently named species were in the unnamed category.

FIGURE 2 Numbers of minerals with specific elements in their formula versus the crustal abundance of that element (data from the CRC Handbook). Crustal abundance is used because most minerals are described from crustal rocks. However, the effects of different normalizations (mantle, etc.) are generally minor because of the logarithmic scales of the graph. Some elements are missing from all formulae and hence from this graph. Rare earth elements are in blue.
Cosmochemistry is an exciting, new and rapidly growing interdisciplinary field. A student of cosmochemistry is expected to have some knowledge of chemistry, physics, astronomy, mineralogy and geology. A scholarly presentation of all these aspects in a single publication has been lacking for many years. Charles Cowley’s *Introduction to Cosmochemistry*, published in 2005, is too heavily biased towards astrophysics to qualify as a comprehensive cosmochemistry book. The new book by Hap McSween and Gary Huss entitled *Cosmochemistry* is to a large extent devoted to the chemical and isotopic composition of solar system materials, but it also contains sections on nucleosynthesis and solar physics and an appendix on analytical techniques. It provides an excellent introduction to the multidisciplinary field of cosmochemistry.

A comparison with Ross Taylor’s *Solar System Evolution* (1992) reveals the enormous progress achieved during the last 18 years of cosmochemical research: (1) Advances in instrumentation for analyzing trace elements and stable and radioactive isotopes in meteorites and components of meteorites down to the micro- and nanometer scales have produced an incredibly precise chronology of the early solar system. (2) New dating tools, such as the $^{182}$Hf–$^{182}$W system, have opened the way for the spectacular discovery that iron meteorites are older than stony meteorites. (3) Completely new types of meteorites have been identified. (4) A wealth of data from new missions to Mars, the Moon, the asteroids and comets has led to a quantum leap in our understanding of the formation and evolution of the solar system. All of this is competently and extensively reviewed in the McSween and Huss book.

The book begins with a definition of cosmochemistry as “the study of the chemical composition of the universe and the processes that produced these compositions.” During the second half of the 20th century, cosmochemistry evolved as an offshoot of geochemistry. Extraterrestrial materials were simply analyzed with instruments commonly used in geochemistry. This has completely changed. Following McSween and Huss, geochemistry may now be considered a branch of cosmochemistry. One can view cosmochemistry as the materials science of the universe. As McSween and Huss point out, the generally small size of valuable extraterrestrial materials has been and will be a driving force for improvement in analytical tools, which will provide collateral benefits to geochemistry, as exemplified, for example, in stable isotope cosmochemistry. Sophisticated procedures specifically developed for measuring tiny variations in stable isotopes among solar system materials find increasing applications in low-temperature geochemistry. Also, many of the isotope systems used for dating Earth rocks were first developed for the analysis of extraterrestrial samples and only later applied to the chronology of terrestrial samples. Examples include the Ar–Ar, Sm–Nd, Lu–Hf, and Re–Os systems.

Following the introduction, some basic nuclear physics and chemistry are presented, apparently addressed to a readership at the undergraduate level. With these tools at hand the origin of elements is discussed in some detail. This sequence highlights the procedure adopted by the authors for the entire book. Basic physics, chemistry and mineralogy are explained to the extent required for understanding the more complicated issues. A didactic approach is visible throughout the book. Each of the fourteen chapters is arranged in the same way, with an overview at the beginning and a summary after the main text; this is followed by a section with questions about the main message of the chapter and suggestions for further reading and references. The text is divided into many smaller units, sections and subsections with appropriate headings. I find this helpful as many readers will use the book mostly as a source of information on specific cosmochemical issues and problems.

Before discussing meteorites, the authors provide a detailed account of presolar grains; this excellent chapter is based on the extensive experience of the second author in this subject. In the following chapters, the authors stress processes of formation of meteorites and their parent bodies and avoid extensive discussions about naming and classifying meteorites and their components.

A full chapter is devoted to geochemical and cosmochemical fractionations – a very useful and informative section highlighting the similarities and differences of geochemical and cosmochemical processes. A first-order observation about the result of a typical cosmochemical process is the depletion of volatile elements in almost all solar system objects. In this and later sections, the authors emphasize evaporation of chondritic matter as their preferred model for producing the low volatile-element contents of most meteorites and planets. The authors consider the famous Ca–Al-rich inclusions (CAIs) as residues of episodic heating processes. Low temperatures prevailed throughout the formation of the solar system except for local heating events that produced chondrules. This point of view is not universally accepted. There is evidence in meteorites for condensation processes. Here the authors could have provided a more balanced discussion by mentioning alternative possibilities. Other chapters deal with chronometers and the chronology of the early solar system, and there is a chapter on highly volatile elements, mainly rare gases and organic matter.

