

California State Polytechnic University

Geological Sciences Department

**Five-Year Assessment Plan for the
Geology and Integrated Earth Studies Majors
(In Lieu of Academic Program Review)**

March 20, 2006

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II. Introduction to the Geological Sciences Department and its Degree Programs

The Geological Sciences Department offers an undergraduate program that emphasizes polytechnic, applications-oriented approaches to learning and career training. The program balances classroom theory and laboratory application with field trips and research experiences. Two Bachelor of Science degree programs are offered: Geology and Integrated Earth Studies. The Geology degree is a comprehensive curriculum focused on Geological sciences that draws upon support courses in Mathematics, Physics, Chemistry, and Biology. The Integrated Earth Studies degree, through its interdisciplinary character, prepares students for careers in broad areas of environmental science and science teaching which require general understanding of the Earth system and geologic processes.

The Geological Sciences Department teaching staff consists of six full-time tenured or tenure-track faculty and five part-time lecturers. Faculty are supported by a full-time secretary and a half-time technician. Major laboratory equipment available for student use includes: 1) Philips x-ray fluorescence spectrometer for multi-elemental analysis of rock and soil samples, 2) Philips x-ray diffractometer, 3) Eight Nikon or Leitz petrographic microscopes equipped for either transmitted light (for traditional thin section analysis) or reflected light (for metallic ore microscopy), 4) Nikon photomicroscopy system, 5) thin section preparation and rock polishing equipment, 6) rock-crushing and mineral separation equipment, 7) Kinematics real-time seismic instrumentation for detecting earthquakes, 8) Trimble and Garmin GPS data loggers and, 9) an 8-passenger 4-wheel drive field vehicle. Computer facilities are state-of-the-art, and linked to a large-format HP printer. Eight work stations available for student use are equipped with contemporary graphics programs. Three lecture/laboratory rooms have complete "Smart" audio-visual projection capabilities.

Our location in a unique geologic and urban environment provides a dramatic natural laboratory in which to teach Geological Science. Frequent occurrence of earthquakes, landslides, storms, floods, wildfires, and human-induced environmental mishaps in the densely populated region surrounding Cal Poly Pomona presents significant challenges that require rapid response and evaluation. All Geological Sciences faculty play an important role in community issues like natural hazards mitigation, site investigation, resource management, and public outreach or education. Most of our graduates are placed locally as scientists in geotechnical firms or as teachers in primary or secondary schools. Hence, the Geological Sciences Department and its programs have great value and relevance to the University and the community.

III. Mission, Goals, and Objectives of the Geological Sciences Department

Mission Statement

The Geological Sciences Department aspires to provide the highest quality education in Earth Science and its applications. Through hands-on learning methods, faculty-mentored research, and exposure to current technology, students shall acquire skills applicable to careers in Earth Science and related disciplines. The Department's programs emphasize understanding of Earth system processes and their interrelationships, thereby providing students a global perspective needed for problem solving, decision making, and leadership roles in a rapidly-changing world confronted with environmental challenges.

Goals

1. Knowledge

Impart broad knowledge of Earth Science and understanding of processes that drive the dynamic Earth system.

2. Skills

Develop skills applicable to successful careers or further education in Earth Science and supporting disciplines.

3. Technology

Provide hands-on learning experience with current technology used to acquire and analyze scientific data, solve problems, and present results.

4. Perspective

Enhance student awareness of local and global environmental challenges and problems facing Earth inhabitants within the context of geologic history.

Learning Objectives Graduates from both degree programs should be able to:

(General Science)

- A.** Understand and implement various facets of the scientific method.
- B.** Effectively communicate results of scientific investigations in written and oral format.

(Observation/Inquiry)

- C.** Recognize common Earth materials, structures, and landforms, describe their properties, and determine their age relationships.
- D.** Acquire geologic data in the laboratory or field using standard observational procedures and scientific equipment.
- E.** Describe the interrelated processes operating in Earth's lithosphere, hydrosphere, atmosphere, and biosphere over different geologic time scales.

(Analysis/Interpretation)

- F.** Use maps, cross sections, and other imagery to analyze and interpret spatial and temporal relationships displayed by Earth features or geologic data sets.
- G.** Utilize quantitative reasoning, experiential judgment, and computer technology to assess data, draw conclusions, and solve problems.

Matrix Relating Learning Objectives to Goals:

The matrix below allows one to view the interconnections between our Department Goals and Department Learning Objectives. Most objectives address more than one goal.

