SACRAMENTO STATE
Geology Department

Self Study

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Table of Contents

List of Figures

List of Tables

1.0 General information- Sacramento State Geology Department

1.0.1 Overview and history of the Department

The Geology Program at Sacramento State began as part of the Physical Science Department in 1955. At that time Dr. Norman Janke was hired to assemble outstanding faculty members (as budgets permitted!) and develop a geology major on the growing Sacramento State campus. The first geology majors entered the program in 1969, and by the early 1970's five full-time faculty members were present. This cadre of faculty members developed many of the core courses that are still taught today. In 1975 the Geology Department officially split from the Physics Department. Two new faculty members were added in the late 1970's to meet the needs of almost 100 majors, and in the 1980's several new faculty members were hired to teach field-oriented classes.

Budget restrictions in the mid-1980's almost eliminated the Geology Department, but successful lobbying retained the program by sharing resources with the Chemistry Department. As one faculty member recalls, "….unable to get lab space due to high demand for limited space, we used a closet for a microscope lab". By the late 1980's conditions had eased considerably, and the Geology Department acquired its own office and lab space.

Continued growth and retirements allowed several new hires in the 1990's, and the Geology Department began to build a reputation as larger, full-service department in the CSU system. Our Department Technician was hired in the early-1990's, and the Department Secretary became an 11 month employee.

In 1997 the University entered into an almost unprecedented agreement with the Federal Government, and the California Water Sciences Center of the U.S. Geological Survey moved to campus. Dr. Greg Wheeler was Chair of the Geology Department at that time, and helped broker the agreement between the USGS, Sacramento State and University Enterprises (UEI) that resulted in groundbreaking for construction of Placer Hall. This agreement continues almost 20 years later, with UEI owning the building, and the USGS and campus paying rent for space occupied.

The association with the USGS has been a tremendous asset to the Geology Department. New faculty hires were geared toward hydrogeology, and collaborations with the USGS have resulted in student jobs and shared advisory roles. USGS scientists have taught many classes as part-time instructors, shared their equipment and expertise, and our students continue to do research and find employment in water-related fields.

The Geology Department capitalized on these strengths in 2002 by introducing a conditional M.S. in Geology Program and admitted the first graduate students. The M.S. program was formally approved in 2007, and moved forward with 10-12 new students per year. Admissions to the Geology graduate program were suspended in Fall 2010 due to University and system-wide budget and FTE constraints.

In Fall 2010 the Geology Department voted to continue the M.S. as a self-supporting program through the College of Continuing Education (CCE). This decision was difficult for Geology faculty members, but it allowed continued operation of the M.S. program. The CCE version of our graduate program operated successfully until a Chancellor's Office audit was launched in Fall 2012. This audit was requested by the Faculty Union, and prosecutorial auditors from the State Attorney General's office were tasked with investigating the effects of privatizing our educational system. As a result of an audit finding, the M.S. program was returned to state-supported instruction to avoid the issue of supplanting (i.e. duplication of state programs in the private sector). New M.S. students were admitted again in Fall 2015 after a brief hiatus for the graduate program.

1.0.2 Reflection: Trends in the Department

The strength of the Geology Department is in its ten full-time faculty members. We are collegial, engaged and successful. We work and socialize together, share common interests and are beginning to collaborate on larger projects. Four new hires in the past five years have changed the complexion of the Department. We are becoming a more modern department, with new analytical equipment, new quantitative courses and GIS integrated into the curriculum. Contract funding from state and federal agencies has equipped a 24 seat classroom with computers, and instrumentation and sample analysis will soon be part of several courses. We are able to offer teaching and research assistantships to five or six graduate students for the foreseeable future.

1.1 Data summary: Introduction and overview of the Geology Department's mission and scope and overview of degree programs.

1.1.1 Mission and scope

The mission of the Geology Department at Sacramento State is to "… provide the best possible undergraduate education…" We do this by challenging our students, giving them real-world examples and providing hands-on advising and mentoring as they move through our program. We also provide quality graduate education at the M.S. level, and have connections to a variety of agencies, industries and professional organizations in California's capital city. We enhance the University's mission by preparing students for leadership, service and success and are proud of our reputation in the geologic community. We share the University's vision that Sacramento State will be a recognized leader in education, innovation, and engagement.

1.1.2 Overview of degree programs

The Geology Department offers four degrees, and each serves a different population of students. The *B.A. in Earth Science* is often chosen by pre-teachers. It provides extra breadth in the sciences by requiring electives from a list of astronomy, weather and climate, anthropology and biology classes. The B.A. in Earth Science is often combined with a teaching credential, although this requires an additional year of coursework through the College of Education or a similar credential program. We graduate two or three students each year with a B.A. in Earth Science.

The *B.A. in Geology* was designed to be a shorter, more flexible program that appeals to naturalists or resource managers, geologic planners, environmentalists and geology-related business people. It has lower math, chemistry and physics requirements than the B.S. in Geology (Table 1.1), and is an excellent choice for students who double major, have obligations that prevent them from attending field camp, or choose to graduate one semester earlier. The number of graduates in this program has ranged from three to six in recent years.

Requirements	B.S. in Geology	B .A. in Geology
Math	Math 30 (Calculus I) required Math 31 (Calculus II) recommended	Math 30 (Calculus I) required *or* Math 26 (Calculus I for the Social and Life Sciences) and Math 29 (pre-Calculus)
Chemistry	Chem 1A (General Chemistry I) Required *or* Chem 1e (General Chemistry for Engineers) Chem 1B (General Chemistry II) recommended	Chem 1A (General Chemistry I) required

Physics	Physics 5A (mechanics, heat and sound) and Physics 5B (light, electricity and magnetism, modern physics) required *or* Physics 11A (mechanics), Physics11B **(**heat, light, sound, modern physics) and Physics 11C (electricity and magnetism)	Physics 5A (mechanics, heat and sound) required *or* Physics 11A (mechanics)
Electives	12 approved upper division units	9 units of upper division electives
Geol 188 (Field camp)	Required	Not required

Table 1.1: Comparison of requirements for the B.S and B.A. degrees in Geology.

The *B.S. in Geology* is the best preparation for graduate school or for professional employment as a geologist. It requires an additional physics class, and Department guidelines recommend additional Math and Chemistry courses with the B.S., especially for students who are considering graduate school. The B.S. program emphasizes mineralogy, sedimentology and stratigraphy, field mapping, igneous petrology, structural geology, GIS, hydrogeology, and report writing. Summer field camp is the culminating experience, and fifteen to twenty five students graduate with a B.S. in Geology most years. This degree is appropriate for regulators, consultants, geologic engineers and other technical specialists.

The *M.S. in Geology* serves traditional students and working professionals. Classes are offered in evening and weekend formats, and candidates are selected for thesis or non-thesis tracks. The program emphasizes real world examples, teamwork, communication to different audiences and strong analytical skills. Graduate admissions reopened in Spring 2015 after a two year hiatus, and the graduate program has admitted a second cohort of students that starts in Fall 2016. The M.S. program offers two or three graduate classes per semester, and there is some cross-enrollment between undergraduate and graduate classes. Approximately 23 students are currently enrolled in the Graduate program. We have not had any graduates from the new M.S. program, but expect 8 to 10 graduates per year based on past experience.

1.1.3 G.E. and service courses

General Education (G.E.) and service courses are an important part of our Department. Over the last 10 semesters 76% to 86% of the students in our courses have been non-majors (Figure 1.1). Our lower Division general education classes in Earth Science (Geol 8), Natural Disasters (Geol 7), Geology of Mexico (Geol 5) and Physical Geology (Geol 10) are consistently full, and there is enough demand to fill larger sections or add additional sections of these classes. Over the last 10 semesters Geology classes have averaged 45 students per class, while college and university class sizes have averaged 33 students and 34 students per class, respectively (Figure 1.2). This difference occurs because we teach several large general education lectures.

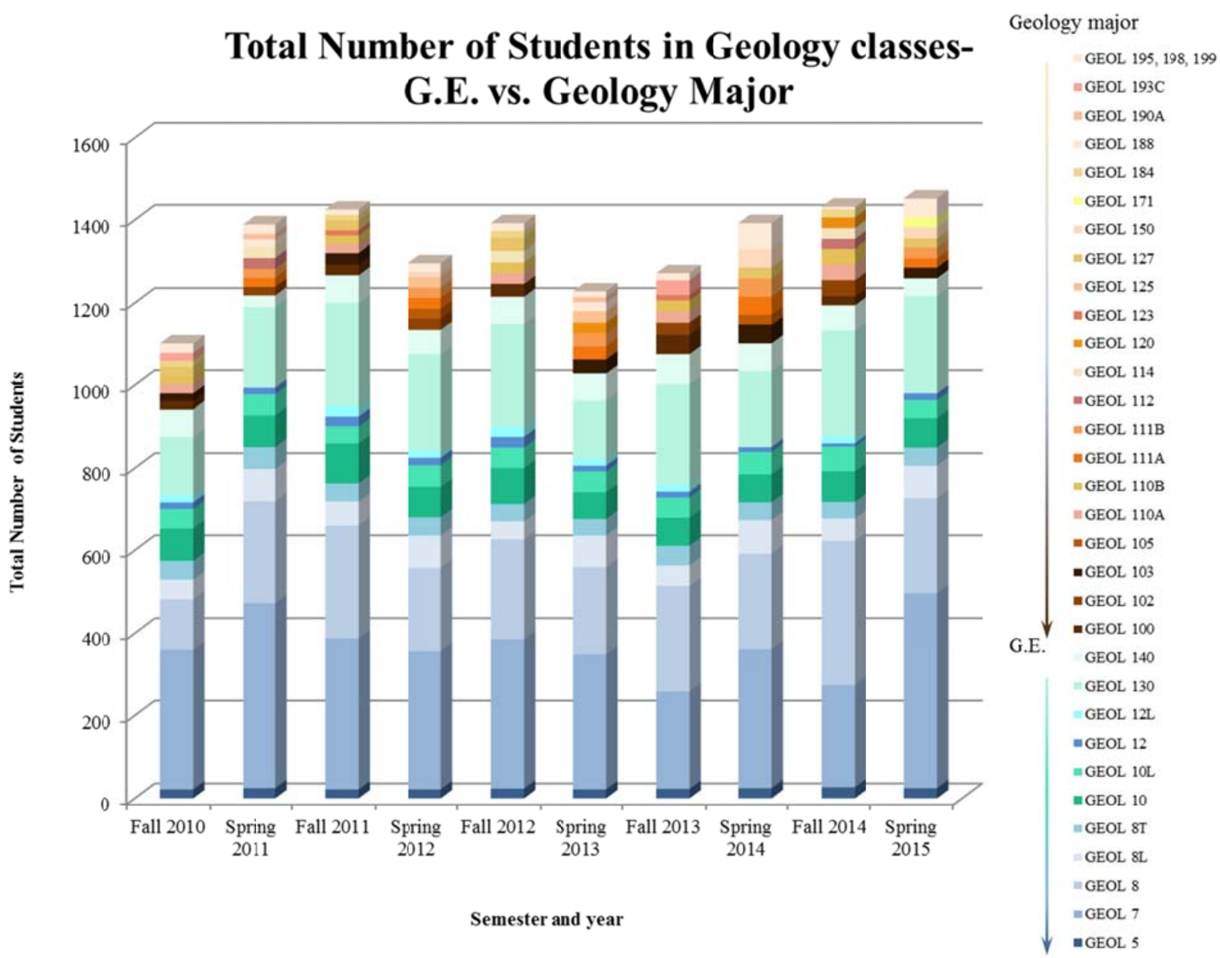

Figure 1.1: Students in General Education classes (shown in shades of green and blue) make up 76% to 86% of the total number of students in Geology classes. Data compiled from the Fact Book Fall 2015 Geology.

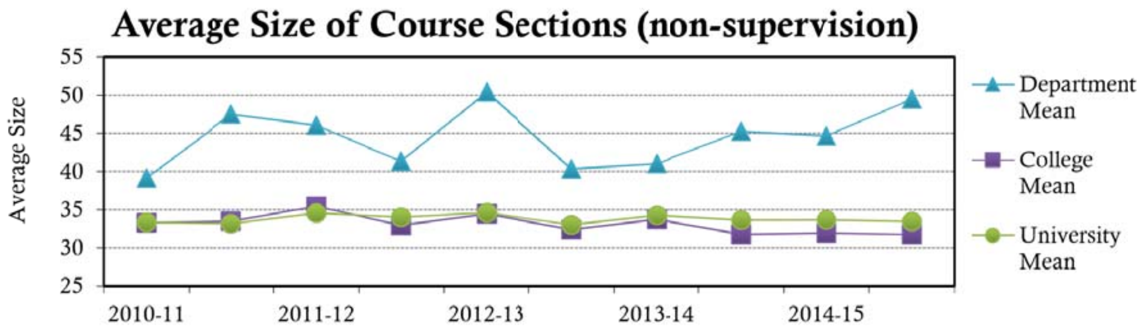

Figure 1.2: The average size of Geology classes is significantly larger than mean values for the College and University. From the Fact Book Fall 2015 Geology, p. 7.

1.1.4 Student data

The ethnicity and gender of Geology students are different from the makeup of the larger university. Student data show that 17 - 30% of undergraduate Geology majors belong to minority groups (Figure 1.3). This contrasts with the College and University populations, where 46 to 58% of undergraduate students self-identify as belonging to minorities. Male/female ratios show similar patterns. Undergraduate Geology majors ranged from 53 - 63% male (Figure 1.4) in contrast to our College and University, where male students make up 42% and 43% of the student population respectively.

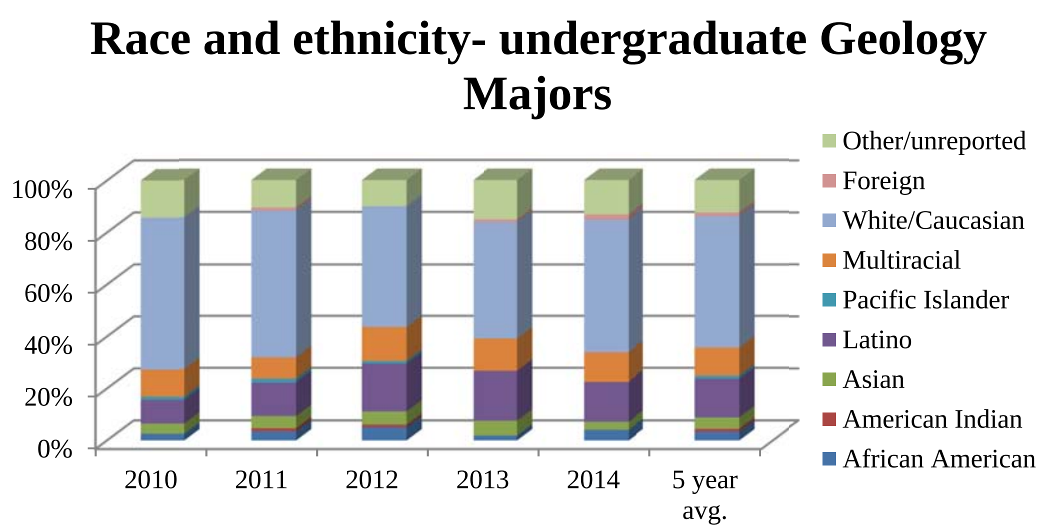

Figure 1.3: Geology majors are dominantly white, and 17 - 30% self-identify as minority students. Data from the Fact Book Fall 2015 Geology.

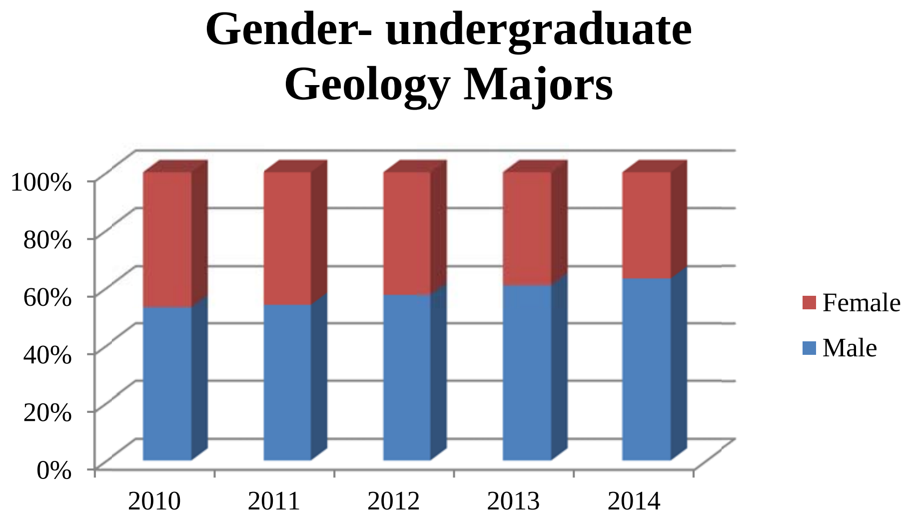

Figure 1.4: Geology majors are 53 – 63% male. Data from the Fact Book Fall 2015 Geology.

