Assessment Plan

Geological Sciences
California State University, Hayward

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Assessment Plan Outline

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Assessment of students in Geological Sciences who attain a BS degree in Geology is an ongoing process with the goal of maintaining the highest possible quality in our undergraduate program in Geological Sciences. Our plan takes into account that we are a small department that produces fewer than 10 graduates annually, and thus cannot rely on the statistical reliability of any sort of objective testing on an annual basis. In addition, the field of geology is extremely broad and applied in nature, giving us a rather wide range of activities with which to assess our students.

Our plan consists of 3 parts: **1)** Completion of specific learning activities by students; **2)** Faculty review of results from Capstone Courses; and **3)** Survey of the professional local and statewide geological community every 5 years. These components are described in more detail below.

1. Completion of specific learning activities: All students must complete of specific learning activities in required and elective coursework designed to assure satisfactory achievement of our Departmental Learning Outcomes for undergraduate students, detailed elsewhere in this document. Faculty advent of learning goals specified in isors will meet with all geology majors on an individual basis at least yearly (quarterly meetings will be strongly encouraged) to ensure that each student attains these learning goals in appropriate courses.

2. Faculty review of Capstone Courses: Faculty will review products created by students in our capstone courses, GEOL 4820 (8), Summer Field Geology, and GEOL 4800 (2) Senior Seminar in Geology, on an annual basis. These courses require students to show competence in a wide variety of skills identified by our faculty and by state and national professional geological licensing agencies as critical to success for professional geologists.

3. Survey of Professional Geological Community: The department will conduct a survey of local and statewide geology employers, CSUH alumni, and government agencies every 5 years to identify specific skills and knowledge needed for professional and post-graduate success in the field of geology.

Department Faculty will set aside at least one faculty meeting per year to discuss the outcomes of each component of our assessment plan. Faculty will use information gained from such discussions to update and improve our Departmental Learning Outcomes, content requirements in our Capstone Courses, and questions asked of alumni and employers in our 5-year survey. The Department's overall goal in implementing this plan is to continually upgrade our undergraduate programs, and to update our Department Mission Statement as needed.

Results, Year One (Fall 2000-Fall 2001)

Results from the first full year (Fall 2000-Fall 2001) of implementation of the Geological Sciences Assessment Plan have been encouraging. Overall, the department appears to be headed in the right direction in terms of offering a competitive, well-rounded undergraduate degree in geology. Specific results identified in faculty discussions held during Fall 2001 are as follows:

1) The vast majority of geology students are successfully achieving our desired learning outcomes based on their accomplishments in course activities. Continual monitoring of individual students by instructors and advisors on a quarterly basis has allowed us to identify students who require additional help in achieving specific learning goals, and direct them to appropriate resources. In one case, a student who could not achieve success in written communication in a specific course was offered, in consultation with faculty advisors, a 1-year plan of action that resulted in the student successfully completing that specific learning goal in the course the following year.

2) Students are producing impressive results in our Capstone Courses, GEOL 4820 and GEOL 4800. Products from students in the Summer 2001 GEOL 4820 course are among the best we have seen in the history of the department. Our seminar course has resulted in most students creating excellent written and oral presentations, and only a few are at least of acceptable quality.

3) Results from our first survey of local and statewide geology employers, CSUH alumni, government agencies and academic institutions have provided meaningful results regarding courses and activities that are emphasized in our geology program. Overall, we appear to be offering content that very much reflects what skills and knowledge are required by professional and post-graduate organizations.

Department of Geological Sciences

California State University, Hayward

Mission Statement

Our primary mission is to provide an excellent field and laboratory based education in geologic science to prepare students for professional careers in geology, graduate study or teaching earth science at the K-12 level.

We also support a number of complimentary missions, including

- providing a research based MS program, taught entirely in the evening to accommodate working professionals. This component also enhances our baccalaureate degrees by allowing us to provide quality research experiences for undergraduates.

- providing general education courses and service courses to other university programs.

- supporting the Environmental Science BS through having a faculty member on that program's advisory board, and by offering an option in geology.

- providing in-service teacher training and continuing education opportunities for professional geologists.

- community outreach and education, especially in the field of geologic hazard and earthquake awareness.

STUDENT LEARNING OUTCOMES IN THE GEOLOGICAL SCIENCES

Department of Geological Sciences
California State University, Hayward

GENERAL LEARNING GOALS IN GEOLOGY

After completing a Bachelor of Science Degree in Geology, students should be able to:

- classify and identify geologic materials
- produce and interpret geologic maps and cross-sections
- produce and interpret quantitative scientific data related to earth processes
- apply fundamentals of chemistry, physics, math and computer science to solving geologic problems
- effectively communicate scientific ideas and results verbally and in writing
- retrieve, assimilate and evaluate existing data
- use, formulate and test multiple working hypotheses based on the scientific method
- utilize keen observational skills in the laboratory and field
- visualize subsurface structures and processes in 3 dimensions
- demonstrate depth and breadth of knowledge in one or more advanced specialty fields (advanced electives)
- recognize, appreciate and communicate scientific uncertainty
- conduct independent field work
- understand geologic time, evolution and global processes such as plate tectonics and climate change