	Goal 1	Goal 2	Goal 3	Goal 4
Objective A	x	x		
Objective B		x	x	
Objective C	x	x		
Objective D		x	x	
Objective E	x			x
Objective F	x	x	x	x
Objective G		x	x	x

IV. Proposed Assessment Activities

To assess the effectiveness of our instructional program and relevance of our goals and objectives, we propose to carry out the following activities over the next five years. As organized below, the intent of these assessment activities is to evaluate three fundamental questions. All Geological Sciences faculty will be involved in these activities to varying degrees, as outlined in the Assessment Timeline of Part V. The quantitative and qualitative feedback yielded shall be incorporated into the next 5-Year Program Review of Geological Sciences Department during 2011-2012.

Assessment Question #1 *Does the current course curriculum address the Learning Objectives and Goals of the Department in sufficient breadth and depth?*

Activity 1A. Analyze the current expanded course outline for each course and draw connections between course content (or educational outcomes) and specific Department Learning Objectives.

Activity 1B. Fill in matrices for the Geology and Integrated Earth Studies curricula, indicating the degree that each Department Learning Objective is addressed in specific courses. (*see pages 6-7 for detailed explanation*)

Assessment Question #2 *How effectively do the Department courses accomplish the Learning Objectives?*

Quantitative Course Assessment Tools:

Activity 2A. Monitor student performance on exam questions linked to specific Department Learning Objectives.

Activity 2B. Track grades on homework assignments, laboratory exercises, term projects, and research papers that relate to Department Learning Objectives.

Activity 2C. Use rubrics to evaluate oral and written Senior Thesis presentations (the capstone experience for Geology majors).

Activity 2D. Conduct “Pre Test-Post Test” analyses of course components related Department Learning Objectives.

Activity 2E. Track student responses to course evaluation question(s) related to learning achievement.

Qualitative Course Assessment Tools:

Activity 2F. Supervise and mentor students on various stages of term paper presentation and senior thesis research and writing.

Activity 2G. Supervise and evaluate student presentations at professional meetings.

Activity 2H. Compile representative portfolios of student work for that exceed expectations, meet expectations, or are below expectations.

Activity 2I. Conduct mid-term teaching evaluations.

Activity 2J. Advise students each quarter to monitor progress toward degree and devise efficient curriculum plan.

Activity 2K. Conduct exit interviews of all graduating majors.

Assessment Question #3 Do the Department's Goals and Learning Objectives address the current needs, trends, and opportunities in the Geoscience profession?

Alumni-Faculty Interactions

Activity 3A. Update alumni data base to track areas of employment or graduate school placement for Geology and Integrated Earth Studies graduates.

Activity 3B. Utilize alumni newsletter ("The Mylonite") to keep alumni informed of Department activities and to publicize alumni news to students and faculty.

Activity 3C. Design an alumni questionnaire to identify important areas of focus for Department Learning Objectives, student training, and future hiring. Is the Department preparing students appropriately for careers in industry, academia, government, or education?

Activity 3D. Meet periodically with alumni and other geoscience professionals from industry and academia. Discuss relative importance of Department Learning Objectives for meeting current needs of the profession.

Alumni-Student-Faculty Interactions

Activity 3E. Geology Club speaker series: Invite alumni or other geoscience professionals to present talks related to their industry work or academic research.

Activity 3F. Organize Career Symposia with alumni presenters to appraise students and faculty of career opportunities for geoscientists and necessary preparation. What entry-level skills and knowledge are crucial for success in the geologic profession?

Faculty-Student-Interactions with Industry and Academia

Activity 3G. Promote and track student internships with local geotechnical companies or government agencies, using faculty as go-between.

Activity 3H. Pursue research opportunities and funding for students as a means of staying current in the geoscience profession.

Activity 3I. Encourage student participation in local or national research conferences to promote interactions with faculty and students from other universities.

Explanation of Assessment Activity 1B (to be carried out during Year 1)

The matrices below will allow us to draw connections between Department Learning Objectives and specific courses in our two degree programs. After analyzing the expanded outlines of frequently-taught courses (**Activity 1A**), the responsible faculty member marks a 1, 2 or 3 in each box to indicate whether a given Learning Objective receives *minimum*, *moderate*, or *major* emphasis in the course.

The result is a curriculum map showing where and when specific Learning Objectives are addressed within the Geology and Integrated Earth Studies programs. In a meeting that concludes Activity 1B, faculty will learn which objectives receive heavy emphasis, as opposed to moderate or light, in specific geoscience courses. This activity promotes communication between all faculty about specific content covered in their designated courses. Such insights should help faculty identify which knowledge, skills, or experiences are developed in pre-requisite courses, so that more time can be devoted to other Learning Objectives.