Almost half of our Geology majors are from low income families, and 15-20% are the first in their family to attend college (Fact Book Fall 2015 Geology). Most future Geology majors transfer to Sacramento State after spending time at community colleges, and most do not start their college careers as Geology majors. 97% of Geology majors live off campus and commute to school on a daily basis (Fact Book Fall 2015 Geology).

Geology majors are typical of the Sacramento State student population with respect to GPA (Table 1.3), class standing and preparation. Geology majors are significantly different from other student populations because they usually find the major after experimenting with other branches of science or engineering. Less than 10% of our students start Freshman year as Geology Majors. Roughly 40% of our Geology majors are 25 years of age or older, and many have life experiences that include military service, family obligations, previous careers, or incomplete academic backgrounds. Most of our incoming students transfer into the program with enough units to be classified as Juniors or Seniors, and most still need to take one or more of the lower division prerequisites. Geology majors take a higher than average unit load per semester (Figure 1.4). This high Spring course load is partially due to the 6 unit field camp requirement for B.S. students.

Average GPA	10 term mean
Lower division courses	
Geology Department	2.63
College of NSM	2.35
University	2.69

Upper division courses	
Geology Department	2.77
College of NSM	2.63
University	2.69
Graduate courses	
Geology Department	3.66 (4 term mean)
College of NSM	3.52
University	3.74

Table 1.3: Comparison of Geology GPA to NSM and University mean values. From the Fact Book Fall 2015 Geology.

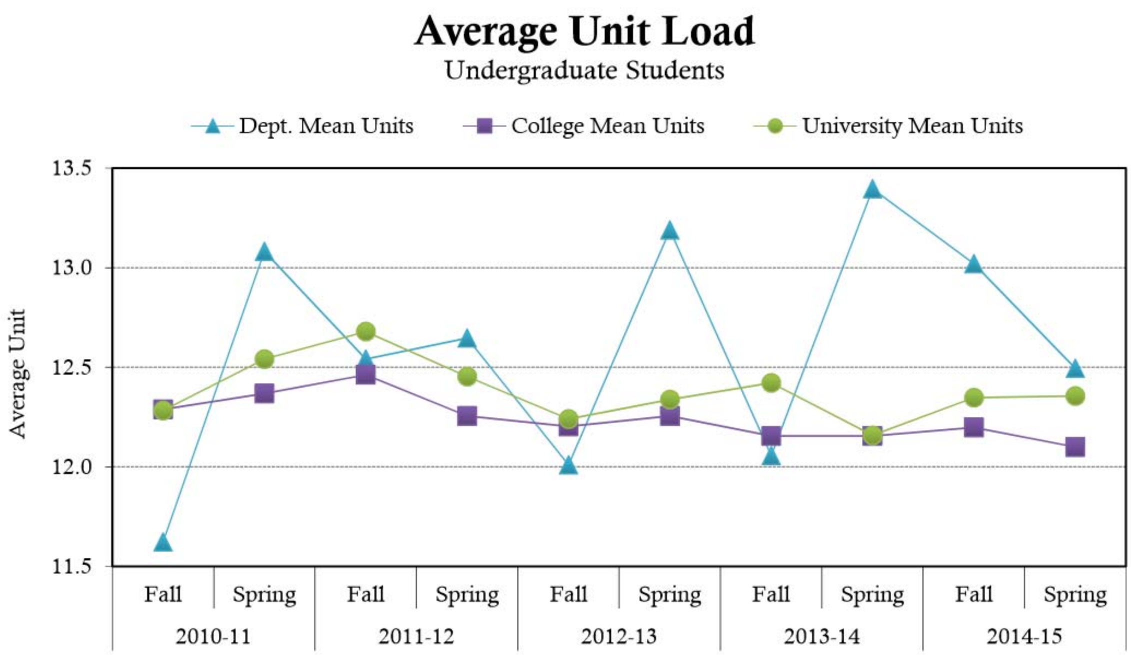

Figure 1.5: Unit load for Geology majors exceeds the average (mean) values for the College and University. From the Fact Book Fall 2015 Geology, p. 6.

1.1.5 Faculty data

The Geology Department has nine full time (tenured and tenure track) faculty members (Table 1.4), and two who have recently retired and entered the faculty early retirement program (FERP). Grant totals from these faculty member average millions of dollars per year (See Table 1.2, Appendix A), with three major programs and many smaller research projects funded on an annual basis. Our full time (tenure track) faculty members are an active group, and engage in a wide variety of teaching, scholarly and service-related activities.

Faculty member	Rank	Specialties and teaching
Dr. Brian Hausback	Professor	Igneous petrology, volcanology, field geology, remote imaging
Dr. Tim Horner	Professor	Sedimentology and stratigraphy, hydrogeology, field mapping, salmon habitat restoration
Dr. Dave Evans	Professor	Hydrogeology, environmental geophysics,
Dr. Kevin Cornwell	Professor	Fluvial geomorphology, mountain meadow restoration, GIS, paleofloods
Dr. Lisa Hammersley	Professor	Igneous petrology, magmatic processes, mineralogy, ores, minority student enhancement
Dr. Dave Shimabukuro	Assistant Professor	Subduction zone tectonics, structural geology, field mapping, petroleum geology, fracking
Dr. Steve Skinner	Assistant Professor	Solid Earth geophysics, tectonics, structural geology
Dr. Amy Wagner	Assistant Professor	Oceanography, geochemistry, oxygen isotopes
Dr. Amelia Paukert	Assistant Professor	Hydrogeology, computer modeling, field geology, contaminant transport
Dr. Judi Kusnick (faculty early retirement program)	Professor	Paleontology and stratigraphy, teacher education, assessment

Table 1.4: Tenured or tenure-track geology faculty members, including FERP (Faculty Early Retirement Program).

Part-time lecturers teach many of our introductory courses and labs, and serve a valuable role in the Geology Department. The population of lecturers ranges from 3 to 8 every semester, and accounts for about 40% of the FTES (full time equivalent students) that we teach. All lecturers have at least an M.S. degree, and many hold Ph.D.'s. Teaching loads for part-time lecturers range from a single course or lab to a 12 unit load per semester. We currently have one lecturer with a contractual obligation for 12 units per semester, and have been able to meet this obligation every semester.

The Geology Department's faculty members are balanced evenly by gender, but our ethnicity is decidedly white, with 93% white and 7% Asian (Geology Fact Book 2015). Our Asian total is due to a single faculty member.

1.1.6 Staff

The Geology Department has two full time staff members. Our Department Secretary is Stacy Lindley, and her position is listed as ASC II (12 month). Stacy has been with the Department since 2009. She manages the department office, assists with financial planning and purchasing, handles all contracts and student add/drop requests and has recently begun to do initial screening and advising for walk-in students.

Steve Rounds was our Department Technician until Dec. 31 2016, when he retired. We are currently relisting the position. Steve held a B.S. in Geology from Sacramento State and worked for the Geology Department from 1991 to 2016. His job is classified as IST II (Instructional Scientific Technician 2) with 12 month status. His replacement will be expert with thin section and rock preparation, computer hardware and software,and will assist with equipment and lab setup.

The Geology Department often hires a part-time student assistant to help with office tasks. This student position comes from a work-study pool where costs are shared equally between the Department and a Federal work study program. This student works 10-15 hours per week, and helps answer the phone, copy course material and interact with the public.

1.1.7 Facilities

Faculty and staff offices in the Geology Department are located in Placer Hall. Placer Hall also has three lecture/lab rooms that seat 24 students each. Recent growth in the major has pushed us beyond 24 students in many upper division classes, and in the near future we will need to offer multiple sections of upper division core classes. Labs in Place Hall contain extensive collections of minerals, rocks and fossils that are used in classes of all levels. This five-story building also houses the California Water Science Center of the U.S. Geological Survey (USGS).

The USGS moved onto campus when Placer Hall opened in 1997, and has been a tremendous asset to the department. More than 140 people work for the USGS, and more than 40 are high-level scientists. USGS scientists have advised and hired our students, taught as part-time instructors, given guest lectures and collaborated on projects. This type of state/federal partnership is rare, and the academic/agency aspect of the collaboration is equally exceptional.

Our place in Placer Hall and association with the USGS provides opportunities that are not available to other departments our size.

The Geology Department also has space in Sequoia Hall: two offices, two rock preparation rooms, one teaching lab and four store rooms (closets). These rooms are remnants from the days when the department occupied parts of 5 different floors of Sequoia Hall. Standard equipment in the rock labs includes thin section machines, rock saws, cutting and polishing equipment and sieves. Office space in Sequoia Hall is used by the Department Technician and part-time instructors, and store rooms hold packing material, small equipment and rock samples.

The Department faculty and students have not had easy access to analytical instrumentation for most of our history. In the past 10 years several faculty members have written grant proposals to fund rock or water chemistry labs, but we have not been successful with major equipment acquisition. New faculty members have acquired some instrumentation from startup funds and grants will expand our capabilities for oxygen isotope analysis, major ion water chemistry, organic carbon analysis and seismic studies. Proposals submitted in the past year may also provide new field sampling equipment for hydrogeology and the ability to analyze trace metals in rocks and water. Space is a challenge with these new acquisitions, and we are packing equipment into the limited research space in Placer Hall.

Our computer facilities include a dedicated 24 seat classroom for geologic modeling and mapping and a 9 seat student lab where Geology majors can work on projects. Students have access to scanners, printers and large format printers within the Department. These computers were initially acquired with grant funds, but have been maintained by the Geology Department, the Geology Club and the College of Natural Sciences and Mathematics.

Sacramento State also has the largest on-campus wellfield in the nation, with 21 engineered monitoring and production wells (Figure 1.6). Eight of these wells were drilling by the CA Department of Toxic Substances control in 1992, and 13 nested wells were installed by the Department of Water Resources in 2002. These wells are used to demonstrate concepts in hydrogeology, conduct research projects, train students and teach short courses. A storage building near the wellfield houses our downhole logging truck (Figure 1.7), an 18 ft power boat and wellfield sampling equipment. We also have access to the American River, the Sierra Nevada, the California Coast Range and north state coastline. Our resources and location allow us to incorporate real-world examples and observations into the geology curriculum.

Figure 1.6: Students collect groundwater samples at the Geology Department wellfield.

Figure 1.7: Downhole logging tools at the Sacramento State wellfield.

1.2 Summary/overview of responses to recommendations from the most recent program review

In May of 2008 the Geology Department started the last Program Review by asking these questions:

1. How well does the content and structure of our curriculum train students to solve geologic problems?

2. How well does the content and structure of our curriculum meet the workforce needs of California?
3. How well does the structure of our programs meet the needs of our faculty to maintain fulfilling professional lives?

Results were shared in the Study with Focused Inquiry for Program Review, released March, 2009.

Geologic problem solving: The 2009 Focused Inquiry report discusses how Field Camp (Geol 188) grades were used to assess student problem-solving ability. Students were surveyed after their culminating field camp experience, and this helped identify areas of weakness in the geology curriculum.

Student knowledge was also assessed as an aspect of geologic problem solving. The Geology Department began standardized testing of geology majors in Spring 2009, and in 2016 we are still using a variation of this test to assess student knowledge of the fundamentals of geology. We administer the test early in a student's career, then administer the same test near the end of the B.S. program. This test has been modified and updated many times, but the basic strategy is intact. We track individual students (w/ protected identities!), cohorts and classes as they move through the program.

Results from standardized testing and assessment have been used to modify the Geology curriculum. The 2009 Program Review mentioned that cross sections, air photo interpretation and the geologic time scale are weak areas for a significant number of Geology majors. Six years later we are still working to strengthen these fundamental concepts. Our approach is to spiral upward, with repeated exposure to basic concepts and increasingly more complex theories in upper division courses. As an example, we now expose introductory students to published cross sections, our Junior-level mapping classes look at more maps and construct more cross sections, and students in our upper division field classes frequently stop to interpret their maps and make cross section sketches of the three-dimensional orientation of different features. Similar changes have reinforced student understanding of geologic time and air photo interpretation. These are excellent examples of assessment items that were managed adaptively over a period of several years.

Meeting workforce needs: The Geology Department's 2009 Focused Inquiry asked whether our curriculum was meeting workforce needs, and approached this question using a standardized test and information from other universities. The inquiry team used the GIT (Geologist in Training) exam as a test of student knowledge after graduation. Then they mapped content items from our undergraduate curriculum to questions on the GIT exam. Finally, they compared the percentage of each question on the exam to the percentage of time that we spend teaching these topics (Figure 1.8). This analysis provided an internal check on our program content, and we realigned some courses or topics to meet the needs of the professional GIT exam.

Table 1. Comparison of content areas of GIT exam with content areas in Sac State Geology Curriculum

Content Area	GIT (% of Questions)	Sac State (% of credit units)
Field	19.4	13.0
Remote Sensing	9.7	0.0
Min/ Petrol/ Petrog/ Geochem	13.6	19.6
Sed / Strat / Paleo	10	19.6
Geomorphology	6.4	8.7
Structure & Tectonics	9.1	10.9
Geophysics & Seismo	3.6	8.7
Hydrogeology	24.5	6.5
Engineering Geol	2.7	6.5
Minerals / Petroleum / Energy	0.9	6.5

Figure 1.8: Comparison of Sacramento State Geology Curriculum with GIT exam topics. From Geology Focused Inquiry.

These pedagogical and curriculum changes were validated in 2012 when ASBOG (the National Association of State Boards of Geology) published results from their standardized geology exam. The ASBOG test is a general examination for recent geology graduates that tests knowledge in the fundamentals of Geology. Many state licensure programs use the ASBOG exam, and widespread participation allows us to compare our student's performance to nationwide averages. Thirty-eight Sacramento State geology graduates who took the ASBOG test from the 1980's to 2012 were included in the study. Our pass rates have risen dramatically during this time (Figure 1.9), and the time period from 2006 to 2012 shows special improvement (Figure 1.10). Sacramento State graduates who took the test from 2006 to 2012 scored higher than the national averages in almost all tested subject areas (Figure 1.10). This is also the time of our recent curriculum revisions, so it is tempting to link success on the ASBOG exam to our recent curriculum changes. Realistically, there is a lag between student graduation and the time that students take the ASBOG exam. The increase in ASBOG scores is probably due to earlier curriculum changes, the general strength and rigor of our program and the quality of our current group of faculty members.

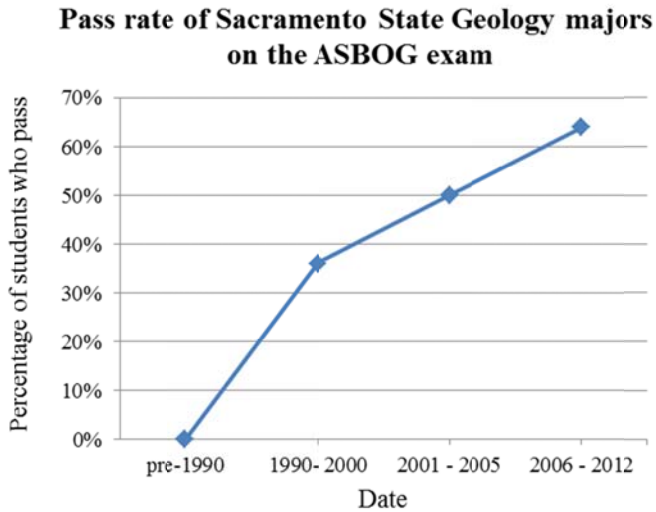

Figure 1.9: Pass rates for Sacramento State geology graduates who took the ASBOG exam before 2012.

