

## **Teaching Geoscience: My Approach**

by Lindsey Waddell

Geology is a rich and diverse subject that, while primarily a scientific discipline, has a great deal of room for creative thought. It is not a subject that many undergraduates plan to pursue upon entering college but is instead something that many choose after being inspired by an introductory course. Unfortunately, enrollments in bachelor's-level degree programs in the geosciences are currently declining nationwide, and the geosciences currently have the lowest diversity of any of the science, technology, engineering, and mathematics fields (Hunton and Lane, 2005). With this in mind I have three primary goals in teaching undergraduates: first, to assist students in learning important vocabulary and concepts essential to the discipline, second, to instill in them an understanding of the behavior of Earth system and its relevance to their everyday lives, and third, to actively involve them in both the scientific and creative aspects of geologic data interpretation. Because, geology is omnipresent, I believe that students with even an introductory background in the subject will have many opportunities during their adult lives to utilize and share their geologic interest and knowledge, whether during a trip to the beach, a discussion with friends about global warming, or a public meeting concerning site selection for a landfill. My role as their teacher is to prepare them for these opportunities.

The greatest barrier that geology presents for students is a tremendous amount of specialized terminology that can make geologic reports and articles very difficult to penetrate. Few people would be undiscouraged by terms like greywacke, orogeny, stromatolite, and guyot, to name a few. Thus, my most basic role as a teacher is to help students organize and distill the material in order to maximize their learning of the essential concepts. For example, in learning plate tectonics, students should know not only what island arcs and trenches are, but they should also understand that these are important features found at the convergence of two oceanic plates. Thus, students in my classes can expect to receive clear outlines of the important concepts and terminology and short, directed reading assignments from a textbook for each topic. I believe that many students appreciate a well-structured learning environment with clear learning objectives and that the outlines and reading assignments should help them to focus their study efforts outside of class. Frequent quizzes give students feedback on whether or not they are successfully integrating the material presented and allow me to identify the common misconceptions.

Once students become familiar with the basic concepts, I like to use active learning techniques to help students understand the relevance of geoscience in their own lives, so most class periods include small group work on problems requiring comprehension, application, and analysis of the concepts presented or a directed discussion of assigned readings on special topics. Small group work fosters an inclusive learning environment when groups are assigned, and as a

result, students are less hesitant about presenting their ideas to the entire class after first holding discussions within their small group. At the introductory level, the special readings that I select are approachable yet scientific and should appeal to students from a variety of disciplines. For example, possible reading topics could include climate change and Mayan civilization, the mysterious loss of CO<sub>2</sub> in the Biosphere, or an article on the current status of the global oil supply. I believe that exams should be take-home in nature and consist of a few in-depth questions similar to those answered during the small group-work sessions or during class discussions of the readings. I prefer take-home exams to in-class exams because students are given the time to organize and clearly communicate their thoughts and I can require them to carry out a deeper analysis of the material.

The lab portion of a geology course is important and should be built around applicable hands-on learning activities such as the examination of rock samples, analysis of soil and water samples, and the use of GIS, and whenever possible, fieldtrips to examine outcrops, take samples, or visit museums. The exact activities are dependent upon the particular class and would be selected to complement to the lecture material. However, the overall role of the lab is to have students practice making their own observations and interpretations of geologic record. Assigning small groups for field and lab work encourages students to discuss their observations and interpretations with their peers, and requiring short individual write-ups for each lab helps students organize their thoughts and improve their writing skills. Student performance in the lab cannot be assessed based solely on whether a student got "the one right answer" because one set of observations for a single outcrop, for example, may yield multiple "correct" interpretations. In this respect, I can encourage student creativity in my introductory courses. I can also take advantage of any differences of opinion that may arise by selecting one group of students to make a presentation of their interpretations each week. Their presentation can be used to stimulate class discussion, and in the process, students can gain valuable experience in making scientific arguments and communicating their ideas.

In light of declining enrollment in geology and the low diversity of the field, I am committed to communicating to students in introductory courses the real world opportunities available to them. Many students are not aware of the many exciting careers or graduate school possibilities that await them, and I have heard from many students that they might have chosen geology had they known more about what the field had to offer. Bringing in professional geoscientists to speak occasionally about their careers should help students see the applicability of the discipline, and may help build the diversity of the field in the long run. Advertisement of any opportunities for lab work, field experience, or research that arise might also help some students to take that first step towards becoming a geoscientist, and overall, it is a path that I hope I can help many more students choose.