The matrices also offer a general guide for implementing Assessment Activities 2A-2I during Years 2, 3, and 4. Ideally, those Learning Objectives strongly emphasized in a given course should be targeted for assessment.

Geology Degree: Specific GSC Course Connections to Learning Objectives							
Required GSC Core Course:	Objective A	Objective B	Objective C	Objective D	Objective E	Objective F	Objective G
*GSC 111-141L							
*GSC 112-151L							
GSC 145L							
GSC 215-215L							
GSC 255-255L							
GSC 300-300L							
GSC 310-310L							
*GSC321-321L							
GSC 323-323L							
GSC 325-325L							
GSC 331-331L							
GSC 333-333L							
GSC 360-360L							
GSC 423-423L							
GSC 424-425L							
GSC 433-433L							
GSC 444-444L							
GSC 461-463							
GSC 490L							
Required GSC General Ed Course:							
*GSC 350							
Optional GSC							

General Ed Course:							
*GSC 116							
*GSC120							
*GSC 320							
*GSC 335							
*SCI 212							

* denotes General Education or Service course open to all Cal Poly Pomona students

Integrated Earth Studies Degree: Specific GSC Course Connections to Learning Objectives							
Required GSC Core Course:	Objective A	Objective B	Objective C	Objective D	Objective E	Objective F	Objective G
*GSC 111-141L							
*GSC 112-151L							
*GSC 116							
GSC 145L							
GSC 215-215L							
GSC 300-300L							
GSC 304							
GSC 310-310L							
*GSC 320							
*GSC321-321L							
GSC 323-323L							
*GSC 335							
*GSC 360-360L							
*GSC 350							
*GSC 120							
*SCI 212							

* denotes General Education or Service course open to all Cal Poly Pomona students

How will the proposed Assessment Activities accomplish a constructive Feedback Loop?

An ideal assessment activity should result in constructive feedback. We expect feedback from our activities to provide insights and suggestions useful for improving program curricula and/or course instruction. In many cases, the feedback is also beneficial to students in providing constructive criticism and guidance throughout their undergraduate careers. Below, we explain how the feedback loop is accomplished and reinforced through implementation of specific Assessment Activities:

Activity 1B (described in detail above) requires Geological Sciences faculty to map the progression of Department Learning Objectives through all stages of the Geology and Integrated Earth Studies degree programs. The resulting matrices, produced during Year 1 of the assessment process, will show faculty where and when specific Learning Objectives are accomplished, and which courses emphasize certain objectives over others. An instructor can then reallocate teaching time to focus on knowledge or skills needed for future courses and de-emphasize content learned in prerequisite courses. The process also encourages communication between faculty members such that areas of overlap or redundancy are reduced whereas a systematic progression of integrative learning is accomplished.

Activity 2A: Examinations are designed to measure the degree to which knowledge, skills, and concepts are retained and later demonstrated by students. The instructor receives a direct gauge of how well the course content is getting across to students. Poor exam scores on certain questions should induce more focus on specific content areas.

Activity 2B: Evaluation of homework, laboratory exercises, term projects, or research papers allows instructor to monitor student performance, degree of understanding, and writing proficiency. Adjustments to content and teaching pedagogy can be made accordingly. Alterations to the assignments may also result. Careful record keeping should identify students whose learning deficiencies are related to poor attendance. Such students may be counseled individually.

Activity 2C: Faculty evaluations of senior theses provide direct measure of how well this capstone exercise demonstrates student proficiency in Department Learning Objectives. The faculty supervisor receives feedback from colleagues about which areas need stronger emphasis in future theses. Students benefit from constructive criticism and validation of their efforts.

Activity 2D: Pre-test and post-test comparison allows instructor to gauge his/her effectiveness in teaching concepts or skills that are especially important to the course. The pre-test also informs instructor about the degree of student preparation at the onset of the course. Time spent teaching specific topics can be allocated accordingly.

Activity 2E: Course evaluations gauge student perceptions of their learning experience; e.g., how much was learned, was the instruction well-organized, was the course content explained effectively, how well did the instructor respond to student questions, etc. Data compiled from these evaluations may guide the instructor to make constructive changes to content emphasis and pedagogy.

Activity 2F and 2G: Direct one-on-one supervision of student research and report preparation is mutually beneficial to the faculty member and the student. Such mentoring provides timely feedback to both parties that may identify areas of misconception and confusion, guide critical thinking and data analysis, assist in time-management, improve written and oral expression, and develop realistic expectations. Through this process, the student benefits from constructive criticism, while the faculty member gains knowledge about a particular research area.

Activity 2H: Portfolios compiled by the instructor provide typical examples of past student work; e.g., laboratory exercises, term projects, senior theses. Students may access these portfolios to gain insight into instructor expectations and formatting styles. The instructor may compare portfolios over the years to gauge variations in quality of submitted work.