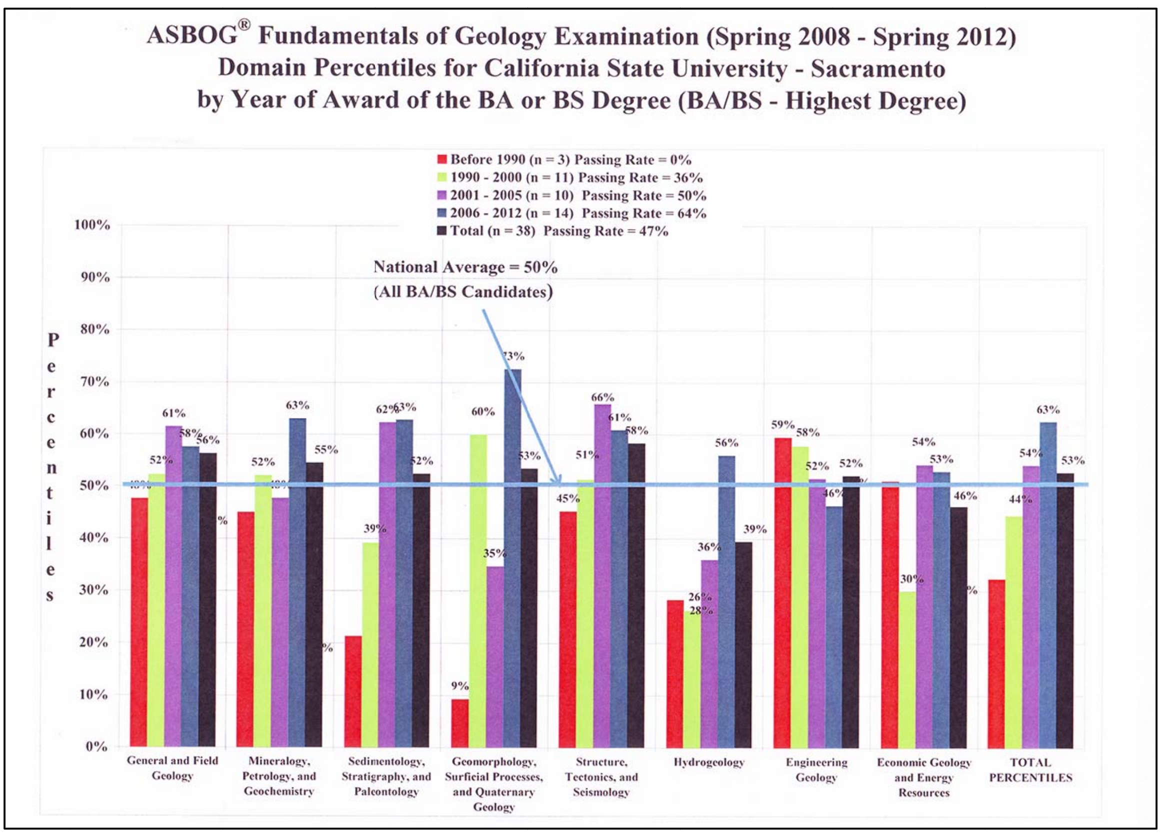

Figure 1.10: Sacramento State Geology majors who took the ASBOG exam have improved steadily since 1990. Current scores are above the national average in almost all areas. From 2012 ASBOG summary to participating institutions.

The 2009 Focused Inquiry also compared course offerings in our program to the course offerings of other, similar universities and geology programs (Figure 1.11). These analyses showed that geophysics, geomorphology and paleontology were not required at most major universities, although they were required for our B. S. degree. This finding pushed the Geology Department to re-classified these courses as upper division electives, and the change is reflected in the current version of the university catalog.

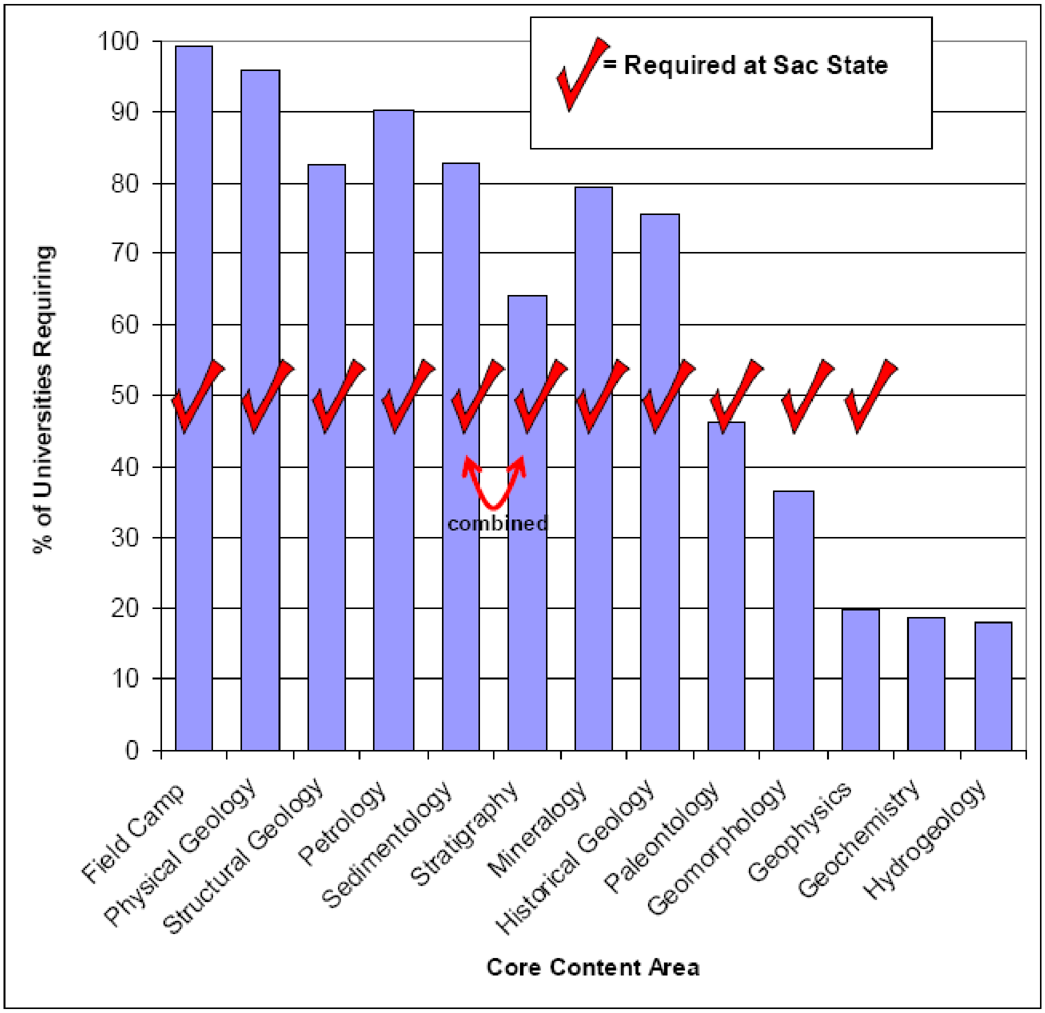

Figure 1.11: Required classes for the B.S. in Geology in 2009. The 2009 Program Review showed that we required more classes than most geology programs, and we changed paleontology, geomorphology and geophysics to electives as a result. From the Geology Self Study with Focused Inquiry for Program Review, March 2009, p. 10.

How well does the structure of our programs meet the needs of our faculty? The third question in the 2009 Program Review was answered using faculty surveys, summaries of faculty productivity and a list of proposed curriculum changes.

The 2009 Faculty survey looked at productivity of our full time faculty members by counting their abstracts, grant applications and publications. It concluded that most faculty members were producing 5-7 items per year, and the group is active and engaged in the professional community. The survey also asked faculty members about their ideal blend of teaching, service and scholarship. The most common response was that faculty members would like more time for scholarship and less teaching responsibility.

Finally, the 2009 Self Study listed several very specific curriculum changes that were needed to make the B.S. and B.A. degrees more relevant and effective (Focused Inquiry for Program Review, March 2009, p. 16). These items include reducing the number of required units in the B.S. degree, supporting core topics that are important on the GIT and ASBOG exams, making field camp units part of the curriculum and reducing the number of weekend field trips. As we look back after six years, these curriculum issues have all been addressed, and many of the suggestions outlined in the 2009 Self Study have been accomplished.

1.3 Alumni Survey and analysis

Our Alumni Survey was conducted in summer 2015 with the help of the Office of Institutional Research. This survey is a standardized instrument that is offered across all departments, but we were allowed to add a few geology questions that relate to our focused inquiry (see part 3 of this report). The alumni survey targeted graduates of our program from the past five years, and did not attempt to reach anyone who graduated prior to 2010. 31 former undergraduate and 2 graduate students responded to the survey, and undergraduate respondents almost certainly had a mixture of B.S. and B.A. degrees. Complete results from the alumni survey are shown in Table 1.5 (Appendix B).

A qualitative look at results from the Alumni Survey shows that our graduates are very satisfied with many aspects of their degree and training. The vast majority of our graduates (usually more than 80%) are *very satisfied* with the quality of instructors and courses and the intellectual challenge of the program. 80- 90% of our graduates also stated that they were *"considerably or sufficiently"* prepared for reading, critical thinking, creative thinking, use of quantitative data, information literacy, problem solving, teamwork, technical writing, lifelong learning and ability to integrate ideas.

Other aspects of the Geology Program received mixed reviews. A majority (> 50%) of the students felt that they were prepared for their career and have discipline-specific knowledge that they need to succeed. This indicates that a significant number do not feel technically prepared for their career. Lower scores on technologies and discipline-specific knowledge were reflected in requests for more computer modeling, statistics and numerical methods.

Our lowest scores on the Alumni Survey relate to social and cultural aspects of the Geology curriculum. We offer a highly technical degree, and spend more time on science and technology than we do with social issues. Students felt that ethical reasoning, civic knowledge and intercultural knowledge were not covered as part of their degree programs. This is a common criticism of science and engineering degrees, and may relate to our challenge attracting a diverse student group to the Geology major.

2.0 Summary of learning outcomes for each degree program

2.1 Summary of assessment efforts in the last review cycle

The Geology Department has had a comprehensive assessment plan for the entire 5 year Program Review period, and all undergraduate degrees have had an assessment plan since at least 2009. We were early participants in the assessment process, largely due to the oversight of Dr. Judi Kusnick, who specializes in teacher education and assessment. All undergraduate assessment plans were updated in 2013, and Table 2.1 (Appendix C) shows our assessment history for the current five year review cycle.

Program Learning Outcomes (PLOs) were defined for each undergraduate degree program in 2013, and criteria for evaluating the PLOs were developed at the same time. We developed PLOs for our new M.S. program in 2015, and our graduate committee is currently working on a detailed assessment plan that includes expectations or standards for the PLO’s.

Results from the assessment process have been used to modify our degree programs and change instruction in our required courses. Our early assessment efforts in the undergraduate programs concentrated on fundamental geologic concepts and problem solving. Table 2.2 (Appendix D) gives the history of our PLO assessment since 2009 and describes the educational effectiveness indicators that are used to evaluate each PLO.

2.2 Comprehensive assessment plans for all programs

The connection between Program Goals, Program Learning Outcomes (PLOs) and assessment is outlined in Table 2.3 (Appendix E). Each undergraduate degree program has a list of overarching program learning goals. These goals are tied to corresponding PLOs, and tools are identified to evaluate or score student performance toward each goal. These tools are very specific; we list activities in required courses that are used to evaluate each PLO, and identify instructors who are responsible for analyzing and reporting the data. Assessment data are then used to make instructional and curricular change in our degree programs. Our new graduate program will have a similar assessment plan, but it is currently under development. The graduate committee has not identified specific courses, activities or performance standards for the assessment process (Table 2.3d, Appendix E).

Program Learning Outcomes (PLOs) from Geology degrees are linked tightly to broader University Baccalaureate Learning Goals (BALGs) in our assessment plan. Table 2.4 (Appendix F) shows the link between each Geology PLO and the corresponding University Baccalaureate Learning Goals for our undergraduate degree programs. Specific training in geologic problem solving, mapping and writing is used to meet undergraduate BALGs that include competence in the discipline, knowledge of the world and personal and social responsibility. This link is will eventually be present in the graduate program, with PLOs tied to Graduate Learning Goals like communication, information literacy and disciplinary knowledge.

The tool that pulls all of these PLOs together is our detailed curriculum mapping. We have deconstructed all classes in our undergraduate and graduate degree programs (including electives), and identified where each concept or skill is taught (Table 2.5, Appendix G). This allows us to link our PLOs to specific classes and modify these classes if PLOs are not met.

2.3 Assessment Narrative

2.3.1 Links between program learning outcomes and: missions and goals of the University, mission and goals of the Geology Department and University's Baccalaureate Learning Goals

The University's mission statement is concise and direct: "*As California's capital university, we transform lives by preparing students for leadership, service and success.*" This mission statement is complimented by a set of strategic goals that define the University's responsibilities to our students and our community:

- Enhance student learning and success
- Foster innovative teaching, scholarship, and research

- Commit to engaging the community by building enduring partnerships that strengthen and enrich the region
- Engage students in a comprehensive university experience
- Excel as a place to learn, work, live, and visit
- Promote a strong University identity

The Geology Department also has a simple mission statement: "*…. To provide the best possible undergraduate education"*. These mission statements from the University and the Geology Department are intentionally broad and inclusive.

The Geology Department's undergraduate Program Learning Outcomes (PLOs) are more specific:

- Students will master a set of fundamental earth science concepts essential to understanding and solving geologic problems.
- Students will be proficient in solving geologic problems.
- Students will be proficient in introductory skills of understanding and producing geologic maps.
- Students will be proficient writers, skilled in the genres of scientific and technical writing.

There is a direct link between the University's Strategic Goals and the Geology Department's Program Learning Outcomes. Geology is a technical discipline, and our PLOs tend to focus on the details of concept mastery, solving geologic problems, writing and mapping. Most of these activities are included under the University's strategic goal of "enhancing student learning and success". In a broader sense our Department's scholarly activities and outreach also contribute to the University's Strategic Goals. We have a faculty group that is active in scholarship and research, uses modern pedagogy, and "fosters innovative teaching, scholarship, and research". Our geology club, field trips and department activities "engage students in a comprehensive university experience", and outreach and service by faculty members keeps our department "engaged in the community, and "work(ing) to promote the university identity".

2.3.2 Methods and tools used to assess program learning outcomes

The Geology Department conducts assessment on an annual basis, and evaluates different Program Learning Outcomes each year. Our methods vary depending which PLO is being assessed. We using writing samples, maps, cross sections, final reports, content tests and exam questions to evaluate different PLOs. Course instructors are responsible for compiling individual pieces of our annual assessment report, and assessment results are discussed by the entire faculty

body so that changes are coordinated between courses. This allows us to identify and fix areas of weakness in our curriculum. Our assessment plan focuses on outcomes, so most assessment activities occur at the end of a semester when student knowledge is highest.
Figure 2.1 (Appendix H) is an example of a survey instrument that is used for assessment by the Geology Department. This is a test that examines basic content knowledge as students enter and leave our program. We test our incoming Junior level students as they begin to take upper division classes, and we use the same test for Senior level students as they leave the program. Early and late versions of the same test give us the ability to follow individual students longitudinally as they progress through our program.

The student knowledge inventory shown in Figure 2.1 (Appendix H) has identified some problems over the years, and we have changed several aspects of our program as a result. We discovered that our incoming transfer students couldn't remember the geologic time periods, and added several exercises in Sophomore, Junior and Senior level classes to reinforce this basic concept. We found that students at all levels were not able to visualize subsurface geology in cross sections, and have expanded our coverage of this topic in Junior and Senior level mapping classes. We have an on-going issue with student's ability to name and identify igneous rocks, and are developing new activities and evaluating course sequencing to address this problem. These direct measures allow us to assess student learning outcomes and adaptively manage our curriculum on an annual basis.

2.3.3 Assessment results

In the last 5 years the Geology Department has assessed these Program Learning Outcomes:

- Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.
- Students will be proficient in solving geologic problems.
- Students will be proficient in understanding and producing geologic maps.
- Students will be proficient writers, skilled in the genres of scientific and technical writing.

Assessment of these activities is scheduled several years in advance, and not all activities are assessed each year. Table 2.3 a-d (Appendix E) shows the assessment schedule for each of these program learning objectives, lists the courses where each PLO is assessed, describes the tools used and data collected for each PLO, lists the standards of performance for each PLO and describes how the data will be used to modify the Geology curriculum. Our assessment schedule from 2014 – 2019 is shown in Table 2.6.

Year	Periodic Tasks	Yearly Tasks
2014-15	Geology 188 review	1. Administer SKI in Fall semester; compile results & review. 2. Collect Geology 188 rubrics, cross-sections and select maps 3. Collect Geology 111B rubrics, cross-sections and maps. 4. Collect writing rubrics 5. Collect embedded assignments from one course. 6. Collect CSET data from Earth Science majors.
2015-16	Geology 111B review	
2016-17	Embedded assessment review Geology 188 review	
2017-18	Writing review Geology 111B review	
2018-19	SKI longitudinal review	

Table 2.6: Assessment schedule from 2014 to 2019, outlining courses where Program Learning Outcomes (PLOs) are assessed.

Performance standards differ depending on the Program Learning Outcome analyzed, but most have a target of 70% of our students assuming mastery of a concept at a level of 70% or better (Table 2.3 a-d, Appendix E). Exceptions to this standard are the student knowledge inventory test (SKI), where we expect 100% of our senior level students to perform at a level of 70% or better on their final standardized test, and our writing standard, where we expect 100% of our students to score at Milestone 2 or above in each skill area.

Table 2.7 shows the link between Program Learning Outcomes and assessment data collected by the Geology Department.