The remainder of the book is devoted to the larger objects of the solar system: asteroids (as meteorite parent bodies), comets and the terrestrial planets. Included are discussions of the composition and evolution of the Earth, Mars, the Moon and Vesta. We have samples of all four of these. Early in their history they differentiated into a core, mantle and crust, but each of them has had a somewhat different evolution. Similarities and differences among the planets are subsumed in what is today called *comparative planetology*, a completely new area of research. The final chapter deals with the description of analytical tools and their applications, a worthwhile addition for scientists from other disciplines.

Despite the 550 pages of text, one will always miss one aspect or another, depending on one’s personal preferences. I, for example, regret the absence of a presentation on recent modeling of the formation of the Earth and the other terrestrial planets, which has been done by Wetherill and later Stewart, Morbidelli and others. Impact enthusiasts will miss a section on impacts and terrestrial craters. It is, however, virtually impossible to cover all aspects of cosmochemistry in a single book.

The book is very well written. It goes into great detail when necessary and succeeds in explaining even complex facts with simple words, avoiding technical jargon. Most of the figures are excellent and focus on the main message. This is a style that the senior author has successfully applied in his earlier books on meteorites and the solar system. The book is complemented by tables with element abundances in some meteorites, condensation temperatures and other items.

In summary, *Cosmochemistry* gives a comprehensive survey of the present state of the science. I highly recommend it for undergraduate and graduate students. Researchers in other fields with some interest in cosmochemistry will also find this book extremely useful.

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THEORETICAL AND COMPUTATIONAL METHODS IN MINERAL PHYSICS: GEOPHYSICAL APPLICATIONS

In the foreword to Reviews in Mineralogy and Geochemistry volume 71, entitled Theoretical and Computational Methods in Mineral Physics: Geophysical Applications, the editors, Renata Wentzcovitch and Lars Stixrude, note that the influence of computational mineral physics to the Earth sciences has been “transformative and was unimaginable at the onset.” Just how much the use of atomistic model calculations in the mineral sciences has changed in the last 25 years becomes clear by comparing volume 71 with volume 14 of the series, published in 1985 (Microscopic to Macroscopic Atomic Environments to Mineral Thermodynamics; S.W. Kieffer and A. Navrotsky, editors). While atomistic model calculations have long been employed to study structure–property relations of a few minerals (e.g. by Born and Zeman in 1963 for garnets), in the mid-1980s atomistic modeling of minerals emerged as a tool to understand and predict structures, stability, and elastic, vibrational, and thermodynamic properties of silicates and related compounds. Volume 14 includes a paper by Burnham, entitled “Mineral Structure Energetics and Modeling Using the Ionic Model,” which describes the state of the art at that time.

Volume 71 shows that models based on empirical potential (force field) are still employed to give fundamental insight that cannot be obtained by models based on quantum mechanics, either in terms of the number of atoms required in the simulation or to the requirement for very fast calculations. For example, in molecular dynamics simulations, millions of time steps may be required. Twenty years ago a simple geometric optimization of an ionic model of garnet on a microVax using one of the few established codes at that time took a few days. Nowadays, the same calculation takes a few seconds on a PC. These advancements are due not only to improvements in the hardware but also to the development of very efficient codes, such as the widely used “General Utility Lattice Program” (GULP), written by J. Gale. The capabilities of this program are introduced in a chapter by J. Gale and K. Wright. In other chapters (Carrez and Cordier on dislocation modeling, Vinograd and Winkler on modeling of the thermodynamics of solid solutions), applications of atomistic modeling studies performed with the GULP code are presented; in these applications, rather complex structural models are required, thus preventing the brute-force approach used with quantum mechanical models. The usefulness of force field calculations is also discussed by Ghiorso and Spera, who employ models with several thousand atoms, running for long times, to study transport properties.