Activity 2I: Qualitative mid-term evaluations help the instructor identify areas of difficulty or misunderstanding pertaining to presentation of material and transfer of knowledge. Adjustments to teaching style and/or modifications to content focus can be made during the second half of course to address student needs.

Activity 2J: Each student will be advised by a designated faculty member prior to pre-registration every quarter. In addition to providing regular communication with faculty, this process is important for keeping the student on an efficient track to graduation. Students receive advice on time-management and are appraised about opportunities for tutoring (if necessary). The Department curriculum benefits in that time conflicts in course scheduling may be identified and corrected.

Activity 2K: Exit interviews, conducted by each student's academic advisor just prior to graduation, yield the student's synoptic perspective of the entire academic program. Honest appraisals by graduating students should affirm strong components of the Department curriculum and required support courses while identifying knowledge or skill areas that were redundant or could have been better developed. Ideas for improving the curriculum may also be expressed. Student opinions will be considered in long term curriculum planning.

Activity 3A: The alumni data base provides current contact information and tracks areas of employment or postgraduate education for Geology and Integrated Earth Studies alumni. Data can be used to document alumni successes, develop internship or scholarship opportunities, provide ideas for Geology Club Speaker series and Career Symposia, and identify potential fund-raising sources. The data base provides a promotional tool for demonstrating the multidisciplinary interests and expertise of Department graduates

Activity 3B: The annual alumni newsletter ("The Mylonite") is an effective communication tool for connecting faculty and students with alumni. Faculty and students are informed of Alumni activities, and vice-versa.

Activity 3C: The alumni questionnaire should highlight the skills and knowledge areas important for succeeding in the modern geoscience profession. Department Learning Objectives

may be modified and adjustments made to the curriculum to address deficiencies and/or reinforce proficiency in essential areas.

Activities 3D, 3E, and 3F: Discussions with alumni and geoscience professionals keep faculty and students apprised about the current job market and trends in industry and academia. What entry-level skills and knowledge are crucial for success in the geologic profession? Where is the current and future demand for Department graduates? Students receive external validation on the relevance of their coursework. The Department curriculum benefits in that new courses may be designed and new faculty hired to cover identified growth areas.

Activities 3H, 3I, and 3J: Faculty serve as a go-between for students in fostering professional connections, setting up internships, obtaining funding, and initiating research projects. These endeavors keep faculty attune to current developments in industry and academia. Fresh ideas for future student-involved projects may also result. Students benefit from interactions with professionals and the application of knowledge and skills learned in their coursework. The Department programs are enhanced in that successes of professionally active students may motivate other students to focus more intently on their courses.

V. Timeline for Implementing Assessment Activities

The Assessment Activities outlined in Part IV shall be implemented according to the schedule below. Each faculty member will be involved with the assessment process in the capacity denoted by italics. The summary chart that follows this section provides a visual overview of the five-year timeline.

Annual Activities

- Meet to discuss assessment results and feedback to date. (*all faculty participate*)
- 2C.** Evaluate senior thesis presentations. (*all Geological Sciences faculty participate*)
- 2J.** Advise students quarterly on academic scheduling. (*designated faculty advisor*)
- 2K.** Exit interviews for graduating seniors. (*conducted by student's designated academic advisor just prior to graduation*)
- 3A.** Update alumni data base. (*Department administrative coordinator, with periodic input from faculty*)
- 3B.** Write and mail alumni newsletter. (*all faculty participate*)
- 3D.** Meet with Alumni Advisory board. (*annual alumni reception attended by all faculty*)
- 3E and 3F.** Promote Geology Club speaker series and Career Symposia. (*Geology Club faculty advisor and Department Chair; all faculty attend presentations and interact with speakers*)
- 3G, 3H, and 3I.** Pursue professional opportunities for students (internships, sponsored research, etc.); promote student involvement at professional conferences; monitor student performance. (*various faculty involved*)

Year 1 Activities (2006-07)

- 1A.** Analyze expanded course outlines in terms of content and expected course outcome. (*Each faculty member is designated his/her frequently taught courses*)
- 1B.** Complete matrices connecting Department Learning Objectives with Expected Course Outcomes for all courses in Geology and Integrated Earth Studies degree programs. (*all faculty participate, then meet to discuss results at conclusion of activity*)

- 2J.** Write questions for exit interview. (*all faculty participate*)
3C. Design alumni questionnaire. (*all faculty participate*)

Year 2 Activities (2007-08)

--*Each faculty member* targets one course for focused outcomes assessment. Choosing from the list of applicable course assessment tools (**Activities 2A through 2I**), the instructor custom-designs and completes two or more assessment exercises. Data compiled for the course are analyzed and briefly summarized.