Program Learning Outcome (PLO)	Type of data collected for assessment
Students will master a set of fundamental geologic concepts	Student knowledge inventory is administered at the start of the Junior year and end of the Senior year coursework.
Students will be proficient in solving geologic problems	Exam questions from Geol 103 (sedimentology and stratigraphy) are scored using a value rubric that evaluates critical thinking.
Students will be proficient in understanding and producing geologic maps	Maps from Geol 111B (Field mapping) and Geol 188 (Senior field) are evaluated for accuracy using a mapping rubric that we have developed.
Students will be proficient scientific writers	Written reports from Geol 111B and Geol 188 are evaluated using a scientific writing rubric that we have developed.

Table 2.7: Data collected to assess each Program Learning Outcome in Geology Undergraduate degree programs.

Results from assessment show that we are meeting our performance standards in most areas, although we still have room for improvement. Our 2015 assessment results (Table 2.8) show the level of detail that is used to evaluate student mapping skills, interpret geologic histories and produce cross sections. These skills were linked to Program Learning Outcomes during previous assessment cycles, and are critical parts of a geologic education.

Skill/Performance level	***50%***	***60%***	***70%***	***80%***	***90%***
Map Drafting	*87*	*78*	*41*	*14*	*8*
Map Explanation	*100*	*100*	*90*	*80*	*41*
Map Format	*100*	*100*	*100*	*62*	*60*
Map Geologic Content	*100*	*82*	*79*	*40*	*8*
Geologic History	*62*	*20*	*17*	*6*	*0*
Overall Map	*100*	*82*	*60*	*10*	*0*
Strat Column	*100*	*100*	*100*	*50*	*3*
Map Structure Content	*100*	*82*	*60*	*20*	*0*
Structure Overlay	*100*	*90*	*90*	*62*	*58*
Cross section Drafting	*80*	*73*	*62*	*46*	*0*
Cross section Explanation	*100*	*75*	*75*	*52*	*30*
Cross section Geologic Content	100	83	62	30	10

Table 2.8: Partial summary of results from 2015 assessment process. Percentages show how many of our students reached each skill or performance level.

Students performed above expectations on many components of geologic mapping and report writing. Map format, map explanations, geologic content, stratigraphic columns and structural interpretations all scored well above the performance standard. Many of these are simple technical skills, although structural overlays require advanced 3-D visualization. The current scoring system for the stratigraphic column does not allow us to tease out the technical component and the problem-solving component of producing a stratigraphic column, but given the students' high scores, we are satisfied with this mixed measure as an indication of geologic problem solving. The average score for most other skills was near the performance standard, and we obviously need more work in these areas: geologic histories, map drafting, cross section drafting and cross section content.

This quote from our 2015 assessment report describes how we used the assessment data to revise our teaching methods:

"…our first priority is to improve student performance on geologic histories. We concluded that there may be two factors at work:

1. The current geologic history portion of the report asks students to both write their own interpretations of the geologic history of the rocks under study, and to integrate information from published histories of the region. It is thus difficult to identify which part of this task students are struggling with in the current grading scheme. We discussed separating these two tasks into separate parts of the report.
2. We also talked about the challenges students are having with geologic histories at all levels, from sophomore course to senior courses. We devised some instructional techniques to give students more practice with geologic histories during all of their mapping courses.

We also noted that while the performance on geologic cross sections is not quite where we want it, we see an enormous improvement from the last time we looked at cross sections two years ago. At that time we identified a number of potential problems in our field mapping courses that could be preventing students from getting adequate practice and feedback. Those changes have been implemented and we are heartened by the resulting increase in student performance."

3. Focused Inquiry

Geology faculty members developed three focused inquiry questions to explore other important aspects of our program. These questions were designed to generate thoughtful discussion about some of the challenges that we face. The first two questions address the role of research for undergraduates, graduate students and faculty members. Our department is growing, and new faculty members are heavily invested in research projects. There is increasing emphasis on research and scholarly activities at the University level, and a large body of literature points to the importance of research as a high-impact activity for student learning. The second focused inquiry question evaluates recruitment and retention of under-represented minorities (URM) in our department.

3.1 What is the value of student research in the Geology Department?

Faculty members in the Geology Department recognize the value of student research. Most faculty members supervise between two and ten student research projects at all times, and we try to make research accessible by providing opportunities in different sub-disciplines and through a variety of short and long-term projects. Our goal is to make research a part of a student's educational experience while they are at Sacramento State, but recently we have started to question the effectiveness of our approach. How many undergraduate students are participating in research projects? Do students value and prioritize research experiences? Do we have institutional barriers or other impediments to student research that prevent access to some students? How important is student research for acceptance into graduate school or entry into the job market? How do we currently fund student research, and can we enhance this? Are there alternatives to the traditional model where students work individually with faculty members? These questions were addressed using survey tools, student and faculty discussions, recent literature on high impact learning practices and collaboration with a multi-disciplinary team from Sacramento State that is exploring the concept of CUREs (Course-based Undergraduate Research Experiences).

3.1.1 Student learning and the value of research

Recent studies in the field of student learning emphasize the value of research as a high impact experience. Hurtado et al. (2013) point out that underrepresented groups may benefit from increases in confidence associated with undergraduate research experiences, and long-term benefits of a URE include students who are more prepared for graduate school and future career pathways. Work published in the Journal Science in 2015 supports this, but showed that an Undergraduate Research Experiences (URE) can be fragmented unless faculty members are directly involved with the project. This suggests that integration and generalizable assessment are needed for many research experiences (Linn et al., 2015). Work by Lopatto (2010) showed that students who participate in an undergraduate research experience gain organizational skills and increased information literacy. These students also have more advancement opportunities, work better independently and grow personally as part of the experience. Students are usually very positive about the research experience (Seymour et al.., 2003), and cite personal gains, experience as a scientist and confirmation of career plans as benefits of their experience. These studies are the foundation for change, and we plan to use undergraduate research experiences to improve the undergraduate curriculum.

3.1.2 Undergraduates and the Senior thesis

The standard model for student research in our Department is either a Senior thesis project (Geol 184A, B) or an independent study project (Geol 199). A Senior thesis is reserved for students who have a 3.0 average or higher, and is a two semester project. The first semester is used for a literature search and to define the project, and in the second semester students collect data, analyze their results, write a report and present their results. A Senior thesis project is graded, and may replace a required upper division elective. Independent study projects vary from one to three units, may be repeated, have no time constraints and are not graded. Historically, we have averaged between one and five Senior thesis projects per year, and in recent years the number has been low. The 2015/16 academic year produced a single Senior thesis project in the entire Department. We traditionally have 10-20 units of Geol 199 projects each semester.

Low participation in the senior thesis and research projects in general were identified as problems, and Geology faculty members have discussed ways to improve student access to research. Informal conversations with students have pointed out the following problems with our Senior thesis:

- A two semester project is a big commitment. Graduating seniors may not have the time and flexibility to complete the entire Senior thesis project.
- Fear of a public presentation is a deterrent to some students.
- Students don't know enough about the Senior thesis prior to their Senior year, and don't plan far enough ahead to commit to a project and sign up in the Fall of their Senior year.
- Students who don't plan to attend graduate school may not understand the value of student research.

These impediments are large deterrents to the Senior thesis, and faculty discussions about the problem are on-going. As we move forward we are proposing the following modifications to the Senior thesis project:

- Encourage students to start before their Senior year. There are no limits or prohibitions to the timeline of the project, and the Junior year or summer session are excellent times to do preliminary data collection and define the project.
- Reassure students that they will be fully supported for the project, and will be experts in their narrow field by the time they present their work. This may allay some fears about the required public presentation. When this barrier still exists we should steer students toward an independent study project rather than the formal Senior thesis. Independent study (Geol 199) is credit/no credit, has lower time expectations with variable units, and does not require a public presentation.
- Inform students earlier about the value of a senior thesis, especially for those who may attend graduate school. We started this process last year with a seminar on "How to apply to graduate school". We repeated the seminar this year, and intend to offer it every Fall to develop a culture of directing our higher performing students toward graduate programs. This seminar covered many topics, but we specifically addressed the value of showing a potential advisor your Senior thesis project. We also talked about timelines, and pointed out that students need to start their project early if they plan to have results when they apply to graduate programs.

- We have concluded that the Senior thesis may not be the proper vehicle for all student research projects. GPA and time constraints may prevent our "average" students from attempting a Senior thesis, despite some sense among students that it could be beneficial. We intend to encourage independent study projects for more students so that a larger number have an opportunity to interact with our faculty members on a one-to-one basis.

3.1.3 Student attitudes toward undergraduate research

Student attitudes toward research are a critical component of this problem. A survey was sent out to all graduates from the last five years during the summer of 2015, and we designed special survey questions to explore attitudes about student research (Table 1.5, Appendix B). Thirty three recent undergraduates and two recent graduate students responded to this survey.

The Geology Alumni Survey shows that more than half of our recent graduates had some kind of research experience (senior thesis, class project or independent study) while they were in our program. Some of this must have been class or lab-related activities, and is not counted toward our teaching load.

We gauged student interest in research projects by asking the following question: "Were you interested in participating in an undergraduate research experience (senior thesis, class project or independent study)?" Responses showed that an overwhelming majority (81%) of our students were interested in an undergraduate research experience. This highlights the disconnect between the number of students that we serve and the number of students who might be interested in undergraduate research.

Q42. The last question drilled deeper to identify reasons for the gap between students who participate in research and students who would like to participate in research. "If you didn't participate in an undergraduate research experience, what were the barriers?" Percentages are listed for each response:

30.00%	Lack of time
13.33%	Lack of opportunity
13.33%	Unaware of opportunities
3.33%	Lack of interest
40.00%	Not applicable

Lack of time is an obvious answer, because students are often over-committed with responsibilities at work, school and home.

3.1.4 Funding and support for student research projects

Student research projects in the Geology Department often receive funding when the major advisor has grant money. This results in uneven access to funding. Many student research projects are unfunded or operate on shoestring budgets, with total operating budgets of tens or hundreds of dollars to pay for gas money, field gear or a few supplies. Student projects that require minor equipment or sophisticated analytical tools are rare and require special agreements.

A fundamental gap in our Department is lack of research equipment and lack of research space. Until very recently we have not owned any major analytical equipment, and this is not typical for a Department our size. Geologists have standard approaches to analytical problems, and a 10 person Geology program would normally have some or all of these instruments:

- mass spectrometer(s)
- x-ray diffraction
- electron microscope
- x-ray fluorescence
- ion chromatographs (water quality)
- plasma mass spectrometer (trace metals)
- magnetometer
- high end computing systems

Recent changes in our faculty and grants have started to give faculty and students access to analytical tools, and this is enhancing student research. We are offering courses that use complex modeling software, have several new labs in various stages of development, and are involving undergraduate and graduate students in all parts of research.

Despite these gains, a recent faculty survey (November, 2016) showed that less than 20% of our undergraduate majors have the opportunity to participate in formal student research. We are currently supervising a total of 18 undergraduate research projects between our 9 faculty members. Access and distribution of these projects is uneven. Four faculty members are not supervising any undergraduate research, and one faculty member is supervising six undergraduate research projects.

The graduate program has higher participation in student research projects, largely due to the thesis option. The current group of 20 graduate students has 17 students (85%) on a thesis or research track, and six faculty members are each supervising between one and five projects. Three faculty members are not currently supervising any M.S. thesis projects. We still need to solve space and instrumentation issues, but it is encouraging that we are able to offer independent research projects to this many graduate students.

3.1.5 CUREs and student learning

Independent research projects belong to a traditional model that has some inherent limitations. Each faculty member has a research lab that forms a pyramid, with undergraduate and graduate students contributing scholarly information toward a common theme. The faculty member at the top of the pyramid has limited has time to supervise student research, so only a small percentage of the undergraduate students actually receive time from the professor. In a small program like Geology we do better than this stark model predicts, but our best efforts only expose 20% of our undergraduate majors to independent research projects. Larger departments like Biological Sciences or Psychology can only affect a small percentage of their majors with the experiential projects that educators have shown to be most effective.

We are addressing several of these issues with CUREs (Course-based Undergraduate Research Experiences). A CURE is an experiential research experience that is embedded in a course, giving every student the chance to participate. The Geology Department is partnering with the Departments of Biological Sciences and Environmental Studies to add CUREs to three courses. This started with an NSF grant obtained by the Biology Department, and we have joined in a new submission to the Keck Foundation. Our goal is to develop CUREs that revolve around water quality, water supply and the American River. Students will be introduced to basic water concepts in lower division courses, then evaluate more complex aspects in upper division courses. Measurements and observations will be recorded to track long term changes in the river system. This project is creating interdisciplinary cooperation between departments, and one major instrumentation proposal has already resulted from the collaboration.

3.2 What is the research climate for Geology faculty members at Sacramento State?

The Geology Department surveyed all full time, tenured and tenure-track faculty members in October, 2016. The purpose of this survey was to evaluate the research climate for faculty members. Faculty members were given two weeks to respond to the survey and answers were submitted anonymously. Results from the survey were discussed at a faculty meeting, and this section contains a summary of the most common responses. The survey was framed as six separate questions:

3.2.1 What role does faculty research play in our department and institution?

Faculty members agree that research is increasingly important at the Departmental and College levels. We are evolving from a teaching institution to a multi-purpose institution, and there is new emphasis on faculty productivity. This includes grant writing, scholarly publications and research collaborations between faculty and students. Higher startup allowances and strategic hires show that our College is committed to faculty research. We are also revising our guiding documents to reflect these changes. In the past two years our Department and College have revised our policies to specify the level of productivity that is required for retention and promotion. These documents show that a faculty member needs to build a focused research program that includes grant writing, presentations and publications to be retained and promoted.

The role of faculty research at an institutional level was less clear to faculty members. The current institutional focus on reducing time to graduation makes the role of faculty research less clear, and requires reframing some standard research approaches. Research that involves undergraduate students and promotes retention and excellence in the major is obviously supported. Research projects that are more esoteric or lack student involvement may not be as high a priority.

Faculty members also commented on the benefits of research. An active research program keeps faculty members current, and research benefits students through experiential learning.

3.2.2 To what extent do institutional barriers or challenges affect faculty research programs?

Geology faculty members were united with their comments about institutional barriers to faculty research. Our largest issues are finding time for research given the heavy teaching load and finding time to write proposals. We currently have a 12 unit teaching load per semester, and this is much higher than the teaching load at research institutions. Some CSU’s have 9 unit teaching loads or support research faculty with extra release time to stimulate faculty research.

Another issue at Sacramento State is the high cost of faculty buyout for research projects. In order to do effective research, faculty members need to be bought out or released from teaching duties. Faculty benefits are almost 50% of a faculty member’s salary, and indirect (overhead) charges on projects are currently at 41%. This makes faculty buyout from courses very expensive. In round numbers, it costs approximately $10,000 to release a faculty member from a single three unit class. Six units of release time costs $20,000 per semester or $40,000 per year. Adding student support to projects puts grant totals over $100,000. This effectively blocks our faculty members from pursuing smaller grant opportunities. The alternative is to accept smaller projects without faculty compensation, and this can result in faculty overload and burnout.

Changes in administration (Provost and President) were also cited as institutional issues at Sacramento State. Priorities have changed as new high level administrators make their mark on the University. The current institutional focus on reducing time to graduation makes the role of research ambiguous (as stated above), and we are looking forward to a new era of administrative stability and support.

One faculty member commented on a lack of funding for professional travel to meetings, and faculty members had variable experiences with University Enterprises Inc. (UEI) as a grant and contract administrator. Several faculty members were pleased with UEI support during grant submission and administration, while others found that it was challenging to work with UEI on hiring, contracting and administrative tasks.

In summary, Geology faculty members felt that they did not have enough time and institutional support to conduct their research programs effectively.

3.2.3 How does the institution support faculty research?

Faculty research is supported at the University level through seed grants, although awards are modest. We have annual calls for Research and Creative Activities (RCA) proposals, and all full-time faculty members are eligible to apply. Faculty members can request summer salary, release time from one or two classes and modest budgets for supplies or analyses. Our new Institute for Water, Energy and Sustainable Technology (iWEST) had a similar call for proposals last year, and required that funded faculty members submit grant proposal to off-campus entities. These institutional programs are incredibly valuable to new faculty members, and are often the first step toward larger research projects and larger off-campus grant proposals.

Other institutional support for faculty research was mentioned previously. We have seen dramatic increases in startup funds, especially for new faculty hires that relate to water themes and iWEST. New faculty members also receive 6 units of release time per year. This serves as a transition period where faculty members publish their dissertation results, adjust to the heavy teaching load and begin to experiment with new research directions. Several of our faculty members also cited UEI is an institutional aid to research, providing help with grant preparation and administration.

