Confessions of a Mineralogy Professor

COMMENT

I am about to blow the cover on one of the best-kept secrets in geology. It's a secret shared by thousands of people, but most *Geotimes* readers may no longer know it. Many who know the secret have never gone to college or have taken few geology courses; others are not yet of college or even high-school age. Almost every geologist knew the secret once, but most became convinced that it wasn't true or they have forgotten it.

What is this secret? *Minerals are the most interesting objects on Earth, and they are fun to study!*

Most children love minerals. Thousands of mineral enthusiasts of all ages travel to the Tucson Gem and Mineral Show each year to buy and trade minerals. The mineral exhibits at the Natural History Museum in Washington, D.C., are the most popular attractions at the Smithsonian Institution, luring nearly six million visitors a year. Why, then, do many geologists feel such lack of enthusiasm for mineralogy? Because most geologists once took a course in mineralogy — and it wasn't very good. I know this to be true of mineralogy courses I have taught and I hereby confess my failings.

Instead of capitalizing on my students' excitement for minerals, I have too often stifled their interest in the name of coverage, completeness, and rotoinversion axes. Oh, I had my excuses: I followed the textbooks; I had to fit two semesters of material into one semester; geology majors needed to know this stuff. But the fact remains that most of my former students would not rate mineralogy as their favorite course. With so much material to digest, important themes and student interests were obscured by details.

The consequences of mishandling mineralogy classes are beginning to look serious. For example, some universities now squeeze mineralogy **and** petrology into a one-semester course. In curricula emphasizing environmental geology, hydrology, and global change, mineralogy is often viewed as somewhat arcane and irrelevant. Mineralogy teachers — like me — have apparently failed to convince their students (who now plan these curricula) that minerals offer important data and constraints on environmental problems. Our students should have learned that minerals can greatly influence ground-water chemistry and can control lake acidification. We didn't make clear that fibrous minerals are not all the same, a mistake now costing millions in asbestos-abatement expenditures. Having these topics in the reading assignments and lectures was not enough. Our students seem not to have learned that minerals and their properties influence virtually all geologic processes.

Perhaps I am overstating the case. Nevertheless, there is room for improvement. College students are not standing in line to get into mineralogy classes. But they should be. After all, *minerals are the most interesting objects on Earth, and it is fun to study them!* I suggest that it is time to adopt some new approaches to teaching mineralogy — methods that build on students' enthusiasms so that they leave mineralogy class wanting more. How?

A few years ago, I joined the rising tide of educators who believe that activity-based discovery is better than passive information transfer. I reorganized my mineralogy course to emphasize collecting and analyzing mineralogical data, performing mineral-transforming experiments, and using mineralogical data to answer geological questions. I now try to be more of a facilitator than a guru. I help my students choose the data to collect and the experiments to perform. I assist with procedures, equipment, and data interpretation. I guide them to mineralogical databases and other resources. I encourage students to work together and to share their knowledge and skills. I try to build on their innate enthusiasm for minerals. Initial results of this new course are very encouraging. The line of students waiting to take my course is still short, but it's growing!

My revised mineralogy course requires more faculty time than a traditional course. It changes each year, and class notes yellowed with age don't help much. Students seek my advice more often. Data collection and experiments do not always proceed as planned. And some cherished topics covered in my old course ... well, there simply isn't enough time. My goal is to train my students as mineralogical problem-solvers who know how to find and use mineralogical resources. If they need to know about additional topics in the future, most of them will know how to learn about them.

This doesn't mean that the mineralogical basics are left out. Formulas of important minerals still need to be learned. But the facts are made meaningful because my students use them to understand and interpret data they collected themselves.

What activities might be part of a revised mineralogy course? The possibilities depend on the instructor's expertise, the equipment available, and the local geology. I recommend collecting minerals and rocks in the field, and answering geologic questions raised by the gathered specimens back in the lab. If your department has an X-ray diffractometer, choose a project involving local clay minerals. If you have a box furnace, try dehydration or decarbonation experiments. The chemistry department may also provide the means to explore the cation-exchange potential of zeolites. And if you can visit a nearby microprobe, a multitude of mineral chemistry projects are possible. It's not so important which specific activities are chosen. The challenge is to choose engaging activities that require the reasoned use of mineralogical evidence.

Many mineralogy professors are revising their courses to make them more inquiry-based. Others may have always taught this way. However, most of us have been too traditional in our teaching. Our courses have not kept pace with technology, or with the changing student body. It's time to reconsider our goals and methods. My recent classroom experiences convince me that change is both possible and rewarding. We can and should train the next generation as mineralogical detectives rather than mineralogical drones. If we do, our students will remain lovers of minerals and will become better scientists in the bargain.

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