So, while more mature, user-friendly, and efficient codes, in conjunction with faster computers, have transformed the field of empirical potential-based modeling, this development could have been anticipated 25 years ago. The most fundamental change, which was not foreseeable 25 years ago, was the impact that density functional theory (DFT)–based calculations have nowadays. DFT-based calculations of structures and their properties are currently the most widely used quantum mechanical models for solids, and they have provided new insight into all fields concerned with the understanding of structure–property relations of condensed matter. Consequently, the book provides overviews to the theoretical groundwork of DFT (by Perdew and Russelinsky) and to density functional perturbation theory (by Baroni et al.). The latter is an extension of “standard” DFT that allows an efficient calculation of the lattice dynamics, and hence of thermodynamic properties, for the quasi-harmonic approximation. These two chapters provide a good entry point for researchers interested in the foundation of modern atomistic simulation approaches. A chapter entitled “Minnesota Density Functionals” (by Zhao and Truhlar) is addressed more to the advanced specialist as, to the best of my knowledge, their functionals have not yet been implemented in DFT codes commonly used in mineral physics studies.

After introducing the theoretical basis, emphasis is placed on studies showing state-of-the-art developments of approaches needed to compute thermodynamic and thermoelastic properties (chapters by Wentzcvitch et al.; Alfe; and Stixrude and Lithgow-Bertelloni). Diffusion (Amman et al.), thermal conductivity (Stackhouse and Stixrude), structure prediction (Oganov et al.), and phase transition in ice and at multi-megabar pressures (chapters by Umemoto and Umemoto et al.). It is worthwhile noting that the studies of dislocations and solid solutions mentioned above also employed density functional theory–based calculations at some stages, e.g. for validating empirical potentials. The ability to compute structural properties and properties at elevated temperatures, and not only in the athermal limit, is of fundamental importance for the applicability of first-principles calculations to the Earth sciences, and the book conveys in an outstanding manner the achievements of the last years.

In addition to the studies mentioned above, which are mostly concerned with crystalline phases, DFT studies also allow the simulation of melts (chapter by Karki). A comparison with the Ghiorso and Spera contribution highlights the differences between force field–based models and parameter-free DFT simulations with respect to accessible ensemble sizes and simulation times. The comparatively small ensembles that can be studied by quantum mechanical methods require extensive tests to exclude size effects, i.e., the dependence of the results on the number of atoms used in the model. On the other hand, the predictive power of force fields is limited to the pressure range for which they were derived, and the applicability of such models in simulations of the behavior of minerals at extreme conditions requires extensive validation studies, so that parameter-free models become a more attractive choice. It will be interesting to see how far and how fast the gap between force field and quantum mechanical dynamic simulations and ab initio calculations will be closed by the evolution of new hardware concepts, such as the use of graphical processing units, in conjunction with new parallelization techniques.

While the above-mentioned chapters convincingly show that with “standard” DFT numerous problems can be addressed, this approach has several shortcomings, many of which are related to our ignorance of the exact form of the exchange-correlation functional. This lack of knowledge forces us to use approximations such as the generalized gradient approximation. It is therefore of great interest to develop alternative methods that do not rely on approximations. One such approach is based on quantum Monte Carlo (QMC) techniques, introduced in the contributions by Ceperley and Mitas and Kolorene. There is, of course, the caveat “Given sufficient computer resources...”, which is a subtle hint to the adventurous reader who is considering trying this approach, that these calculations can be computationally very expensive, and that the codes are certainly not as easy to use as some of the mature DFT codes available in the public domain.

Alternatively, some shortcomings of standard DFT approaches can be overcome by an extension of standard DFT, and one such extension, the so-called LDA+U approach, is reviewed by Cococcini. In the Earth sciences, this approach, which better describes the interaction of localized electrons, is required for accurate studies of several important iron-containing phases, such as wüstite and fayalite, and specifically for studies of spin transitions of lower-mantle minerals (chapter by Hsu et al.).

As is obvious from this long list of topics, volume 71 provides a comprehensive overview of recent developments in atomistic modeling approaches in mineral physics. The editors have very carefully selected complementary contributions from leaders in the field, which cover the general topic from a variety of viewpoints. There is very little redundancy. The contributions are balanced, although other approaches, such as the calculation of phonons from finite displacements instead of perturbation theory, could have been included. It probably would have been helpful for some readers to have a list of Internet resources, as many codes are in the process of development and relevant tutorials are available on the web. But these are minor shortcomings, as the extended bibliographies contain all the necessary information.

In conclusion, volume 71 of Reviews in Mineralogy & Geochemistry offers a representative snapshot of the current state-of-the-art computational methods in mineral physics. Comparing volume 14 to volume 71 leads me to wonder about the unforeseen developments that volume 137, to be published around 2035, will contain.