3.2.4 How are faculty members involving students in their research programs?

Section 3.1 went into more detail about the value of experiential research for students. From a faculty perspective, this is all about numbers. A faculty research lab needs undergraduate students as the lowest level labor force, graduate students for collaboration and higher-level products, and common scientific themes that pull the group together. This pyramid helps faculty members generate data and produce results. Our newest faculty members have the highest investment in this model, and we are collectively currently supervising 18 undergraduate students and 17 graduate students. These students are usually enrolled in Independent study (Geol 199), Senior thesis (Geol 198) or M.S. thesis research (Geol 500) but volunteers with no credit are also common.

Our faculty members frequently take students into the field to conduct research, and two have travelled overseas in the past year. Faculty members also travel and take students to meetings. This is most common with our newest faculty members. In the past year we have had at least 12 presentations at national meetings where faculty and students collaborated on projects. This is near our capacity for one-on-one experiential research, given space, time, funding and equipment limitations.

3.2.5 What infrastructure and equipment factors limit our faculty research programs?

Geology faculty members were unanimous in their response to this question. Lack of research lab space is our single largest problem. Our “labs” in Placer Hall are really faculty prep. rooms, and most don’t have a hood with vacuum, deionized water and gas. They were designed for sample storage and average 110 ft^2 in area. Bench space is extremely limited in the prep. rooms, we don’t have room for tables, and major instrumentation that requires different power supply or vents isn’t an option.

This contrasts with other science departments at Sacramento State. In Sequoia Hall faculty members often have their offices adjacent to a larger lab, and research and teaching are conducted in the lab space. The Geology Department’s space issues are a result of new faculty hires and our rental agreement in Placer Hall. We have expanded to fill all available faculty office space, have all part-time instructors sharing two offices, and have no options to grow or use additional lab space in Placer Hall. The ultimate solution may be re-purposed lab space in Sequoia Hall when Science II is built.

Geology faculty members also cited our lack of instrumentation and analytical equipment as a major institutional barrier. The same factors that limit undergraduate student research (Section 3.1.4 above) also limit faculty research. We don’t have access to XRD, XRF, a plasma mass spectrometer or an electron microscope. These major instruments are usually acquired over many years as faculty members obtain external funding, and they require space and tech. support for continued operation.

Other less common institutional limitations included lack of office space for graduate students, lack of tech. support in the event that we obtain major instrumentation, and difficult access to vehicles for field projects.

3.2.6 How can we maintain appropriate levels of external funding and student support?

External funding is a key to solving some of the problems outlined in the previous five sections. Faculty members provided individual ideas about obtaining and maintaining appropriate levels of external funding, and these ideas were distilled into a composite list.

- Faculty members need assigned time to apply for grants.
- We need guarantees of space when larger projects are funded.
- We need more analytical equipment.
- All faculty members should have a lower teaching load.
- Faculty members who are supervising students should get supervisory units. Our college is working on a strategy to address this.
- Faculty members who are awarded grants should get extra release time. There is precedent for this at other CSU's.
- Students should be paid to do research, especially in graduate school. We currently have research support for six of our graduate students, and three graduate students are paid to teach introductory labs.
- Faculty members should collaborate on larger instrumentation grants. This started last year with a collaborative proposal for a plasma mass spectrometer.
- Undergraduates need to be included in research programs. We are working on the concept of CURE's and plan to make independent research more accessible to our undergraduate population.

Several of these suggestions are works in progress, and others will require higher levels of support.

3.3 Has the Geology Department been successful at recruiting a diverse student body?

Sacramento is one of the more ethnically diverse cities in the United States, and Sacramento State reflects that diversity. In 2015 Comstock's Magazine ranked Sacramento State as the 24th most diverse Undergraduate University in the Nation, and the 14th most diverse west of the Mississippi. In 2015 the University was also designated a Hispanic Serving Institution, with more than 25% of the full-time undergraduate population identified as Hispanic/Latino. This followed the University's 2010 designation as an Asian American Native American Pacific Islander (AANAPISI) serving institution, when students with Asian heritage surpasses 10% of the population. These designations as a minority serving institution are official recognition of the diversity on our campus.

We expect that this diversity will also be reflected at the Departmental level, but our undergraduate geology majors are dominantly white and male. Section 1.1.4 breaks down the racial and ethnic composition of our undergraduate Geology majors. Numbers vary slightly from year to year, but our Department averages 53-63% male and 17-30% self-identify as minority students. This contrasts with the larger University, which is composed of 42-43% male and 58% minority students.

More detailed breakdowns highlight this disparity. Our percentage of African American students varies from zero to a few percent in the last five years, in contrast to the University's 6% African American population. Asian students make up less than 5% percent of our Department, but represent 22% of the University as a whole (2015 Geology Fact Book). Hispanic students compose 23% of this year's University population, but only make up 10% to 18% of our Department (Figure 1.3). These differences show that the Geology Department has not been successful at recruiting and retaining a diverse student body.

We have been aware of this problem for many years, and have had many formal and informal discussions about recruiting and retaining women and under-represented minorities (URM) in the major. We have worked to diffuse a male-dominated culture that may push females, LGBTQ and minority students into the background. Much of this centers around labs and field trips, where women and URM may not be comfortable with the process and language of science or the outdoor skills required in the field. Our instructors are the front line in this battle, and are quick to diffuse conflicts between students, reprimand students for inappropriate language or behavior, or report serious incidents to appropriate authorities. Our goal is to make the program transparent and friendly to women, the LGBTQ community and URM.

The Geology Department has also taken steps to recruit URM. Our most successful effort to date is Geol 5 (Geology of Mexico). This class was first offered with NSF support more than 15 years ago, and is a parallel class to our Geol 10 (Physical Geology) class. Both courses are gateways to the Geology major, and students who enter through the Geology of Mexico class are beginning to strengthen the Hispanic component of our student population. Figure 1.3 shows that the Hispanic (Latino) population in our major has grown over the last 5 years, and is almost equal to the Hispanic population of the larger University.

Recruiting is the first step, but retention and graduation are the ultimate goals for our students. Our next step will be to examine the retention of URM in the Geology major. We are just beginning this step, and are working with Dr. Mae Chaplin from the Child Development Department to address faculty and student attitudes and needs toward diversity. She has surveyed faculty members and compiled information about our Department's culture. She will meet with groups of students soon, and we hope to generate data about our Department attitudes toward diversity.

We also need to track the retention of women and URM in our major using University statistics. This wasn't completed for the 2016 Program Review, but will provide valuable information about the progress of students after they enter the Geology major. We would like to know if students that we recruit to our program are successful, and identify any barriers that prevent the success of women and minority students in our program.

The University has many programs that are designed to help students from disadvantaged backgrounds succeed at Sacramento State (Table 3.1).

Program at Sacramento State	Target audience or goal
PEER mentoring	Peer-led study groups in Chemistry, Math, Physics classes http://csus.edu/nsm/c2s/peer-mentoring.html
MESA	Mathematics, Engineering and Science Achievement for educationally disadvantaged students. http://www.ecs.csus.edu/mep/
California State University Louis Stokes Alliance for Minority Participation (CSU-LSAMP)- Statewide headquarters	Enhance academic and professional preparation in STEM fields for URM and disadvantaged students. http://www.csus.edu/nsm/see/programs/lsamp%20.html
Science Educational Equity (SEE) Program	Academic support for students who face social, economic and educational barriers to careers in health professions, science and science teaching. http://www.csus.edu/nsm/see/
Academic Achievement Center (Educational Opportunity Center)	Special admission and retention services for California residents who have historically experienced barriers to higher education access. http://www.icarol.info/ResourceView2.aspx?org=2264&agencynum=4091806
College Assistance Migrant Program (CAMP)	Helps students from migrant and farmworker backgrounds succeed at Sacramento State. Facilitates transition from high school to first year. http://www.csus.edu/camp/

McNair Scholars Program	Prepares select under-represented students for doctoral programs http://www.csus.edu/mcnair/
Full Circle Project	Improve retention and graduation rates of underrepresented Asian American and Pacific Islander (AAPI) and other high-need students. http://www.csus.edu/fcp/
Faculty Student Mentor Programs	Offers academic and personal support to students from low-income communities. http://www.csus.edu/fsmp/
First Year Experience	Improves retention and graduation rates of Freshmen students through cohorted classes, advising and support.
Multicultural Organization of Science Students (MOSS)	Provides a supportive system for students of diverse ethnic heritage, who are interested in pursuing careers in the health professions, math and science research and/or teaching http://mossatsacstate.weebly.com/
Minority Association of Premedical Students (MAPS)	Prepares students for premedical or dental school. https://orgsync.com/2520/chapter
Hmong Health Alliance (HHA)	Provides academic and career support for pre-health students http://sacstate.orgsync.com/org/hmonghealthalliance/home
The Well's Student Health and Counseling Center	Offers health services from acute care to athletic injuries, counseling, wellness coaching, a pharmacy, flu shots and emergency services. https://shcssacstate.org/
Sacramento State Counseling and Psychological Services (CAPS)	Offers psychological counseling services , helps students cope with stress or troubling personal problems. http://www.csus.edu/coe/ccds/index.html
The Parent Corner	A movement of student-parents that strive for excellence in their academic endeavors and eliminate the stigma that you have to choose between career and family.
Sacramento State's Women's Resource Center	Supports gender equity, provides education and advocacy for the campus community. http://www.csus.edu/wrc/
The Pride Center	Provides support for the LGBTQ community. http://www.csus.edu/pride/
The Society of Women Engineers (SWE)	An educational and service organization that empowers women to succeed and advance in the field of engineering. http://athena.ecs.csus.edu/~swe/

Table 3.1: Resources available to students at Sacramento State that support women and URM.

This is a robust list of services, but it may not be the answer to attracting and retaining women and minority students in the Geology major. Students of all backgrounds need to feel a sense of community and acceptance, and it helps when they meet people that look like they do. We will continue to work on faculty and student diversity, and expect to see a gradual evolution toward a more diverse Department.

4.0 Summary

The 2016 Program Review finds Sacramento State's Geology Department larger and more active than we were five years ago. We have grown from six to ten tenured and tenure-track faculty members. Our Department is collegial, and our specialties provide broad coverage of the main sub-disciplines in geology. We continue to benefit from our association with the USGS. New emphasis on research is stimulating faculty and student research, and faculty members have been very successful at obtaining grants and publishing their work.

The degree programs and core curriculum owned by the Geology Department are healthy. The newly reconstituted state-side M.S. Program is healthy and has a full roster of students, and our graduate coordinator is now receiving 3 units of assigned time per semester. We have an active graduate subcommittee that is developing curriculum and policy for the new graduate program. We are also starting a comprehensive review of the B.S. curriculum. These curriculum changes are done in a thoughtful manner, with broad-reaching curriculum content mapping, assessment, attention to sequencing and sensitivity to student and faculty workloads.

Positive aspects of the program are balanced by challenges. We are chronically short on research space. Part-time faculty office space and graduate student office space is also a challenge. Placer Hall does not have expansion options because we share the building with the USGS, and efforts to grow into adjacent buildings have not been successful. We need to pursue these space issues at the College and University level, and may be able to leverage additional space when the new Science II building is constructed in 2017. We are also remarkably short on analytical equipment for a department our size, and our faculty members are writing proposals to fund instrumentation and analytical work through outside sources.

Lack of faculty and student diversity is also troubling, and we suspect that our retention of minority students is worse than our retention of white students. These topics will be pursued in the upcoming year using an outside consultant/researcher from the College of Education. Women are under-represented in our program, and African American, American Indian, Asian and Latino students are all under-represented. Our *Geology of Mexico* class is one bright spot in this dismal diversity picture, and has significantly increased the number of Latino students in the Geology program.

5.0 References

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Appendix A (Table 1.2)- Grants and projects by Geology Department Full time Faculty Members, 2010 – 2016.

Faculty member (name)	Project title	Project duration (dates)	Total dollar amount
Dr. Kevin Cornwell	Hydrologic characterization of the English Meadow, Tahoe National Forest, California	2016	$25,000
Dr. Kevin Cornwell	Physical and hydrologic characterization of the Bear Valley Meadow, Nevada County, California	2010	$30,000
Dr. Lisa Hammersley	NSF HRD 1602210 Bridge to the Doctorate at California State University, Los Angeles: CSU-LSAMP-BD Cohort 13	2016-18	$1,075,000
Dr. Lisa Hammersley	NSF HRD 1463889. 2015 CSU-LSMAP Bridge to the Doctorate at California State University, Los Angeles	2015-18	$987,000
Dr. Lisa Hammersley	NSF HRD 1363399. 2014 CSU-LSAMP Bridge to the Doctorate at California State University, Los Angeles.	2014-16	$987,000
Dr. Lisa Hammersley (Co-PI)	NSF HRD 1302873. California State University Louis Stokes Alliance for Minority Participation (CSU-LSAMP) Senior Alliance	2013-18	$4,000,000
Dr. Lisa Hammersley (Co-PI)	Collaborative Research: Recharge, Mixing, and Eruption Triggering Mechanisms at Chaos Crags and the 1915 Eruptions, Lassen Volcanic Center, California	2013-16	$235,984
Dr. Lisa Hammersley	NSF HRD 1246662. 2012 CSU-LSAMP Bridge to the Doctorate at California State University, Los Angeles. $987,000	2012-14	$987,000
Dr. Lisa Hammersley (Senior Personnel)	HRD 1139803. CSU-LSAMP Bridge to the Doctorate at California State University, Northridge (Cohort 9)	2011-13	$986,999
Dr. Lisa Hammersley (Co-PI)	NSF HRD 0802628. California State University Louis Stokes Alliance for Minority Participation (CSU-LSAMP) Senior Alliance - Senior Level Alliance.	2008-13	$4,852,481
Dr. Tim Horner	Sacramento Water Forum and U.S. Bureau of Reclamation grant to study steelhead lifecyle in the American River	2016-17	$67,000
Dr. Tim Horner	Sacramento Water Forum contract to count salmon redds on the American River	2016-17	$20,509
Dr. Tim Horner	California Department of Water Resources grant for spawning gravel evaluation in the Low Flow Channel (LFC) of the Feather River.	2015-17	$215,050
Dr. Tim Horner	Sacramento Water Forum contract to count salmon redds on the American River	2015-16	$18,986
Dr. Tim Horner	Sacramento Water Forum and U.S. Bureau of Reclamation grant to study steelhead lifecyle in the American River	2015-16	$66,000
Dr. Tim Horner	California Department of Water Resources grant for spawning gravel evaluation in the Low Flow Channel (LFC) of the Feather River.	2011-15	$148,000
Dr. Tim Horner	Sacramento Water Forum contract to count salmon redds on the American River	2014-15	$16,714
Dr. Tim Horner	Sacramento Water Forum and U.S. Bureau of Reclamation grant to conduct habitat assessment and physical monitoring at a gravel restoration site at Sailor Bar on the American River	2012-13	$55,700

Dr. Tim Horner	Sacramento Water Forum and U.S. Bureau of Reclamation grant to monitor physical conditions at three gravel restoration sites on the American River.	2011-12	$55,700
Dr. Tim Horner	Bureau of Reclamation grant to evaluate a gravel restoration site on the American River.	2010-11	$54,546
Dr. Judi Kusnick (co-PI)	NSF DUE 1557323 Sacramento Math and Science Teacher Leaders (SacMAST-L)	2016-21	$1,999,302
Dr. Judi Kusnick	Californis Dept of Education ITQ-15-15196: Project TEAMS (Triangulating Equitable Access to Math and Science)	2016-17	$484,695
Dr. Judi Kusnick	California Dept of Education: Integrating Science and Engineering Education (iSEE)	2016-19	$2,041,753
Dr. Judi Kusnick	California Subject Matter Projects: Sacramento Area Science Project	2011-16	$124,264
Dr. Judi Kusnick	No Child Left Behind: Sacramento Area Science Project	2011-16	$106,452
Dr. Judi Kusnick (co-PI)	NSF: Model Based Reasoning: Biology	2014-16	$172,072
Dr. Judi Kusnick	Dixon Unified School District Professional Development	2015-16	$17,269
Dr. Judi Kusnick	Alameda County Office of Education	2011-201	$115,963
Dr. Judi Kusnick	California Subject Matter Projects: Sacramento Area Science Project	2014-15	$35,000
Dr. Judi Kusnick	Folsom Unified School District Professional Development	2014-15	$1,224
Dr. Judi Kusnick	California Dept of EducationExcellence in Science Education + (eSCI+)	2012-15	$2,544,150
Dr. Judi Kusnick	California Dept of EducationExcellence in Science Education (eSCI)	2010-201	$935,732
Dr. Judi Kusnick (co-PI)	NSF: Improving Science Instruction through Modeling	2011-12	$73,143
Dr. Judi Kusnick	Cal Postsecondary Education Commission: Closing Achievement Gaps in Science and Mathematics (CAGiSM) - Augmentation	2012-13	$50,000
Dr. Judi Kusnick	Cal Postsecondary Education Commission: Closing Achievement Gaps in Science and Mathematics (CAGiSM)	2010-13	$1,234,174
Dr. Judi Kusnick	Cal Postsecondary Education Commission: Analyzing Lesson Study in California	2011-12	$48,059
Dr. David Shimabukuro	Cooperative Research Project on Connectivity Between Zones Set Aside for the Disposal of Oil and Gas Wastes and Broader Aquifer Systems (USGS Cooperative Agreement G15AC00039)	2015-16	$569,103
Dr. David Shimabukuro	Connectivity Between Oil and Gas Development and Groundwater Resources (USGS Cooperative Agreement G16AC00042)	2016-21	$3,300,000
Dr. Amelia Vankeuren	Groundwater Technical Support for the City of Sacramento Water Forum	2016-17	$20,000
Dr. Amelia Vankeuren	CSUS Research and Creative Activity Faculty Award	2016-17	$10,000
Dr. Amelia Vankeuren	CSUS Provost's Research Incentive Fund Award	2015-16	$5,000
Dr. Amelia Vankeuren	US Department of Energy National Energy Technology Laboratory Faculty Research Participant	2015-17	$15,000

Dr. Amy Wagner	Investigating Holocene Primary Productivity and Environmental Variability in the California Current Ecosystem and Implications for Future Climate Change	2015-16	$14,950
		total:	**$28,801,974**

Appendix B (Table 1.5)- Complete Results from Alumni Survey

Note: The Alumni Survey is a standardized instrument that is used by the Office of Institutional Research during program reviews. It focuses on graduates from the past five years. Thirty one recent undergraduates and two recent graduate students from the Geology program responded to this survey.