3C. Implement alumni questionnaire and compile results. (*Assessment Coordinator and Department administrative coordinator*)

Year 3 Activities (2008-09)

--*Each faculty member* targets two courses for focused outcomes assessment. Choosing from the list of applicable course assessment tools (**Activities 2A through 2I**), the instructor custom-designs and completes two or more assessment exercises for each course. Data compiled for these courses are analyzed and briefly summarized.

3C. Analyze results of alumni questionnaire and discuss feedback from this survey and other alumni interactions. (*all faculty participate*)

Year 4 Activities (2009-10)

--*Each faculty member* targets two courses for focused outcomes assessment. Choosing from the list of applicable course assessment tools (**Activities 2A through 2I**), the instructor custom-designs and completes two or more assessment exercises for each course. Data compiled for these courses are analyzed and briefly summarized.

Year 5 Activities (2010-11)

--Organize and tabulate assessment data compiled during previous years. (*each faculty member contributes*)

--Analyze and integrate assessment results; discuss feedback in context of modifying Department Learning Objectives, improving Department curriculum, hiring new faculty, and acquiring external support. (*meeting of entire Geological Sciences faculty*)

--Write a summary assessment report to incorporate into the 2011-12 Five-Year Academic Program Review. (*committee composed of Department Assessment Coordinator and 2-3 faculty members*)

Five-Year Timetable for Implementation of Assessment Activities

Yearly Activities	2006-7	2007-8	2008-9	2009-10	2010-11
Evaluate senior theses	Analyze course outlines and complete matrices relating course curriculum to Department Learning Objectives				
Conduct exit interviews	Design rubric for senior thesis evaluation				
	Design exit interview				
Write alumni newsletter	Design alumni questionnaire				
Update alumni data base					
Meet with alumni at annual picnic		Discuss results of matrix activity; modify course emphases as needed			
Promote Geology Club speaker series and career symposia		Custom-design methods / tools to measure learning outcomes in specific courses			
Pursue opportunities for student internships and academic research		Each faculty member targets one course for outcomes assessment; data are compiled and analyzed			
Advise students each quarter to monitor progress toward degree and devise efficient curriculum plan		Implement alumni questionnaire; compile results			
			Discuss feedback from alumni questionnaire and other alumni interactions		
			Refine methods / tools for measuring learning outcomes		
			Each faculty member targets two courses for outcomes assessment; data are compiled and analyzed		
					Integrate assessment results and discuss feedback
					Discuss improvements to Department curriculum and course content as suggested by assessment feedback
					Write summary report

VI. Relationship of the Geological Sciences Degree Programs to the University and College of Science

Both degree programs of the Geological Sciences Department provide high-quality science teaching with a “hands-on” emphasis that prepares students for careers in academia and applied Earth Science. Our location in a unique geologic and urban environment offers a natural laboratory in which to realize the missions of Cal Poly Pomona and the College of Science. For example, the first part of the University’s mission is to “advance learning and knowledge by linking theory and practice.” The Department’s first three goals that emphasize *Knowledge*, *Skills*, and *Technology* directly relate to this mission. Our fourth goal, *Perspective*, is to “enhance student awareness of local and global environmental challenges and problems facing Earth’s inhabitants in the context of geologic history.” This goal is in direct alignment with the second part of the University mission: “to prepare students for lifelong learning, leadership, and careers in a changing, multicultural world.”

The Geological Sciences Department’s lectures, laboratories, field trips, research experiences, and alumni interactions take advantage of our unique setting to further accomplish the mission of the College of Science. For example, through direct observation and evaluation of natural hazards (e.g., earthquakes, landslides, storms, floods, and wildfires) that occur locally and frequently, we provide an “academically stimulating environment” and teach our students “skills and knowledge necessary to collect, evaluate, and apply information to complex problems.” Our strong connections to the local geotechnical industry offer further opportunities (e.g., internships and research projects) to “emphasize a hands-on, learn-by-doing approach” and to “reach beyond the bounds of the campus in an effort to meet the needs of the local and global communities.”

VII. Faculty Participation Sign-off Sheet

The following faculty members acknowledge their participation in design of the Geological Sciences Department Assessment Plan and agree to, in one capacity or another, be involved in its implementation.

Dr. John A Klasik (Department Chair)	_____
Dr. Jonathan A. Nourse (Assessment Coordinator)	_____
Dr. Jeffrey S. Marshall	_____
Dr. David R. Jessey	_____
Dr. David R. Berry	_____