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**ICAM 2011**

ICAM2011.org

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**CALENDAR**


**August 1-5** 10th ICAM International Congress for Applied Mineralogy, Trondheim, Norway. Details: Maarten A.T.M. Broekmans, e-mail: maarten.broekmans@ntnu.no; website: www.icam2011.org


**August 7-11** European Association of Geochemistry (EAG) Workshop: Tools in Environmental Biogeochemistry – Opportunities and Limitations, Tübingen, Germany. Details: Andreas Kappler, e-mail: andreas.kappler@uni-tuebingen.de; web page: www.eag.eu/EAG_Workshop.html

**August 8-12** 74th Annual Meeting of the Meteoritical Society, Greenwich, England. Details: Gretchen Benedix, e-mail: greb@nhm.ac.uk; web page: www.metsoc2011.org


**August 28-September 1** 242nd American Chemical Society (ACS) National Meeting & Exposition, Denver, CO, USA. Web page: www.acs.org


**September 4-7** 7th European Conference on Mineralogy and Spectroscopy (ECMS 2011), Potsdam, Germany. Details: Prof. Dr. Monika Koch-Mueller; e-mail: mkoch@gsf-potsdam.de; web page: www.physchemgeo.ecms/index.html

**September 4-7** FRAGILE EARTH: Geological Processes from Global to Local Scales and Associated Hazards, Munich, Germany. Webpage: www.geosociety.org/meetings/2011munich

**September 20-24** GEOMED2011 – 4th Hemispheric Conference on Medical Geology, Bari, Italy. Details: Saverio Fiore, e-mail: fiore@mma.cn.it; web page: www.geomed2011.it

**September 26-29** 11th Biennial Society for Geology Applied to Mineral Deposits (SAGA) Meeting, Antofagasta, Chile. E-mail: sga2011@ucn.cl; web page: www.sga2011.ucn.cl

**October 9-12** Geological Society of America Annual Meeting, Minneapolis, MN, USA. E-mail: meetings@geosociety.org; web page: www.geosociety.org/meetings/2011

**October 16-20** Materials Science & Technology 2011 Conference and Exhibition – MS&T ’11 combined with the AACES 113th Annual Meeting, Columbus, OH, USA. Web page: www.tms.org/Meetings/meetings.asp

**November 21-24** Conference on Arsenic in Groundwater in South Asia, Hanoi, Vietnam. E-mail: vietcatasds@yahoo.com; web page: vietcetasd53@yahoo.com

**November 28-December 2** MRS (Materials Research Society) Fall Meeting, Boston, MA, USA. Web page: www.mrs.org/s_mrs/index.asp

**2012**

**March 11-15** The Minerals Metals & Materials Society (TMS) TMS 2012: Linking Science and Technology for Global Solutions, Orlando, FL, USA. E-mail: mtgserv@tms.org; web page: www.tms.org/meetings/annual12/AM12home.asp

**March 25-29** 243rd American Chemical Society (ACS) National Meeting & Exposition, San Diego, CA, USA. Web page: www.acs.org


**April 22-25** AAPG Annual Convention & Exhibition, Long Beach, CA, USA. Web page: www.aapg.org/meetings


**July 15-19** International Congress on Ceramics (ICCA), Chicago, IL, USA. Web page: ceramics.org/4th-internat-congress-on-ceramics-icc4

**July 28-August 2** American Crystallographic Association (ACA) Annual Meeting, Boston, MA, USA. Web page: www.AmerCrystalAsn.org


**August** Annual meeting of the Meteoritical Society, Cairns, Queensland, Australia. Details: Trevor Ireland; e-mail: trevor.ireland@anu.edu.au; web page: www.meteoriticalsociety.org


**August 2-10** 34th International Geological Congress, Brisbane, Australia. E-mail: info@34igc.org; web page: www.34igc.org

**August 19-23** 244th ACS National Meeting & Exposition, Philadelphia, PA, USA. Web page: www.acs.org

**September 9-13** First European Mineralogical Conference, Johann Wolfgang Goethe-University, Frankfurt, Germany. Website: http://emc2012.uni-frankfurt.de

**September 17-20** Geoanalysis 2012, Búzios, Brazil. Web page: www.ige.ucsd.edu/geoanalysis2012

**November 4-7** Geological Society of America (GSA) Annual Meeting, Charlotte, NC, USA. Web page: www.geosociety.org/meetings