2015 Geology Alumni Survey

Description:
Date Created: 6/10/2015 1:13:37 PM
Date Range: 7/6/2015 12:00:00 AM - 8/28/2015 11:59:00 PM
Total Respondents: 33

Q2. Among the following factors, which ONE was the MOST important in selecting your major?

Count	Percent	
12	37.50%	I enjoyed a course I had related to the major.
7	21.88%	I thought it would prepare me for a career in the field.
5	15.63%	I had always been interested in studying the major.
0	0.00%	I heard good things from peers about the major.
6	18.75%	My coursework at a community college led me to the major.
2	6.25%	I was impressed with the faculty in the major at Sacramento State.
32	Respondents	

Q3. Please indicate your level of satisfaction with the following: - The quality of faculty instruction you received in your major courses

Count	Percent	
27	84.38%	Very satisfied
5	15.63%	Somewhat satisfied
0	0.00%	Neutral
0	0.00%	Somewhat dissatisfied
0	0.00%	Very dissatisfied
32	Respondents	

Q4. Please indicate your level of satisfaction with the following: - The quality of the courses you took in your major

Count	Percent	
26	81.25%	Very satisfied
6	18.75%	Somewhat satisfied
0	0.00%	Neutral
0	0.00%	Somewhat dissatisfied
0	0.00%	Very dissatisfied
32	Respondents	

Q5. Please indicate your level of satisfaction with the following: - The intellectual challenge you received in the major

Count	Percent	
29	90.63%	Very satisfied
3	9.38%	Somewhat satisfied
0	0.00%	Neutral
0	0.00%	Somewhat dissatisfied
0	0.00%	Very dissatisfied
32	Respondents	

Q6. Please indicate your level of satisfaction with the following: - The ability of the department to schedule classes that would allow you to graduate within a reasonable period of time

Count	Percent	
16	50.00%	Very satisfied
10	31.25%	Somewhat satisfied
4	12.50%	Neutral
2	6.25%	Somewhat dissatisfied
0	0.00%	Very dissatisfied
32	Respondents	

Q7. Please indicate your level of satisfaction with the following: - Your overall experience in the major

Count	Percent	
26	81.25%	Very satisfied
4	12.50%	Somewhat satisfied
1	3.13%	Neutral
1	3.13%	Somewhat dissatisfied
0	0.00%	Very dissatisfied
32	Respondents	

Q8. Please indicate your level of satisfaction with the following: - The level of preparation you received from the major in relation to succeeding in the world after college

Count	Percent	
12	37.50%	Very satisfied
11	34.38%	Somewhat satisfied
5	15.63%	Neutral
1	3.13%	Somewhat dissatisfied
3	9.38%	Very dissatisfied
32	Respondents	

Q9. Please indicate how well the curriculum in your program provided you with the following: - The discipline-specific skills needed to succeed in your chosen field

Count	Percent	
11	34.38%	Exceptionally well
12	37.50%	More than adequately
6	18.75%	Adequately
3	9.38%	Less than adequately
0	0.00%	Not at all
0	0.00%	Not applicable
32	Respondents	

Q10. Please indicate how well the curriculum in your program provided you with the following: - Understanding of the methods and practices of the profession

Count	Percent	
9	28.13%	Exceptionally well
15	46.88%	More than adequately
5	15.63%	Adequately
2	6.25%	Less than adequately
1	3.13%	Not at all
0	0.00%	Not applicable
32	Respondents	

Q11. To what extent did your major help you develop the following types of knowledge and proficiencies? - Careful reading (Reading is "the process of simultaneously extracting and constructing meaning through interaction and involvement with written language.")

Count	Percent	
17	54.84%	Considerably
11	35.48%	Sufficiently
3	9.68%	Somewhat
0	0.00%	Very little
31	Respondents	

Q12. To what extent did your major help you develop the following types of knowledge and proficiencies? - Critical thinking (Critical thinking is the intellectually disciplined process of actively and skillfully conceptualizing, applying, analyzing, synthesizing, and/or evaluating information gathered from, or generated by, observation, experience, reflection, reasoning, or communication, as a guide to belief and action.)

Count	Percent	
24	77.42%	Considerably
6	19.35%	Sufficiently
1	3.23%	Somewhat
0	0.00%	Very little
31	Respondents	

Q13. To what extent did your major help you develop the following types of knowledge and proficiencies? - Creative thinking (Creative thinking is both the capacity to combine or synthesize existing ideas, images, or expertise in original ways and the experience of thinking, reacting, and working in an imaginative way characterized by a high degree of innovation, divergent thinking, and risk taking.)

Count	Percent	
13	41.94%	Considerably
12	38.71%	Sufficiently
4	12.90%	Somewhat
2	6.45%	Very little
31	Respondents	

Q14. To what extent did your major help you develop the following types of knowledge and proficiencies? - Understanding and using quantitative information (Quantitative Literacy or Quantitative Reasoning is a competency and comfort in working with numerical data. Individuals with strong quantitative skills possess the ability to reason and solve quantitative problems from a wide array of contexts and situations. They understand and can create sophisticated arguments supported by quantitative evidence and they can clearly communicate those arguments in a variety of formats [using words, tables, graphs, mathematical equations, etc.])

Count	Percent	
16	51.61%	Considerably
13	41.94%	Sufficiently
1	3.23%	Somewhat
1	3.23%	Very little
31	Respondents	

Q15. To what extent did your major help you develop the following types of knowledge and proficiencies? - Information literacy and research skills (Information literacy is a set of abilities requiring individuals to "recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information.")

Count	Percent	
22	70.97%	Considerably
8	25.81%	Sufficiently
1	3.23%	Somewhat
0	0.00%	Very little
31	Respondents	

Q16. To what extent did your major help you develop the following types of knowledge and proficiencies? - Effective technical or scientific writing (Effective written communication is the development and expression of ideas in writing)

Count	Percent	
20	64.52%	Considerably
7	22.58%	Sufficiently
3	9.68%	Somewhat
1	3.23%	Very little
31	Respondents	

Q17. To what extent did your major help you develop the following types of knowledge and proficiencies? - Effective writing (Effective written communication is the development and expression of ideas in writing.)

Count	Percent	
19	61.29%	Considerably
6	19.35%	Sufficiently
5	16.13%	Somewhat
1	3.23%	Very little
31	Respondents	

Q18. To what extent did your major help you develop the following types of knowledge and proficiencies? - Effective oral communication (Oral communication is a prepared, purposeful presentation designed to increase knowledge, to foster understanding, or to promote change in the listeners' attitudes, values, beliefs, or behaviors.)

Count	Percent	
15	48.39%	Considerably
10	32.26%	Sufficiently
6	19.35%	Somewhat
0	0.00%	Very little
31	Respondents	

Q19. To what extent did your major help you develop the following types of knowledge and proficiencies? - Teamwork (Teamwork is behaviors under the control of individual team members [effort they put into team tasks, their manner of interacting with others on team, and the quantity and quality of contributions they make to team discussions].)

Count	Percent	
17	56.67%	Considerably
9	30.00%	Sufficiently
1	3.33%	Somewhat
3	10.00%	Very little
30	Respondents	

Q20. To what extent did your major help you develop the following types of knowledge and proficiencies? - Problem-solving (Problem solving is the process of designing, evaluating and implementing a strategy to answer an open-ended question or achieve a desired goal.)

Count	Percent	
24	75.00%	Considerably
6	18.75%	Sufficiently
2	6.25%	Somewhat
0	0.00%	Very little
32	Respondents	

Q21. To what extent did your major help you develop the following types of knowledge and proficiencies? - Ethical reasoning and action (Ethical reasoning is reasoning about right and wrong human conduct. It requires students to be able to assess their own ethical values and the social context of problems, recognize ethical issues in a variety of settings, think about how different ethical perspectives might be applied to ethical dilemmas and consider the ramifications of alternative actions.)

Count	Percent	
12	37.50%	Considerably
10	31.25%	Sufficiently
5	15.63%	Somewhat
5	15.63%	Very little
32	Respondents	

Q22. To what extent did your major help you develop the following types of knowledge and proficiencies? - Civic knowledge and engagement (Civic engagement is "working to make a difference in the civic life of our communities and developing the combination of knowledge, skills, values, and motivation to make that difference. It means promoting the quality of life in a community, through both political and non-political processes." In addition, civic engagement encompasses actions wherein individuals participate in activities of personal and public concern that are both individually life enriching and socially beneficial to the community.)

Count	Percent	
9	28.13%	Considerably
11	34.38%	Sufficiently
6	18.75%	Somewhat
6	18.75%	Very little
32	Respondents	

Q23. To what extent did your major help you develop the following types of knowledge and proficiencies? - Intercultural knowledge and competence (Intercultural knowledge and competence is "a set of cognitive, affective, and behavioral skills and characteristics that support effective and appropriate interaction in a variety of cultural contexts.")

Count	Percent	
5	15.63%	Considerably
7	21.88%	Sufficiently
12	37.50%	Somewhat
8	25.00%	Very little
32	Respondents	

Q24. To what extent did your major help you develop the following types of knowledge and proficiencies? - Foundations and skills for lifelong learning (Lifelong learning is "all purposeful learning activity, undertaken on an ongoing basis with the aim of improving knowledge, skills, and competence.")

Count	Percent	
16	51.61%	Considerably
12	38.71%	Sufficiently
2	6.45%	Somewhat
1	3.23%	Very little
31	Respondents	

Q25. To what extent did your major help you develop the following types of knowledge and proficiencies? - The ability to integrate or connect ideas or information (Integrative learning is an understanding and a disposition that a student builds across the curriculum and co-curriculum, from making simple connections among ideas and experiences to synthesizing and transferring learning to new, complex situations within and beyond the campus.)

Count	Percent	
21	70.00%	Considerably
9	30.00%	Sufficiently
0	0.00%	Somewhat
0	0.00%	Very little
30	Respondents	

Q26. To what extent did your major help you develop the following types of knowledge and proficiencies? - The ability to apply your knowledge to new situations or problems

Count	Percent	
20	66.67%	Considerably
8	26.67%	Sufficiently
2	6.67%	Somewhat
0	0.00%	Very little
30	Respondents	

Q27. Which of the following best describes your current primary activity?

Count	Percent	
20	62.50%	Employed full-time
4	12.50%	Employed part-time
3	9.38%	Graduate/professional school full time
1	3.13%	Graduate/professional school part time
0	0.00%	Military service
3	9.38%	Not employed, seeking employment, admission to graduate school, or other opportunity
1	3.13%	Not employed by choice (homemaker, volunteer, traveling, etc.)
32	Respondents	

Q28. Which of the following best describes your career path since graduation? (Check all that apply)

Count	Respondent %	Response %	
9	28.13%	21.43%	Work in the private sector (environmental, geotechnical or engineering geology)
10	31.25%	23.81%	Work in the public sector "local, state, or federal government"
3	9.38%	7.14%	Work for a regulatory agency "local, state or federal government"
3	9.38%	7.14%	Work in the mining or mineral industry
2	6.25%	4.76%	Work in the petroleum industry
6	18.75%	14.29%	Attending or about to attend Graduate school
2	6.25%	4.76%	Teaching K-12
1	3.13%	2.38%	Teaching college
6	18.75%	14.29%	Not currently working in geology
0	0.00%	0.00%	None of the above
32	Respondents		
42	Responses		

Q29. Describe your job satisfaction in your current job:

Count	Percent	
9	28.13%	Extremely satisfied
12	37.50%	Very satisfied
3	9.38%	Satisfied
3	9.38%	Somewhat satisfied
3	9.38%	Not satisfied
2	6.25%	Not applicable
32	Respondents	

Q30. Which skills are important in your present job? (Check all that apply)

Count	Respondent %	Response %	
14	53.85%	10.69%	Field skills, surficial and subsurface mapping techniques
14	53.85%	10.69%	GIS, digital map making and remote imaging
15	57.69%	11.45%	Hydrogeology and environmental geology
9	34.62%	6.87%	Structural geology and tectonics
12	46.15%	9.16%	Sedimentology, stratigraphy, paleontology
7	26.92%	5.34%	Economic geology (metallic and non-metallic ores, petroleum)
6	23.08%	4.58%	Mineralogy, petrology, igneous petrology, volcanology
13	50.00%	9.92%	Geochemistry
4	15.38%	3.05%	Geophysics
13	50.00%	9.92%	Surficial processes, geomorphology
7	26.92%	5.34%	Engineering geology
17	65.38%	12.98%	Management and regulatory
26	Respondents		
131	Responses		

Q31. Which skills should the Geology Department strengthen in the undergraduate program?		
Count	Percent	
15	46.88%	Exposure to specific technology that you use in your job, including hardware, software and instrumentation
3	9.38%	Critical thinking and dealing with uncertainty
4	12.50%	Technical writing capability
0	0.00%	The ability to integrate or connect ideas or information
2	6.25%	Communication skills
1	3.13%	Practice working in teams or groups
7	21.88%	Computer modeling, statistics, numerical methods
32	Respondents	

Q32. How important to your current employer is your undergraduate degree?		
Count	Percent	
18	56.25%	Very important
5	15.63%	Somewhat important
4	12.50%	Only slightly important
2	6.25%	Not important at all
3	9.38%	Not applicable
32	Respondents	

Q33. My current job: (Check all that apply)			
Count	Respondent %	Response %	
19	59.38%	12.26%	Is related to my undergraduate major
20	62.50%	12.90%	Uses important skills I gained during college
17	53.13%	10.97%	Is related to my desired career path
20	62.50%	12.90%	Is work I find meaningful
21	65.63%	13.55%	Allows me to continue to grow and learn
17	53.13%	10.97%	Pays enough to support my desired lifestyle
18	56.25%	11.61%	Pays health insurance benefits
20	62.50%	12.90%	Is likely to continue until I wish to leave
3	9.38%	1.94%	Not applicable
32	Respondents		
155	Responses		

Q34. What is your gender?		
Count	Percent	
19	59.38%	Female
13	40.63%	Male
0	0.00%	Prefer not to say
32	Respondents	

Q35. What is your age?		
Count	Percent	
2	6.25%	20 - 24
14	43.75%	25 - 29
9	28.13%	30 - 34
1	3.13%	35 - 39
1	3.13%	40 - 44
2	6.25%	45 - 49
2	6.25%	50 or above
1	3.13%	Prefer not to say
32	Respondents	

Q36. What is your racial/ethnic identity?		
Count	Percent	
2	6.25%	African American/Black, non-Hispanic
0	0.00%	Native American or Alaska Native
22	68.75%	Caucasian/White
1	3.13%	Mexican/Hispanic/Latino
1	3.13%	Asian
0	0.00%	Pacific Islander/Native Hawaiian
0	0.00%	Foreign/Nonresident Alien
1	3.13%	Other/multiracial
5	15.63%	Prefer not to say
32	Respondents	

Q37. Which of the following best describes you in relation to the degree(s) you received from Sacramento State?		
Count	Percent	
30	93.75%	I received a Bachelor's degree only.
0	0.00%	I received a Master's degree only.
2	6.25%	I received both a Bachelor's and Master's degree.
0	0.00%	I do not have a degree from Sacramento State.
32	Respondents	

Q38. In what year did you receive your Bachelor's degree?		
Count	Percent	
6	18.75%	2010
3	9.38%	2011
10	31.25%	2012
8	25.00%	2013
5	15.63%	2014
32	Respondents	

Q39. In what year did you receive your Master's degree?