SPECIFIC LEARNING GOALS IN GEOLOGY SPECIALTY FIELDS

Student Learning Goals in: Mineralogy (GEOL 3601)

In this area of geology, students should know:

- mineral compositions and crystal chemical principles
- basic crystallography
- uses of minerals

Students should be able to:

- identify 100 important minerals in hand sample and thin section
- use physical and optical properties to identify minerals
- calculate mineral formulas from chemical analyses

Student Learning Goals in: Petrology (GEOL 3701/3702)

In this area of geology, students should know:

- classification schemes and identification of igneous, sedimentary and metamorphic rocks
- rock associations and plate tectonics
- field relationships of igneous, sedimentary and metamorphic rocks

Students should be able to:

- interpret phase diagrams, compatibility diagrams, ternary plots and petrogenic grids
- interpret rock genesis in light of current petrogenetic models

Student Learning Goals in: Sedimentology / Stratigraphy (GEOL 3030, 3702, 3730)

In this area of geology, students should know:

- analysis of sedimentary facies, depositional environments and systems
- how to interpret earth history and evolution
- how to recognize and understand diagenesis
- how to use stratigraphic principles
- lithostratigraphy, biostratigraphy, chronostratgraphy and magnetostratigraphy
- how to recognize and use fossil groups
- applications in engineering and resource geology

Students should be able to:

- conduct textural analysis (particle size, shape and sorting)
- identify and interpret sedimentary structures
- classify and interpret sediments and sedimentary rocks
- perform petrographic analyses (texture, mineralogy, provenance, diagenesis)
- measure stratigraphic sections and construct columns
- create and interpret fence diagrams and isopach maps

Student Learning Goals in: Structural/Field Geology (GEOL 3810, 3910, 4820)

In this area of geology, students should know:

- how to integrate and apply knowledge from various specialties in the field
  - visualize and interpret field relationships in 3- and 4-dimensions
  - basic geologic project design and implementation

Students should be able to:

- create, read and interpret geologic maps and cross-sections
- use, formulate and test multiple working hypotheses
- interpret spatial/temporal relationships in the field
- solve 3-point problems
- perform quantitative analysis
- quantify, synthesize and communicate observations and interpretations in oral and written format

Student Learning Goals in: Engineering / Environmental Geology (GEOL 4320)

In this area of geology, students should understand:

- underlying principles of the hydrologic cycle
- mechanical properties of earth materials
- the crustal processes that create landforms
- human interactions with the environment
- well mechanics and flow through porous media
- fundamental chemical principles of water and soil

Students should be able to:

- apply geologic knowledge to solve engineering or environmental problems
- determine physical properties of earth materials
- recognize potential geologic hazards in the field (flood, slides, faulting)
- interpret aerial photographs, topographic maps, flownets and geologic maps/cross-sections
- use and interpret data from field instruments

APPENDIX

Geological Sciences BS Program Survey

California State University, Hayward

25800 Carlos Bee Boulevard, Hayward, California 94542-3088

Which courses are important to include in a Geology BS degree program?

Please use these responses:
1 = required core course 2 = useful elective course 3= may only be useful for advanced work

___Physical Geology	___Structure	___Geochemistry
___Historical Geology	___Field Methods	___Clays & Soils
___Mineralogy	___Seminar	___Hydrogeology
___Optical Mineralogy	___Mapping	___Writing for Geoscientists
___Igneous Petrology	___Geomorphology	___Marine Geology
___Sedimentary Petrology	___Paleoclimatology	___Metamorphic Petrology
___Stratigraphy	___Oceanography	___Quaternary Geology
___Ore Deposits	___Geophysics	___Senior Thesis
___ _____	___ _____	___ _____

Which geological skills and knowledge are most important for professional geologists?

Please use these responses:
1 = required for general geologist 2 = useful, may be required for specialist 3 = may need rarely 4 = not necessary

___Grain size analysis	___Sedimentology	___Geophysical techniques
___Field mapping	___Computer applications	___Electronic mapping (GIS)
___Chemical analysis	___Crystallography	___Micropaleontology
___Petrography	___Field surveying (GPS)	___Paleontology
___ _____	___ _____	___ _____

Please give some information about yourself:

___B.S. in Geology or: _____
___M.S. in Geology or: _____
___Ph.D. in Geology or: _____

___ employed as professional geologist
(geological specialty:_____)
___ employed in earth science education
___ employed in other field:
_____
___ retired ___ not currently employed

Any comments you have about what a high quality geology B.S. program should include would be of great value to us; please write your comments on the back of this page.

Thank you for completing our survey!

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(optional) If you would like feedback about the results of this survey or would like to be on our mailing list, please write your name and address below, or attach your business card.

DATE: 02/08/00

TO: All Faculty

FROM: Diane Williams, Secretary

RE: BS Program Survey

In late 1999, approximately 150 survey forms (see attached) were sent to alumni and CSU geology departments throughout the state. Results charted below are based on averages from 77 total responses pertaining to which courses are the most important to be included in a B.S. program in geology.

In the chart below, courses ranked close to 1 were considered essential for core requirements by respondents. Courses ranked around 2 were considered useful electives, while courses ranked higher than 2 may only be useful for advanced work. (Other survey results are still being compiled.)