**November 26-30** MRS Fall Meeting, Boston, MA, USA. Web page: www.mrs.org/s_mrs/index.asp

**2013**

**April 7-11** 245th American Chemical Society (ACS) National Meeting & Exposition, New Orleans, LA, USA. Web page: www.acs.org

**May 19-22** AAPG Annual Convention & Exhibition, Pittsburgh, PA, USA. Web page: www.aapg.org/meetings


**July 13** IAVCEI General assembly 2013: Forecasting Volcanic Activity, Kagoshima, Japan. Details: Masato Iguchi, e-mail: iguchi@iavo.dpr.kyato-u.ac.jp; web page: www.iavcei.org/IAVCEI.html

**August** ECM-28 – XXVIII European Crystallographic Meeting, Warwick, UK. Details forthcoming

**August 4-8** Microscopy & Microanalysis 2013, Indianapolis, IN, USA. Web page: www.microprobe.org/events

**September 8-12** 246th American Chemical Society National Meeting & Exposition, Indianapolis, IN, USA. Web page: www.acs.org

**October** M56&T’13: Materials Science & Technology Conference and Exhibition, Montreal, Quebec, Canada. Details forthcoming

**October 27-30** Geological Society of America Annual Meeting, Denver, CO, USA. E-mail: meetings@geosociety.org; web page: www.geosociety.org/meetings

The meetings convened by the societies participating in Elements are highlighted in yellow. This meetings calendar was compiled by Andrea Koziol. To get meeting information listed, please contact Andrea at Andrea.Koziol@notes.udayton.edu/.
It is strange how sometimes a striking and unusual family name seems to attract our attention repeatedly, linking apparently unrelated places, events and activities. The name Agassiz is extremely rare but turns up in all manner of contexts. The family originated from a village near Lake Neuchâtel in Switzerland and has produced an extraordinary number of high-achievers. Most Elements readers will have heard of Louis Agassiz (1807–1873), and perhaps his son Alexander (1835–1910), because they both made important contributions to Earth sciences. But what of Auguste, who founded the Longines watch firm? Or James, who commanded a ship in Lord Nelson’s fleet during the Napoleonic wars and was praised for his act of sending fire ships into the French lines. Or James’s son, Lewis, who as a British Royal Marine led a firing party into Washington, DC, during the Anglo-American war of 1812–1815? National boundaries appear not to have existed for the Agassiz clan.

The graceful mountain which dominates my first picture is the Finsteraarhorn (4274 m), the highest peak in the Bernese Oberland. The first point on the long ridge leading from the summit is the Agassizhorn, named after Louis Agassiz. He was born in Switzerland and his first post was professor of natural history in Neuchâtel. He worked initially on living fish, before studying fossils and more general palaeontology. Louis became interested in glaciers and built a hut on one of the Aar glaciers in which he lived for some time, observing their behaviour. He was the first person to suggest that large areas of Europe had been covered by ice sheets like the one in present-day Greenland. After moving to Harvard University in 1846, he became one of the best-known scientists in the world. Glacial Lake Agassiz is central North America is also named after him.

But Louis had what many would now regard as a dark side. He never accepted Darwin’s view of evolution, and rather than seeing all of humankind as having common origins, he advanced the view that the individual races were created separately and, more controversially, that the black races were intrinsically inferior. He illustrated this supposed inferiority in 1850 with a photograph of a slave from the Congo, called Renty, whom he found in South Carolina. An organization called the ‘De-mounting Louis Agassiz’ committee has been organizing a petition to change the name Agassizhorn to Rentyhorn, which has recently been refused by the three Swiss communities in whose territory the mountain stands. Louis based his ideas on race on what he perceived as scientific facts, and although he was wrong, it seems to me that Louis deserves his minor peak as a reward for his glaciological insights. You may not agree.

In 1840 Louis visited Scotland, and on being shown grooves on an exposure of andesite forming one of the numerous volcanic necks that give Edinburgh its dramatic skyline, declared that they were produced by ice. The ‘Agassiz Rock’, as it is now known, has a seminal position in our modern view that all of Scotland owes its landforms to glaciation. The Rock is somewhat overhanging, and being conveniently close to the Edinburgh University science campus, is used by rock climbers, who are responsible for the film of white powder you can see in the photograph. On my lunchtime walks I often pass little young men standing contemplating their route up, although curiously I have never seen one actually climbing. There is even a detailed guide to the climbs. Here are the instructions for getting up a route called The Wizard, rated Br 5c/6a Font 6a: F12, G12 (jugs), LH-I9 (slope pinch), RH-K9 (edge)… I could go on. It reminds me somewhat of the knitting patterns my grandmother used to generate multicoloured Shetland sweaters.

