

## PRINCIPAL EDITORS

JAMES I. DREVER, University of Wyoming, USA (drever@uwyo.edu)  
 GEORGES CALAS, IMPMC, France (Georges.Calas@impmc.jussieu.fr)  
 JOHN W. VALLEY, University of Wisconsin, USA (valley@geology.wisc.edu)

## ADVISORY BOARD 2012

JOHN BRODHOLT, University College London, UK  
 NORBERT CLAUSER, CNRS/Uds, Université de Strasbourg, France  
 WILL P. GATES, SmecTech Research Consulting, Australia  
 GEORGE E. HARLOW, American Museum of Natural History, USA  
 JANUSZ JANECZEK, University of Silesia, Poland  
 HANS KEPPLER, Bayerisches Geoinstitut, Germany  
 DAVID R. LENTZ, University of New Brunswick, Canada  
 ANHUI LU, Peking University, China  
 ROBERT W. LUTH, University of Alberta, Canada  
 DAVID W. MOGK, Montana State University, USA  
 TAKASHI MURAKAMI, University of Tokyo, Japan  
 ROBERTA OBERTI, CNR Istituto di Geoscienze e Georisorse, Pavia, Italy  
 TERRY PLANK, Lamont-Doherty Earth Observatory, USA  
 XAVIER QUEROL, Spanish Research Council, Spain  
 MAURO ROSI, University of Pisa, Italy  
 BARBARA SHERWOOD LOLLAR, University of Toronto, Canada  
 TORSTEN VENNEMANN, Université de Lausanne, Switzerland  
 OLIVIER VIDAL, Université J. Fourier, France  
 MEENAKSHI WADHWA, Arizona State University, USA  
 BERNARD WOOD, University of Oxford, UK  
 JON WOODHEAD, University of Melbourne, Australia

## EXECUTIVE COMMITTEE

CARLOS AYORA IBÁÑEZ, Sociedad Española de Mineralogía  
 LIANE G. BENNING, European Association of Geochemistry  
 THOMAS D. BULLEN, International Association of Geochemistry  
 PETER C. BURNS, Mineralogical Association of Canada  
 BERNARDO CESARE, Società Italiana di Mineralogia e Petrologia  
 BARBARA L. DUTROW, Mineralogical Society of America, Chair  
 W. CRAWFORD ELLIOTT, The Clay Minerals Society  
 MONICA M. GRADY, The Meteoritical Society  
 BERNARD GROBÉTY, Swiss Society of Mineralogy and Petrology  
 GUY LIBOUREL, Société Française de Minéralogie et de Cristallographie  
 MAREK MICHALIK, Mineralogical Society of Poland  
 EIJI OHTANI, Japan Association of Mineralogical Sciences  
 EDWIN A. SCHAUBLE, Geochemical Society  
 CLIFFORD R. STANLEY, Association of Applied Geochemists  
 PETER TRELOAR, Mineralogical Society of Great Britain and Ireland  
 FRIEDHELM VON BLANCKENBURG, Deutsche Mineralogische Gesellschaft  
 MICHAEL WIEDENBECK, International Association of Geoanalysts

## MANAGING EDITOR

PIERRETTE TREMBLAY, tremblpi@ete.inrs.ca

## EDITORIAL OFFICE



490, rue de la Couronne  
 Québec (Québec) G1K 9A9, Canada  
 Tel.: 418-654-2606 Fax: 418-653-0777

Layout: POULIOT GUAY GRAPHISTES  
 Copy editor: THOMAS CLARK  
 Proofreaders: THOMAS CLARK  
 and DOLORES DURANT  
 Printer: ALLEN PRESS

The publishers assume no responsibility for any statement of fact or opinion expressed in the published material. The appearance of advertising in this magazine does not constitute endorsement or approval of the quality or value of the products or of claims made for them.

[www.elementsmagazine.org](http://www.elementsmagazine.org)

## DECISIONS, DECISIONS



Tim Drever

In a previous editorial (*Elements*, December 2011), I discussed how difficult it is to predict with certainty the environmental impact of activities such as mining, energy production, and radioactive waste disposal. Here I shall continue on this theme with some musings on how regulatory decisions are made—particularly in the United States, the country with which I am most familiar. The first obvious point is that any activity such as mining or energy production will have an impact on the environment. Generally speaking the impact will be negative—loss of wildlife habitat, visual disturbance, air and water pollution. On the other hand there are benefits to society—we need energy and we need mineral resources. Ideally, conservation, substitution, and recycling will reduce these requirements, but they will not be eliminated, at least in the short term. We thus need to perform some sort of cost-benefit analysis. It is relatively easy to quantify the benefits but quite difficult to put an economic value on the costs. What is a scenic view worth? Wildlife habitat? Endangered species? These really come down to personal value judgments: regulations reflect some sort of consensus, although individuals often hold strongly differing opinions. And what about possible hazards that are not part of the normal operation of a project: how do we assign a probability (and hence a cost) that a pipeline will burst or that a major earthquake will occur? And who should bear this cost? The Fukushima Dai-ichi disaster made us all more sensitive to these questions.

There is also the question of how we make the decision, in particular, who are the “we”? Typically, the benefits of a major project such as the (now-cancelled) Yucca Mountain radioactive waste repository and the (now-suspended) Keystone XL oil pipeline from Alberta to the US Gulf Coast are widely distributed across society, whereas the costs (or at least some of them, thinking of possible water pollution and disturbance of the landscape) are much more localized. Whose voice should be decisive in determining whether a project should be authorized? I have been reading editorials recently arguing that such decisions should be local—or at least each affected US state should have a veto. This seems reasonable at first sight, but is it realistic? Will any state ever volunteer to host a high-level radioactive waste repository? And if a state does volunteer, does a

site in that state have the optimum geologic setting for a repository? In the case of the Keystone XL pipeline, is it appropriate that any one of the six US states and two Canadian provinces should be able to block a project whose impacts, for better or for worse, extend far beyond the boundaries of these jurisdictions? The Keystone XL project also raises the question of CO<sub>2</sub> emissions and global warming. Should decisions on a global issue like this be in the hands of individual states, provinces, or even smaller political subdivisions? It seems to me that national governments must be able to make decisions on major projects. It is unfortunate, though, that these decisions tend to involve political considerations as much as the merits of the projects. Ultimately almost all decisions are challenged in courts of law. It seems reasonable to expect judges to decide whether

An informed public will reinforce the need for decisions to be made on a scientific basis.

proper procedures have been followed and regulations observed: it does not seem reasonable to expect them to evaluate scientific data or make what are essentially value judgments. Courts do, however, end up making such judgments: in our present political environment there seems no other way of reaching a resolution. In an ideal world we would have an agency that presented the scientific facts on a particular issue and was reasonably trusted by all parties involved. The ultimate decision, though, is a political as much as a scientific one. As scientists we need to present and disseminate the best information that we can. An informed public will reinforce the need for decisions to be made on a scientific basis. We hope that *Elements* can make a contribution to informing the scientific community and the public on some of these important issues.

We are making some progress in reducing the environmental impact of energy and mining projects. The planning process is including more sensitivity to environmental concerns, and our understanding of how to control the movement of contaminants and how to reclaim disturbed land is constantly improving. The public is also becoming more informed about the tradeoffs. Microbiological approaches, as discussed in this issue, are really in their infancy, but they are becoming increasingly important in reclamation and are contributing to an overall reduction in the impact of mining on the environment. We hope that the potential of these methods will be realized and that this will reduce some of the conflicts between economic and environmental priorities.

James I. Drever\* (drever@uwyo.edu)  
 University of Wyoming

\* Principal editor in charge of this issue