Count	Percent	
0	0.00%	2010
0	0.00%	2011
0	0.00%	2012
0	0.00%	2013
2	100.00%	2014
2	Respondents	

Q40. Did you participate in an undergraduate research experience (senior thesis, class project or independent study)?

Count	Percent	
18	56.25%	Yes
14	43.75%	No
32	Respondents	

Q41. Were you interested in participating in an undergraduate research experience (senior thesis, class project or independent study)?

Count	Percent	
26	81.25%	Yes
6	18.75%	No
32	Respondents	

Q42. If you didn't participate in an undergraduate research experience, what were the barriers?

Count	Percent	
9	30.00%	Lack of time
4	13.33%	Lack of opportunity
4	13.33%	Unaware of opportunities
1	3.33%	Lack of interest
12	40.00%	Not applicable
30	Respondents	

Appendix C (Table 2.1)- Summary of Program Assessment in the Current Program Review Cycle

Program Review Summary Tables

Table 2.1: Summary of Program Assessment in the Current Program Review Cycle[1]

List of all the degree programs for the Academic Unit	Developed an assessment plan	Updated the assessment plan	Developed PLOs	Developed/ adopted expectations/ standards/criterion for the PLOs	Explicitly Assessed PLOs	Collected program data	Used data for improvement	Previous Fall Enrollment[2]	External Accredited
I. Bachelor Degrees								90	
1 BS Geology	Pre-2009	2013	2013	2014	2013-16	2013-16	2013-16	64 (est.)	No
2 BA Geology	Pre-2009	2013	2013	2014	2013-16	2013-16	2013-16	12 (est.)	No
3 BA Earth Science	Pre-2009	2013	2013	2014	2013-16	2013-16	2013-16	14 (est.)	No
II. Master Degrees									
1 MS Geology	2016	N/A	2015	In progress	N/A	N/A	N/A	1	No
2									
3									
III. Credential Programs									
1									
2									
3									
IV. Ph. D, Ed, d. and other high level degrees									
1									
2									

[1] Please use assessment feedback and reports from previous years to fill in the above table.
[2] Get the number from the **Departmental Fact Book**: http://www.csus.edu/oir/Data%20Center/Department%20Fact%20Book/Departmental%20Fact%20Book.html

Please list the names, email addresses, and phone numbers of the faculty who have filled out the table above:

Name: ____________Judi Kusnick________________

Email: ____________kusnickje@csus.edu__________

Phone No: _________278-4692_________________

Assessment Coordinator: [X] Yes [ ] No

If not, who is: ____

Tips for answering: 1) yes, 2) no, 3) don't know

Appendix D (Table 2.2)- Inventory of Educational Effectiveness Indicators for Program Learning Outcomes

Table 2.2a. Inventory of Educational Effectiveness Indicators for Program Learning Outcomes

Name of the Program: ______BS Geology_______________

Questions / Year of Assessment	What PLOs are **explicitly** assessed this year	Where are these PLOs published? (Please specify)	Other than GPA, what data/evidence[1] was used to determine that graduates have achieved stated outcomes for the degree?	What are the expectations and/or criterion for assessing these PLOs? Please attach the rubric as appendices if any?	What were the findings? What percentages of students met the expectations[2] (both aggregated and disaggregated)?	Who interpreted the evidence? What was the process?	How were the findings used? By whom?	Date of the last program review?
2015-16	2. Students will be proficient in solving geologic problems	In assessment plan In assessment report	Not yet measured	Not yet measured	Not yet measured	Not yet measured	Not yet measured	2009
2014-15	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems. 2. Students will be proficient in solving geologic problems 3. Students will be proficient in understanding and producing geologic maps.	In assessment plan In assessment report	1. Performance on knowledge inventory 2 & 3. Performance on mapping task	1. 70% of seniors answer questions in each domain correctly 2. & 3. 70% of students should be scoring 70% or above in each skill area.	1. Students met expectations in some areas and not others 2 & 3. Students met expectations in some areas and not others See Appendix for data tables and discussion	1. Whole faculty 2 & 3. Committee of field instructor	1. Changed instruction in courses 2 & 3. Changed instruction and curriculum in field courses See Appendix for details	2009
2013-14	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not in others. See Appendix for longitudinal data.	Whole faculty	Instructional and curricular changes	2009
2012-13	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	1. Performance on knowledge inventory	No expectations established yet. No rubric.	1. Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes. Adopted mandatory advising every semester.	2009

	2. Students will be proficient in solving geologic problems 3. Students will be proficient in understanding and producing geologic maps.		2 & 3. Performance on mapping task		2. & 3. Students below expectations in cross-section drawing.			
2011-12	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	1. Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes	2009
2010-11	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	1. Students met expectations in some areas and not others	Whole faculty	Revised assessment plan	2009
2009-10	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems. 2. Students will be proficient in solving geologic problems 3. Students will be proficient in understanding and producing geologic maps.	In assessment plan In assessment report	1. Performance on knowledge inventory 2. & 3. Field camp grades (from other institutions)	No expectations established yet. No rubric.	1. Students met expectations in some areas and not others 2. & 3. Average field camp grade of 3.5	Whole faculty	Instructional and curricular changes	2009

[1] Examples of data and evidence: student work, exams, surveys, portfolios, e-portfolios, research projects, student reflections, quiz, final exam, presentation, project, performance, observations, classroom response systems, computer simulated tasks, analytical paper, case study, portfolio, critique, policy paper, qualifying or comprehensive examination, thesis, dissertation and many others.

[2] Examples of ways to express expectation(s)/standard(s) of performance: Percentages of all who "passed" at the 70% level; Number/Percentage of those scoring a 4.5/5.0 on an assignment assessment rubric; Number/percentage who scored at a designated level according to a standard rubric.

Table 2.2b. Inventory of Educational Effectiveness Indicators for Program Learning Outcomes

Name of the Program: ___BA Geology__________________

Questions / Year of Assessment	What PLOs are **explicitly** assessed this year	Where are these PLOs published? (Please specify)	Other than GPA, what data/evidence[1] was used to determine that graduates have achieved stated outcomes for the degree?	What are the expectations and/or criterion for assessing these PLOs? Please attach the rubric as appendices if any?	What were the findings? What percentages of students met the expectations[2] (both aggregated and disaggregated)?	Who interpreted the evidence? What was the process?	How were the findings used? By whom?	Date of the last program review?
2015-16	3. Students will be proficient in understanding and producing geologic maps.	In assessment plan In assessment report	Student maps were evaluated in Junior level (Geol 111A) and Senior level (Geol 110B) classes.	70% of students should be scoring 70% or above in each skill area.	B.A. students were not separated in the assessment process.	Field mapping instructors review each year's maps, and scores are tabulated with rubrics.	Findings are included with the annual assessment plan, and our curriculum committee works with instructors to address problem areas.	2009
2014-15	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	70% of seniors answer questions in each domain correctly	Students met expectations in some areas and not others See Assessment Appendix for longitudinal data.	Whole faculty	Instructional and curricular changes	2009
2013-14	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not in others.	Whole faculty	Instructional and curricular changes	2009
2012-13	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes. Adopted mandatory advising every semester.	2009
2011-12	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes	2009

2010-11	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Revised assessment plan	2009
2009-10	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes	2009

[1] Examples of data and evidence: student work, exams, surveys, portfolios, e-portfolios, research projects, student reflections, quiz, final exam, presentation, project, performance, observations, classroom response systems, computer simulated tasks, analytical paper, case study, portfolio, critique, policy paper, qualifying or comprehensive examination, thesis, dissertation and many others.

[2] Examples of ways to express expectation(s)/standard(s) of performance: Percentages of all who "passed" at the 70% level; Number/Percentage of those scoring a 4.5/5.0 on an assignment assessment rubric; Number/percentage who scored at a designated level according to a standard rubric.

Table 2.2c. Inventory of Educational Effectiveness Indicators for Program Learning Outcomes

Name of the Program: ___BA Earth Science__________________

Questions / Year of Assessment	What PLOs are **explicitly** assessed this year	Where are these PLOs published? (Please specify)	Other than GPA, what data/evidence[1] was used to determine that graduates have achieved stated outcomes for the degree?	What are the expectations and/or criterion for assessing these PLOs? Please attach the rubric as appendices if any?	What were the findings? What percentages of students met the expectations[2] (both aggregated and disaggregated)?	Who interpreted the evidence? What was the process?	How were the findings used? By whom?	Date of the last program review?
2015-16	3. Students will be proficient in understanding and producing geologic maps**.**	In assessment plan In assessment report	Student maps were evaluated in Junior level (Geol 111A) and Senior level (Geol 110B) classes.	70% of students should be scoring 70% or above in each skill area.	B.A. students were not separated in the assessment process.	Field mapping instructors review each year's maps, and scores are tabulated with rubrics.	Findings are included with the annual assessment plan, and our curriculum committee works with instructors to address problem areas.	2009
2014-15	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	70% of seniors answer questions in each domain correctly	Students met expectations in some areas and not others See Appendix for longitudinal data.	Whole faculty	Instructional and curricular changes	2009
2013-14	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not in others.	Whole faculty	Instructional and curricular changes	2009
2012-13	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes. Adopted mandatory advising every semester.	2009
2011-12	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes	2009

2010-11	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Revised assessment plan	2009
2009-10	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems.	In assessment plan In assessment report	Performance on knowledge inventory	No expectations established yet. No rubric.	Students met expectations in some areas and not others	Whole faculty	Instructional and curricular changes	2009

[1] Examples of data and evidence: student work, exams, surveys, portfolios, e-portfolios, research projects, student reflections, quiz, final exam, presentation, project, performance, observations, classroom response systems, computer simulated tasks, analytical paper, case study, portfolio, critique, policy paper, qualifying or comprehensive examination, thesis, dissertation and many others.

[2] Examples of ways to express expectation(s)/standard(s) of performance: Percentages of all who “passed” at the 70% level; Number/Percentage of those scoring a 4.5/5.0 on an assignment assessment rubric; Number/percentage who scored at a designated level according to a standard rubric.

Table 2.2d. Inventory of Educational Effectiveness Indicators for Program Learning Outcomes

Name of the Program: __MS Geology___________________

Questions / Year of Assessment	What PLOs are **explicitly** assessed this year	Where are these PLOs published? (Please specify)	Other than GPA, what data/evidence[1] was used to determine that graduates have achieved stated outcomes for the degree?	What are the expectations and/or criterion for assessing these PLOs? Please attach the rubric as appendices if any?	What were the findings? What percentages of students met the expectations[2] (both aggregated and disaggregated)?	Who interpreted the evidence? What was the process?	How were the findings used? By whom?	Date of the last program review?
2015-16	None - developed assessment plan this year	PLOs are published in our assessment plan	N/A	N/A	N/A	N/A	N/A	2009
2014-15	None – assessment plan not yet developed	N/A	N/A	N/A	N/A	N/A	N/A	2009
2013-14	None – assessment plan not yet developed	N/A	N/A	N/A	N/A	N/A	N/A	2009
2012-13	None – assessment plan not yet developed	N/A	N/A	N/A	N/A	N/A	N/A	2009
2011-12	None – assessment plan not yet developed	N/A	N/A	N/A	N/A	N/A	N/A	2009
2010-11	None – assessment plan not yet developed	N/A	N/A	N/A	N/A	N/A	N/A	2009
2009-10	None – assessment plan not yet developed	N/A	N/A	N/A	N/A	N/A	N/A	2009

[1] Examples of data and evidence: student work, exams, surveys, portfolios, e-portfolios, research projects, student reflections, quiz, final exam, presentation, project, performance, observations, classroom response systems, computer simulated tasks, analytical paper, case study, portfolio, critique, policy paper, qualifying or comprehensive examination, thesis, dissertation and many others.

[2] Examples of ways to express expectation(s)/standard(s) of performance: Percentages of all who "passed" at the 70% level; Number/Percentage of those scoring a 4.5/5.0 on an assignment assessment rubric; Number/percentage who scored at a designated level according to a standard rubric.

Appendix E (Table 2.3)- Connecting Program Goals, Program Learning Outcomes and Assessments

Table 2.3a: A Comprehensive Assessment Plan for All the Programs in the Next Program Review Cycle

<u>FOCUS: Student Learning</u>

Connecting Program Goals, Program Learning Outcomes (PLOs), and Assessments

(Adopted from the CSU Chancellor's Office)

Name of the Program: ___BS Geology__________________

Overarching Program Learning Goals	Corresponding Program Learning Outcomes (PLOs). (Each must directly relate to one or more Program Goals)	In which course(s) will the PLO(s) be assessed?	In which year will the PLO(s) be assessed and how often?	What types of assessment activities[1] will be used to collect the data?	What types of tools[2] will be used to score/evaluate the activity? Who will develop/modify the tool and/or evaluated the activities?	How will the data be collected? By whom?	How will the data be reported[3] (both aggregated and disaggregated), and by whom? What will be the standard of performance?	Who will analyze the data?	How will the data be used? By whom?
I. Students are prepared for professional and /or graduate study involving the geosciences; II. Students develop a deep understanding of Earth systems: how Earth systems work and how they interact; III. Students develop their ability to solve geologic problems through the use of scientific method; IV. Students develop a deep curiosity about how the Earth works, and a lifelong appreciation of the Earth's place in space and time; and V. Students develop their technical communication skills: seeking and	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems	GEOL 100 GEOL 110	Yearly, longitudinal review every 5 years (2018-19)	Student knowledge inventory (SKI), embedded assessments	SKI yields score, requires no rubric. Embedded assessment rubric developed by faculty	Data collected by course instructors. SKI: short test administered in one junior, one senior course. Embedded assessments: copies made of student work.	SKI: Scores disaggregated by topic and by junior/senior. 70% of seniors answer questions in each domain correctly	SKI: full faculty Enbedded assessments: subcommittee of faculty with relevant specialty	SKI: used by full faculty for instructional/curricular change. Embedded assessments: used by full faculty to track development of specific knowledge.
	2. Students will be proficient in solving geologic problems	GEOL 188	2014-15, every five years thereafter	Field reports from GEOL 188	Field report rubric, developed by field faculty	Data collected by field instructors. Copies of scoring rubrics kept.	70% of students should be scoring 70% or above in each skill area.	Data analyzed by field faculty subcommittee	Improvement of field course, alignments of prereqs.

processing technical information; and communicating technical information and conclusions in both oral and written form.	3. Students will be proficient in understanding and producing geologic maps.	GEOL 188	2014-15, every five years thereafter	Field reports from GEOL 188	Field report rubric, developed by field faculty	Data collected by field instructors. Copies of scoring rubrics kept.	70% of students should be scoring 70% or above in each skill area.	Data analyzed by field faculty subcommittee	Improvement of field course, alignments of prereqs.
	4. Students will be proficient writers, skilled in the genres of scientific and technical writing	GEOL 111B electives	2017-18, every five years thereafter	Field reports from GEOL 111B, Literature reviews from electives	Adapted VALUE Written Communication rubric	Data collected by course instructors. Copies of scoring rubrics kept, examples of different levels of writing.	70% of students should be scoring Milestone 2 or above in each skill area.	Data analyzed by writing subcommittee	Design and inclusion of writing supports for students into curriculum

Table 2.3b: A Comprehensive Assessment Plan for All the Programs in the Next Program Review Cycle

FOCUS: Student Learning

Connecting Program Goals, Program Learning Outcomes (PLOs), and Assessments

(Adopted from the CSU Chancellor's Office)

Name of the Program: ___BA Geology__________________

Overarching Program Learning Goals	Corresponding Program Learning Outcomes (PLOs). (Each must directly relate to one or more Program Goals)	In which course(s) will the PLO(s) be assessed?	In which year will the PLO(s) be assessed and how often?	What types of assessment activities[1] will be used to collect the data?	What types of tools[2] will be used to score/evaluate the activity? Who will develop/modify the tool and/or evaluated the activities?	How will the data be collected? By whom?	How will the data be reported[3] (both aggregated and disaggregated), and by whom? What will be the standard of performance?	Who will analyze the data?	How will the data be used? By whom?
I. Students are prepared for professional and /or graduate study involving the geosciences; II. Students develop a deep understanding of Earth systems: how Earth systems work and how they interact; III. Students develop their ability to solve geologic problems through the use of scientific method; IV. Students develop a deep curiosity about how the Earth works, and a lifelong appreciation of the Earth's place in space and time; and V. Students develop their technical communication skills: seeking and	1. Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems	GEOL 100 GEOL 110	Yearly, longitudinal review every 5 years (2018-19)	Student knowledge inventory (SKI), embedded assessments	SKI yields score, requires no rubric. Embedded assessment rubric developed by faculty	Data collected by course instructors. SKI: short test administered in one junior, one senior course. Embedded assessments: copies made of student work.	SKI: Scores disaggregated by topic and by junior/senior. 70% of seniors answer questions in each domain correctly	SKI: full faculty Enbedded assessments: subcommittee of faculty with relevant specialty	SKI: used by full faculty for instructional/curricular change. Embedded assessments: used by full faculty to track development of specific knowledge.
	2. Students will be proficient in solving geologic problems	GEOL 111B	2015-16, every five years thereafter	Field reports from GEOL 111B	Field report rubric, developed by field faculty	Data collected by field instructors. Copies of scoring rubrics kept.	70% of students should be scoring 70% or above in each skill area.	Data analyzed by field faculty subcommittee	Improvement of field course, alignments of prereqs.