I encountered another Agassiz when, about ten years ago, I visited Michigan Tech in Houghton as an MSA Lecturer. Houghton is at the base of the Keweenaw Peninsula, which sticks out into Lake Superior and is notable for its amazing snowfall, hitting a recorded maximum of 9.92 m in 1978–79. It also has the world’s largest deposits of native copper, which have been mined for around 7000 years, up to 1968. In the 19th century, miners arrived from Finland and from Cornwall, in southwest England, and you can still enjoy a sauna and a Cornish pasty. The copper was precipitated from warm brines circulating in Proterozoic conglomerates and amygdaloidal basalts. The lump in my picture weighs 4.26 tonnes and is worth about US$32,000 at today’s prices. Like his father Louis, Alexander Agassiz started his career as an expert on fish and always maintained his interest in marine biology, but through a web of family connections became involved in the copper mining, which in 1867 was beginning to falter, partly because of the inaccessibility of the region. With great determination Alexander developed the mines, eventually amassing a considerable fortune of which he gave US$500,000 to Harvard to found its museum of comparative zoology. His statue can be seen in the town of Calumet, Michigan, looking more academic than mining tycoon.

Ian Parsons
University of Edinburgh, UK

Statue of Alexander Agassiz in Calumet, Michigan, USA

Elements
Parting Shots
The Department of Earth Sciences (ES) at IUPUI invites applicants for two tenure/tenure-track positions in geochemistry and hydrology—rank open. Candidates should have a Ph.D., strong research records, an interest in multidisciplinary research and commitment to undergraduate and graduate education. A Ph.D., received prior to August 2011 in geology, hydrology, limnology, geochemistry, or a closely related field, is required. ES is a growing and evolving department that embraces an Earth Systems approach to research and teaching as we adopt a new interdisciplinary Ph.D. degree program in Applied Earth Sciences. This new program is built on the research strengths of two centers that reside in the department: the Center for Earth and Environmental Science, recognized for excellence in water resources research, and the Center for Urban Health with a focus on earth science-based solutions for improving human health. Efforts will be supported by a number of existing interdisciplinary efforts, state-of-the-art laboratories, instrumented field research stations and information technology resources.

**Hydrology/Hydrogeology.** We seek an individual with experience in either hydrology or hydrogeology as applied to natural systems and/or environmental geosciences, including water quality and human health. Field-based research and teaching programs are important to the program and preference will be given to individuals who can interface with interdisciplinary research teams, including collaboration with other ES faculty and those in chemistry, biology and public health.

**Geochemistry.** We will consider individuals with experience in the broad field of low temperature geochemistry, and who can effectively apply their techniques and expertise towards natural, (paleo-) environmental and/or societal issues. Disciplines might include, but are not limited to, aqueous geochemistry, hydrogeochemistry, biogeochemistry, water/mineral/microbe interactions and stable isotope geochemistry. Preference will be given to individuals who can interface with interdisciplinary research and teaching programs, including collaboration with faculty in hydrology, sedimentology, petrology, and remote sensing. Opportunities also exist for collaboration with faculty in other departments at IUPUI, Indiana University, and Purdue University.

Applicants should submit a letter of application, curriculum vitae, statement of research interests, statement of teaching interests and philosophy, and the names and contact information (including e-mail) of at least four (4) references. Review of applications will begin December 15, 2010 but the position will remain open until filled. Interested individuals are encouraged to submit their application electronically to department chair, Kevin Mandernack, at kevinman@iupui.edu, specifying either the Hydrology or Geochemistry Search Committee. Mailed applications can be sent to: Department of Earth Sciences, Indiana University-Purdue University at Indianapolis, 723 West Michigan Street, SL118, Indianapolis, Indiana, 46202-6132. Questions regarding the hydrology/hydrogeology position should be directed to Lenore Tedesco (ltedesco@iupui.edu) and those for the Geochemistry position to Andrew Barth (ibsz100@iupui.edu). Prospective candidates can also learn more about these positions at the fall AGU meeting in San Francisco where ES faculty will be in attendance and available for consultation. Competitive start-up award and salary are available. Consideration will be given to mid-rank professionals in addition to entry-level candidates.

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In one and the same fire, clay grows hard and wax melts.

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**Francis Bacon**

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