An introduction to historical perspectives on and modern approaches to field geology education

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Field education has historically occupied a central role in undergraduate geoscience curricula, often starting with class-specific weekend field trips and progressing to a capstone summer field course or “camp” at the conclusion of undergraduate coursework. Over the past century, countless geoscience students have honed their field credentials through immersion in the techniques of geologic field mapping as part of a six- to eight-week summer field course. Traditionally, field camp has been required for graduation by many college geoscience departments, and nearly 100 field camps are currently offered by accredited American universities and colleges (King, 2009). However, many geoscience programs in the past few decades have moved away from traditional geologic fieldwork (e.g., bedrock mapping and stratigraphic analysis) and toward applied geology (geophysical remote sensing, laboratory-based geochemical analyses, and environmental assessment, to highlight a few examples). As a result, many geoscience programs have questioned the importance of field instruction in the undergraduate curriculum (Drummond, 2001; AGI, 2006). This volume resulted from a cascade of meetings, field forums, and conference sessions that focused on the supposed decline of the importance of field geology, and the apparent erosion of field experience in recently graduated geoscience students, as perceived by many professionals.

The data supporting an apparent shift in curricular emphasis away from fieldwork are convincing. The number of geoscience departments offering summer field courses has declined by 60% since 1995 (AGI, 2009). As a result, only 15% of geoscience departments listed in the current Directory of Geoscience Departments (Keane and Martinez, 2008) offer a summer field camp, whereas 35% of geoscience departments offered a field course in 1995. In contrast, a 2008 survey of active field courses showed a steady increase in the number of students attending summer field camps (Fig. 1; AGI, 2009). Given the decrease in schools offering such courses, one can only conclude that field course enrollment must be increasing. This is supported by the American Geological Institute (AGI) data, though enrollment trends are not quite as striking as one would suspect after field camps are filtered to include only those that ran summer courses for at least five of the past ten years (Fig. 2). Nevertheless, if field course enrollments have been stable to modestly rising over the past ten years, one must question the outlook of some academic administrators and others within the geoscience community who proclaim the decreasing relevance of field education as an important element of the undergraduate curriculum.

Recent trends within geoscience disciplines that may have bearing on this perception include:

(1) the decline of the petroleum and mining industries in the 1980s and 1990s, although this has reversed somewhat since the start of the twenty-first century;

(2) a significant decrease in professional jobs that incorporate substantial time mapping geology in the field;

(3) the continuing transition in academics from observation-driven research to equipment-intensive experimental, modeling, and theoretical research; and
(4) a decline in the number of geoscience majors nationwide (AGI, 2009).

There can be no doubt that geology as a discipline has widened its focus dramatically to include a range of subdisciplines. These include geophysics, surficial geology, oceanography, climatology, and geohydrology, as well as emerging disciplines such as geomicrobiology, and applied geoscience such as engineering geology and environmental geology. In the face of these trends, it is not surprising that many established field courses have felt the need to substantially modify traditional curricula away from the previously ubiquitous bedrock geology mapping projects. New field courses have been initiated that focus on subdisciplines within the geosciences. Examples include camps oriented toward geophysics (SAGE, the Summer of Applied Geophysical Experience), oceanography (Urbino Summer School for Paleoceanography), and coastal geomorphology (University of South Florida summer field school), to cite but a few. Field-based research programs (e.g., National Science Foundation–Research Experiences for Undergraduates sites) have been used as a proxy for a traditional field camp in some programs. In other settings, field-based research is being reintegrated into the “core” geoscience curriculum, or used as a follow-up to more traditional field instruction.

The audience for field-based immersion experiences has also expanded to include geoscience teachers seeking professional development to better serve precollege students in their charge. Another important driver for curricular changes in field courses has been the advent of new technologies, such as global positioning system (GPS) and geographic information systems (GIS), that have revolutionized modern methods of fieldwork and mapping. Industry professionals have embraced these new technologies, and many field programs have recognized and included digital mapping and fieldwork components within their camp curricula.

Though many geoscientists have been vocal in questioning the relevance of field courses and whether field camps can or should survive (Drummond, 2001; AGI, 2006), academic and industry professionals frequently maintain that field competence is an essential skill that should be a prominent component of an undergraduate curriculum. A common thread in conversations with industry professionals, whether in mining and petroleum exploration, hydrologic and environmental consulting, or hazard assessment, is the need for students entering the workforce to be comfortable with equating remote, indirect, or restricted data sets with the appropriate real-world outcrop geology and/or environment. The old adage that “the person that sees the most rocks wins” can be translated to the importance of seeing as much geology in person on the outcrop, especially when asked to extrapolate large-scale geology from limited data.

This volume developed out of topical sessions at the 2007 national Geological Society of American (GSA) and American Geophysical Union (AGU) conferences (GSA session T139: The Future of Geoscience Field Courses, and AGU session ED11: Information Technology in Field Science Education), which focused on historical and modern approaches to field-based education. The papers herein highlight the historical perspectives and continued importance of field education in the geosciences, propose future directions of geoscience field education, and document the value of this education. We have organized the volume into five sections, as follows.
I. Historical to Modern Perspectives of Geoscience Field Education

This group of papers begins with overviews of well-established field camps and how they have evolved through the years (Douglas et al., Sisson et al., Puckette and Suneson, Geissman and Meyer). The latter papers in the section broadly address changes to traditional field course curricula in light of modern developments in our discipline (De Paor and Whitmeyer, Kelso and Brown, Thomas and Roberts, Marshall et al., Ham and Flood).

II. Modern Field Equipment and Use of New Technologies in the Field

This section includes papers that highlight new equipment and technologies that have revolutionized data collection and mapping in the field (Whitmeyer et al., Swanson and Bampton, Bauer et al.) and suggest ways in which these technologies have supplemented as well as supplanted traditional field geology skills (Vance et al.).

III. Original Research in Field Education

A welcome recent trend in field education is the inclusion of projects where students collect and interpret data as part of a long-term original research project. These papers illustrate approaches to immersing students in active field research (deWet et al., Conner, Potter et al., May et al.) and suggest an alternative approach that more fully empowers students to use the information learned in a field course experience (Gonzales and Semken).

IV. Field Experiences for Teachers

Several field courses have been designed to target audiences beyond the undergraduate geoscience population. This section highlights a broad range of field experiences for precollege teachers though college instructors (Bishop et al., Lee et al., St. John et al., Kitts et al.), which strongly support the transformation of field course experiences into pedagogical content knowledge experiences that can be adapted in original ways to different audiences.

V. Field Education Pedagogy and Assessment

A common thread throughout all of the papers in this volume is a need for in-depth assessment of field-based learning and educational approaches. This final section includes papers that document and/or present assessment and evaluation vehicles for field-based education (Stokes and Boyle, Boyle et al., Riggs et al., Pyle), underscoring the value of such information, not just internally to students, but also externally to policy-makers and financial decision-makers at institutions that offer field course experiences.

With this volume, we hope to foster discussion among geoscientists on the continuing relevance of field-based education while highlighting new initiatives that address the needs of the modern, diverse geoscience community. The papers that follow document the past importance of field courses in providing a solid foundation of experience and knowledge to up-and-coming geoscientists, and they also stress the fact that field education has expanded beyond traditional mapping to include modern subdisciplines, methods, and techniques. Finally, we hope this volume will serve as a strong voice to emphasize the need for qualitative and, particularly, quantitative evaluation and assessment of field-based learning and education. We as a discipline need compelling and abundant data on the importance of field education to our profession if we have any hope of convincing skeptical administrators and other members of the academic and professional geoscience community.

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REFERENCES CITED


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