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Geoscience Essentials of Radioactive Waste Management

some geologists responded favorably to this suggestion—stability of the abyssal sediments could be guaranteed for tens of millions of years. However, hydrogeologists hastened to point out that, despite the inherently low permeability of pelagic sediments, the introduction of a localized heat source would likely destabilize the highly porous sediment and initiate a convection system that would effectively move radionuclides toward the sediment–water interface and into the ocean itself (the argument was also put forth that radionuclide influx into seawater wouldn't be so bad because dilution to the point of harmlessness would be assured). The last scenario I'll describe was referred to in the environmental impact statement as "planned in situ rock melting." The idea was to deposit in a borehole a mass of radioactive waste sufficient to induce melting of the host crystalline rock. Subsequent solidification of this "magma" body would seal the radionuclides in a sarcophagus of artificial igneous rock, with dangerous radionuclides sequestered in durable accessory minerals. This idea is not without merit, and has been discussed recently in the geologic literature.

Not long after the filing of the environmental impact statement described above, the U.S. Congress moved relatively quickly—with passage in 1982 of the Nuclear Waste Policy Act—toward a commitment to "geologic" isolation of high-level commercial waste using conventional mining technology.

Each time I describe these and related ideas in class, I come away with a renewed conviction that we are extremely fortunate to have a basic working knowledge of Earth systems. Much remains to be learned, of course, but the information accumulated through the work of geoscientists of past decades has built an understanding that allows us to evaluate the wisdom of exploiting certain Earth systems (bedrock, glaciers, sea-bed, etc.) for storage or recycling of our waste products. Geologic knowledge has been important to greater or lesser degrees in the decisions of nuclear nations worldwide on disposal options for high-level radioactive waste. This should be a clear and effective lesson in why it is important for society and governments to support basic research in the geosciences, even when the immediate benefits are not apparent to everyone. It is a lesson, also, that I believe politicians may learn all over again when they eventually acknowledge the need to re-inject CO_2 into the Earth as a measure aimed at curtailing global warming. In developing a strategy for CO_2 sequestration, we face challenges not unlike those of radioactive waste isolation. Intimate knowledge of geosystems—and assurances of very long-term stability—will be crucial to success.

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THIS ISSUE

With the Nuclear Fuel Cycle issue, we end the "Ewing Cycle." Rod has been closely involved with *Elements* from the very beginning. Even though his term as principal editor officially ended at the end of 2005, he continued on until the Water on Mars issue, for which he acted as principal editor, was in press and he has worked actively on this issue as guest editor. We cannot thank him enough for his vision and for "selling" it so successfully to the community.

This issue highlights the contributions of mineralogy and geochemistry to nuclear waste disposal. If nuclear power is making a comeback, then the waste disposal issue has to be addressed, and mineralogists and geochemists are at the forefront of evaluating waste forms that will lock in radioactive wastes for time periods of geological length.

LOOKING BACK

As we close the final issue of 2006, it is an appropriate time to reflect on the accomplishments of the past year. You are holding the 11th issue of *Elements*. For every issue that is delivered to your desk, an extraordinary feat of collaboration must happen. Authors of each of the articles have to be shepherded to produce their articles according to a firm deadline; society news editors must send news from their societies; book reviews and conference news must be assembled. Our technical editor, Thomas Clark, then combs through every manuscript and adds a layer of polish. The managing editor follows suit and prepares the manuscripts for return to the authors for review. When the manuscripts are returned they are sent to our design team for assembly. Michel Guay, the graphic artist responsible for the look of *Elements*, and his assistant, Vincent Boivin, make their magic to produce an innovative colorful layout. A number of people then pore over the proofs: the authors and guest editor, the copy editors, Dolores Durant and Thomas Clark, and the managing editor. Then it is press time, and the printer Caractéra takes over; our representative, Sylvio Proteau, follows all the production steps to ensure a high-quality product. Then our mailer, Glenn Graham at APC Postal Logistics, has the shipment delivered to their New Jersey facilities for processing and mailing. APC Postal Logistics provide bulk airmail shipping to our international members at very reasonable costs. The dedication of all these people makes *Elements* happen. We thank them all.

A Few Numbers

In 2006, we published 37 thematic articles. Of the 49 authors who contributed to our second-year lineup, 24 were from the USA, 9 from France, 7 from the UK, 3 from Germany, and 1 each from Canada, Spain, and Australia.

Elements *and Citations*

One of the highlights of this year was learning in March that *Elements* had been accepted for the following Thomson ISI products, beginning with volume 1 (1), January 2005:

- *Science Citation Index-Expanded (SCIE)* including the *Web of Science*
- *ISI Alerting Service*
- *Chemistry Citation Index (CCI)*
- *Current Contents/Physical, Chemical & Earth Sciences (CC/PC&ES*

This means that references to articles in *Elements* are counted and that *Elements* will have a citation index starting in 2007. The most cited issue so far is "The Geochemical Origin of Life," followed by "Diamonds." Which journals have cited *Elements* so far? *Earth and Planetary Science Letters*, *Journal of Petrology*, *Astrobiology*, *Journal of Colloids and Interfaces*, and *Organic Geochemistry*, to name a few.

Elements *at GSA*

It was heart warming to receive such positive feedback on *Elements* at the recent GSA meeting. You told us that you liked *Elements*, that you use it in the classroom, and that you liked the topics covered.

LOOKING FORWARD

In the next issue, we will welcome five new societies —the Association of Applied Geochemistry, the Società Italiana di Mineralogia e Petrologia, the Deutsche Mineralogische Gesellschaft, the International Association of Geoanalysts and the Polskie Towarzystwo Mineralogiczne (Mineralogical Society of Poland)—for a total of 13 participating societies and three affiliated societies. They will all introduce themselves in the society pages of the next issue.

We are also pleased to present you our 2007 line-up in the next two pages.

Back Issues

Starting in 2007, it will be possible to order back issues of *Elements* via the MSA website. We envision that many small colleges with limited budgets might want to obtain a subscription to *Elements* and order past issues to have a complete set. Prices reflect the cost of processing orders and handling payments.