The Elements Toolkit

WELCOME TO THE TOOLKIT

From my laboratory perspective, I see scientific progress as a dynamic and ever-evolving human endeavor. This is certainly true for the Earth sciences, where lengthy periods of filling in the puzzle pieces are punctuated with breakthroughs in our understanding of how our planet works. But how are such leaps in knowledge achieved? Three aspects appear to interact to bring a sudden surge in our comprehension of nature:

- A steady flow of seemingly unrelated observations suddenly crosses a threshold where some new "truth" becomes apparent: the "long, hard toil route."
- Discovery resulting from a new research strategy leads to a fully unanticipated conclusion: the "serendipitous route."
- Finally, progress frequently can be attributed to "breakthrough technologies," which flow into the hands of the broad research community.

An example of this last route to discovery is the explosion in data resulting from the introduction of laser ablation sampling technology in conjunction with ever-improving mass spectrometric methods. Over the past decade or two, this cost-effective and rapid analytical method has become an essential tool for many colleagues. Certainly, some of the resulting data are of questionable significance or dubious quality—as always, the value of the data rests in the hands of the individual practitioner. Nonetheless, it would be difficult for me to imagine modern-day geochemistry without the existence of laser ablation technology.

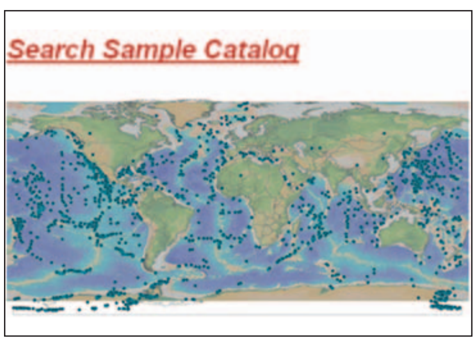
"The Elements Toolkit" is a feature that the editors of this magazine have asked me to provide at regular intervals, roughly every second issue. My goal is to present new technologies that seem to offer great potential to the research community. I will also highlight instrumentation or software that I see as powerful but underutilized tools of our trade. Perhaps my musings will give the broader community a picture of key strategies being applied in other disciplines. Of course, I would only be too happy if the dissemination of such ideas into the hands of the adventurous were to lead to serendipity...

I hope that you will find this and the upcoming Toolkit articles of interest. Perhaps some of the resources that I present will actually prove useful in your own research. And now, as a first contribution, I would like to briefly present a web resource that provides a glimpse of what might become in a few years "standard methodology" for Earth science researchers.

The Global Registration of Geologic Sampling

Have you ever felt that it would be really useful to have a list of all samples that have been collected in or near your field area? Of course, such a database would ideally provide both a basic description of the material and information about where one should look to obtain part of said sample. Better still, wouldn't it be great if the sample numbers were linked to all literature citations in which the material is mentioned? And wouldn't it also be a big advantage if all sample designators were unique and unambiguous? Well, such a web resource has been under construction for the past couple of years. The International Geo Sample Number (IGSN) registry, managed by the System for Earth Sample Registration (SESAR), addresses these issues. An IGSN is a unique and persistent identifier for geomaterials, and such an identifier can easily be assigned by registering sample properties with SESAR via the Internet. If data in a publication are referenced to an IGSN, then key information about the sample can rapidly be retrieved from the SESAR database. Have a look at http://www.geosamples.org/.

As an example of what one might learn from this database, my search of all records from South Africa reports a total, as of mid-September 2010, of 603 registered samples.



This is certainly not a comprehensive record of geologists' activities in the country, but nonetheless it is a useful starting point. In addition to using this database with a geographic filter, it is also possible to conduct a search based on rock type. As a test, I randomly selected a filter based on intermediate plutonic rocks, the net result being only three entries, a rather meagre yield for fans of monzonite. This low result is despite the fact that some 4 million records are registered in the system. Looking at individual records, one finds many characteristics reported as "not provided," meaning extra time at the computer will be necessary to determine if a given sample is relevant for the topic of study. Nonetheless, despite these shortcomings, this tool might already prove valuable to many, and one can hope that such a system will win ubiquitous support from the field geologists and lab analysts of the future. Interested in finding out a bit more? Have a look at "Facilitating Research in Mantle Petrology with Geoinformatics," by K. Lehnert and J. Klump (2008) (www.cosis.net/abstracts/9IKC/00250/9IKC-A-00250-1.pdf).

Michael Wiedenbeck
(michawi@gfz-postdam.de)

ABOUT THE AUTHOR

Michael Wiedenbeck is in charge of the Potsdam Secondary Ion Mass Spectrometry facility, a position he has held since December 1998. He began his career as an isotope geochemist at the ETH-Zürich, being trained in the art of K–Ar and Rb–Sr age determinations. Having discovered that wet chemical isotope work can involve a Herculean struggle against the laboratory blank, he decided to move to Australia to become one of the early practitioners in the then emerging field of ion probe geochronology. His work on the Archean of Western Australia brought with it the epiphany that data quality in analytical geochemistry is critically dependent on access to high-quality calibration materials. Leaving Canberra, his next move was back to Europe, to the CRPG in Nancy, France, where he devoted a year's effort to finding and characterizing homogeneous zircon crystals for calibrating U–Th–Pb age determinations. Subsequent career stops included Ahmedabad, India (more Archean SIMS geochronology); Oak Ridge, Tennessee (building a new type of SIMS instrument); and Albuquerque, New Mexico (running a multi-user SIMS facility).

Michael's position as a senior scientist at the Helmholtz Center Potsdam has allowed him to invest a significant effort toward his passion for improving metrology in analytical geochemistry. Through his involvement with the International Association of Geoanalysts, of which he has been president since 2006, Michael has been involved with the ISO-based certification of five whole-rock Reference Materials; these remain some of the best-characterized Earth materials ever produced. With this experience in the production of highest-quality reference materials for bulk analytical methods, he is now turning his attention towards the needs of the microanalytical community.