processing technical information; and communicating technical information and conclusions in both oral and written form.	3. Students will be proficient in introductory skills of understanding and producing geologic maps.	GEOL 11B	2015-16, every five years thereafter	Field reports from GEOL 111B	Field report rubric, developed by field faculty	Data collected by field instructors. Copies of scoring rubrics kept.	70% of students should be scoring 70% or above in each skill area.	Data analyzed by field faculty subcommittee	Improvement of field course, alignments of prereqs.
	4. Students will be proficient writers, skilled in the genres of scientific and technical writing	GEOL 111B electives	2017-18, every five years thereafter	Field reports from GEOL 111B, Literature reviews from electives	Adapted VALUE Written Communication rubric	Data collected by course instructors. Copies of scoring rubrics kept, examples of different levels of writing.	70% of students should be scoring Milestone 2 or above in each skill area.	Data analyzed by writing subcommittee	Design and inclusion of writing supports for students into curriculum

Table 2.3c: A Comprehensive Assessment Plan for All the Programs in the Next Program Review Cycle

FOCUS: Student Learning

Connecting Program Goals, Program Learning Outcomes (PLOs), and Assessments

(Adopted from the CSU Chancellor's Office)

Name of the Program: ___BA Earth Science__________________

Overarching Program Learning Goals	Corresponding Program Learning Outcomes (PLOs). (Each must directly relate to one or more Program Goals)	In which course(s) will the PLO(s) be assessed?	In which year will the PLO(s) be assessed and how often?	What types of assessment activities[1] will be used to collect the data?	What types of tools[2] will be used to score/evaluate the activity? Who will develop/modify the tool and/or evaluated the activities?	How will the data be collected? By whom?	How will the data be reported[3] (both aggregated and disaggregated), and by whom? What will be the standard of performance?	Who will analyze the data?	How will the data be used? By whom?
I. Students are prepared for professional and /or graduate study involving the geosciences; II. Students develop a deep understanding of Earth systems: how Earth systems work and how they interact; III. Students develop their ability to solve geologic problems through the use of scientific method; IV. Students develop a deep curiosity about how the Earth works, and a lifelong appreciation of the Earth's place in space and time; and V. Students develop their technical	1. Students will master a set of fundamental earth science concepts essential to understanding and solving geologic problems	GEOL 100 CSET scores (exam for teacher certification)	Yearly, longitudinal review every 5 years (2018-19)	Student knowledge inventory (SKI), CSET scores	SKI yields score, requires no rubric. CSET scores require no rubric.	Data collected by course instructors. SKI: short test administered in one junior course. CSET scores collected from students as they take the exam	SKI: Scores disaggregated by topic and by junior/senior. 70% of seniors answer questions in each domain correctly	Full faculty	Data used by full faculty for instructional & curricular change.
	2. Students will be proficient in solving geologic problems	GEOL 111B	2015-16, every five years thereafter	Field reports from GEOL 111B	Field report rubric, developed by field faculty	Data collected by field instructors. Copies of scoring rubrics kept.	70% of students should be scoring 70% or above in each skill area.	Data analyzed by field faculty subcommittee	Improvement of field course, alignments of prereqs.

communication skills: seeking and processing technical information; and communicating technical information and conclusions in both oral and written form.	3. Students will be proficient in introductory skills of understanding and producing geologic maps.	GEOL 11B	2015-16, every five years thereafter	Field reports from GEOL 111B	Field report rubric, developed by field faculty	Data collected by field instructors. Copies of scoring rubrics kept.	70% of students should be scoring 70% or above in each skill area.	Data analyzed by field faculty subcommittee	Improvement of field course, alignments of prereqs.
	4. Students will be proficient writers, skilled in the genres of scientific and technical writing	GEOL 111B electives	2017-18, every five years thereafter	Field reports from GEOL 111B, Literature reviews from electives	Adapted VALUE Written Communication rubric	Data collected by course instructors. Copies of scoring rubrics kept, examples of different levels of writing.	70% of students should be scoring Milestone 2 or above in each skill area.	Data analyzed by writing subcommittee	Design and inclusion of writing supports for students into curriculum

Table 2.3d: A Comprehensive Assessment Plan for All the Programs in the Next Program Review Cycle

FOCUS: Student Learning

Connecting Program Goals, Program Learning Outcomes (PLOs), and Assessments

(Adopted from the CSU Chancellor's Office)

Name of the Program: ___MS Geology___________________

Overarching Program Learning Goals	Corresponding Program Learning Outcomes (PLOs). (Each must directly relate to one or more Program Goals)	In which course(s) will the PLO(s) be assessed?	In which year will the PLO(s) be assessed and how often?	What types of assessment activities[1] will be used to collect the data?	What types of tools[2] will be used to score/evaluate the activity? Who will develop/modify the tool and/or evaluated the activities?	How will the data be collected? By whom?	How will the data be reported[3] (both aggregated and disaggregated), and by whom? What will be the standard of performance?	Who will analyze the data?	How will the data be used? By whom?
I. Students will be able to read and digest complex scientific papers in the discipline, assess competing hypotheses and reach rational and logical conclusions. II. Students will be able to evaluate and interpret real-world data sets and use discipline-specific analytical tools to generate insight into discipline specific geologic problems. III. Students will develop presentation skills and the ability to relay technical data and scientific concepts to diverse audiences.	1a) Evaluates the scholarly significance and relevance within and beyond the discipline 1b) Recognizes possible implications of the text for contexts, perspectives, or issues beyond the assigned task 1c) Compares and evaluates multiple and diverse sources and viewpoints according to specific criteria appropriate for the discipline. 1d) Articulates an understanding of the multiple interpretive possibilities particular to a text.	TBD	TBD	In-class presentations and discussions, written responses from students, cumulative exit exam (GEOL 596)	Faculty will use reading, writing and oral rubrics	Instructor of course	Data will be disaggregated by rubric item. Standard of performance TBD	Graduate committee	Used by committee and individual instructors for instructional and curricular improvements
IV. Students will demonstrate the ability to obtain, assess, and analyze information from a variety of sources V. Students will demonstrate	2a) Uses specific inductive or deductive reasoning to make inferences regarding premises. 2b) Thoroughly identifies and addresses key aspects of	TBD	TBD	Technical reports	Analysis rubric	Instructor of course	Data will be disaggregated by rubric item. Standard of performance TBD	Graduate committee	Used by committee and individual instructors for instructional and curricular

an understanding of professional integrity VI. Students will demonstrate relevant knowledge and application of intercultural and / or global perspectives.	the problem, 2c) Insightfully uses facts and relevant evidence from analysis to support and defend potentially valid solutions.								improvements.
	3a) Main points are clear and organized effectively and support a clear purpose. 3b) Language is familiar to the audience and appropriate for the setting. 3c) The delivery is natural, confident, and enhances the message - posture, eye contact, smooth gestures, facial expressions, volume, and pace.	TBD	TBD	Classroom presentations, thesis	Writing and oral rubrics	Instructor of course, thesis advisor	Data will be disaggregated by rubric item. Standard of performance TBD	Graduate committee	Used by committee and individual instructors for instructional and curricular improvements.
	4a) Students compare and evaluate multiple and diverse sources and viewpoints according to specific criteria appropriate to the discipline. 4b) Effectively synthesizes and integrates information from a variety of sources.	TBD	TBD	Classroom presentations, written reports, thesis	Writing Rubric	Instructor of course, thesis advisor	Data will be disaggregated by rubric item. Standard of performance TBD	Graduate committee	Used by committee and individual instructors for instructional and curricular improvements.
	5a) Students consistently and accurately cite ideas and information of others correctly in written and oral exercises. 5b) Students are properly attired and present clear and cogent presentations to audience in oral exercises.	TBD	TBD	Classroom presentations, written reports, thesis	Writing and oral rubrics	Instructor of course, thesis advisor	Data will be disaggregated by rubric item. Standard of performance TBD	Graduate committee	Used by committee and individual instructors for instructional and curricular improvements.
	6a) Insightfully relates concepts and ideas from multiple sources and across geographic regions relative to geologic processes and hazards. 6b) Evaluates the scholarly	TBD	TBD	Classroom presentations, written reports, thesis	Reading and analysis rubrics		Data will be disaggregated by rubric item. Standard of performance TBD	Graduate committee	Used by committee and individual instructors for instructional and curricular improvements.

	significance and relevance within and beyond the discipline and geographic region.									

Appendix F (Table 2.4)- Linking Program Learning Objectives to the University Baccalaureate Learning Goals (BALGs)

Table 2.4a: Linking Program Learning Outcomes to the University Baccalaureate Learning Goals (BALGs)[1]
(Refer to Appendix 1)

Program Learning Outcomes (PLOs)	University Baccalaureate Learning Goals (BALGs)
1. Students will master a set of fundamental earth science concepts essential to understanding and solving geologic problems	Competence in the Disciplines Knowledge of Human Cultures and the Physical and Natural World
2. Students will be proficient in solving geologic problems	Competence in the Disciplines Knowledge of Human Cultures and the Physical and Natural World Intellectual and Practical Skills Integrative Learning,
3. Students will be proficient in introductory skills of understanding and producing geologic maps	Competence in the Disciplines Knowledge of Human Cultures and the Physical and Natural World Intellectual and Practical Skills Personal and Social Responsibility Integrative Learning
4. Students will be proficient writers, skilled in the genres of scientific and technical writing	Intellectual and Practical Skills Personal and Social Responsibility Integrative Learning,

[1] Currently this is only for the undergraduate program.

Table 2.4b: Linking Program Learning Outcomes to the University Office of Graduate Studies Graduate Learning Goals

Program Learning Outcomes (PLOs)	Office of Graduate Studies Graduate Learning Goals
1. Students will be able to read and digest complex scientific papers in the discipline, assess competing hypotheses and reach rational and logical conclusions.	Disciplinary knowledge
2. Students will be able to evaluate and interpret real-world data sets and use discipline-specific analytical tools to generate insight into discipline specific geologic problems.	Critical thinking / analysis
3. Students will develop presentation skills and the ability to relay technical data and scientific concepts to diverse audiences.	Communication
4. Students will demonstrate the ability to obtain, assess, and analyze information from a variety of sources	Information literacy
5. Students will demonstrate an understanding of professional integrity	Professionalism
6. Students will demonstrate relevant knowledge and application of intercultural and / or global perspectives.	Intercultural / global perspectives

Appendix G (Table 2.5)- Curriculum Map: Geology BS and BA

Table 2.5a: Curriculum Map: Geology BS and BA

Linking Program Learning Outcomes[1] (PLO) to Each Course in the Curriculum (number of Learning Outcomes varies per program)

Outcomes (PLOs) / Courses	**Outcome 1:** Students will master a set of fundamental geologic concepts essential to understanding and solving geologic problems	**Outcome 2:** Students will be proficient in solving geologic problems	**Outcome 3:** Students will be proficient in (BA: introductory) skills of understanding and producing geologic maps	**Outcome 4:** Students will be proficient writers, skilled in the genres of scientific and technical writing	**Outcome 5:**	**Outcome 6:**	**Outcome 7:**	**Outcome 8:**
Required Courses								
GEOL 10	I	I						
GEOL 10L	I	I	I					
GEOL 12	I	I		I				
GEOL 12L	I	I	I					
GEOL 100	D	D						
GEOL 102	D	D						
GEOL 103	D	D	D	D				
GEOL 110A	D	D	D					
GEOL 110B	D	D	D	D				
GEOL 111A	D	D	D					
GEOL 111B	M	M	M	M				
(GEOL 188 – only in BS)	M	M	M	M				
Elective Courses								
GEOL 105	M	M		D				
GEOL 112	M	M						
GEOL 114	M	M		D				
GEOL 120	M	M						
GEOL 123	M	M						
GEOL 125	M	M						
GEOL 127	M	M						
GEOL 150	M	M	M					

GEOL 171	M	M						
GEOL 190A	M	M						
GEOL 190C	M	M						
GEOL 198A	M	M		M				
GEOL 198B	M	M		M				

[1] use “I” for “Introduced”, “D” for “Developed”, and “M” for “Mastered”.

Table 2.5b: Curriculum Map: Earth Science BA

Linking Program Learning Outcomes[1] (PLO) to Each Course in the Curriculum (number of Learning Outcomes varies per program)

Outcomes (PLOs) / Courses	**Outcome 1:** Students will master a set of fundamental earth science concepts essential to understanding and solving geologic problems	**Outcome 2:** Students will be proficient in solving geologic problems	**Outcome 3:** Students will be proficient in introductory skills of understanding and producing geologic maps	**Outcome 4:** Students will be proficient writers, skilled in the genres of scientific and technical writing	**Outcome 5:**	**Outcome 6:**	**Outcome 7:**	**Outcome 8:**
Required Courses								
GEOL 5, GEOL 7, GEOL 8 or GEOL 10	I	I						
GEOL 8L or 10L	I	I	I					
ASTR 4B & ASTR 6								
BIO 1 & BIO 2; OR BIO 7								
CHEM 1A OR CHEM 6A								
GEOL 12	I	I		I				
GEOL 12L	I	I	I					
GEOL 17 (currently being changed to GEOL)	D	D						
MATH 26A	I							
PHYS 5A & PHYS 5B	I, D							
GEOG 111	D							
GEOL 103	D	D	D	D				
GEOL 111A	D	D	D					
GEOL 111B	M	M	M	M				
GEOL 130	D	D		M				
Elective Courses								
GEOL 105	M	M		D				
GEOL 110A	M	M	M					
GEOL 114	M	M		D				
GEOL 120	M	M						

GEOL 140	M	M		M				
GEOL 184	I	M	I					
ANTH 124	D							
ANTH 151	D		M					
ENGL 120P				M				
GEOG 113	D							
GEOG 116	D							
GEOG 117	D			M				
GEOG 161	D			M				
JOUR 131				M				
PHIL 125	D							
RPTA 153	D							

[1] use “I” for “Introduced”, “D” for “Developed”, and “M” for “Mastered”.

Table 2.5c: Curriculum Map: Geology MS

Linking Program Learning Outcomes[1] (PLO) to Each Course in the Curriculum (number of Learning Outcomes varies per program)

Outcomes (PLOs) / Courses	**Outcome 1:** Students will be able to read and digest complex scientific papers in the discipline, assess competing hypotheses and reach rational and logical conclusions.	**Outcome 2:** Students will be able to evaluate and interpret real-world data sets and use discipline-specific analytical tools to generate insight into discipline specific geologic problems.	**Outcome 3:** Students will develop presentation skills and the ability to relay technical data and scientific concepts to diverse audiences.	**Outcome 4:** Students will demonstrate the ability to obtain, assess, and analyze information from a variety of sources.	**Outcome 5:** Students will demonstrate an understanding of professional integrity.	**Outcome 6:** Students will demonstrate relevant knowledge and application of intercultural and/or global perspectives.	**Outcome 7:**	**Outcome 8:**
Required Courses								
GEOL 200	X	X	X		X	X		
GEOL 275	X	X	X	X				
GEOL 290	X	X	X	X	X			
Elective Courses								
GEOL 202	X	X	X	X	X			
GEOL 208	X	X	X	X	X			
GEOL 212	X		X	X	X	X		
GEOL 213	X	X	X	X	X	X		
GEOL 218	X	X	X	X				
GEOL 220	X	X	X	X	X	X		
GEOL 227	X	X	X	X	X			
GEOL 240C	X		X	X	X	X		
GEOL 500	X	X	X	X	X	X		
GEOL 596	X	X	X	X				

[1] Note: currently courses are marked with an "X" to indicate which ones contain PLOs. Eventually course map will include "I" for "Introduced", "D" for "Developed", and "M" for "Mastered", but those determinations are still in progress.

Appendix H (Figure 2.1)- Student knowledge inventory for annual assessment

Student Knowledge Inventory **Name ___________________________**
Fall 2016

Where did you take your Physical Geology course? ________________________________

Where did you take your Historical Geology course? ________________________________

Circle the correct answer (or answers where appropriate).

1. The periods of the Paleozoic include (mark all that apply)
   A. Triassic D. Paleogene
   B. Permian E. Oligocene
   C. Silurian

2. Different________of an element are atoms containing the **same number** of protons but **different** numbers of neutrons.
   A. ions D. isotopes
   B. classes E. varieties
   C. particles

3. Normal faults occur where
   A. there is horizontal shortening
   B. there is horizontal tension
   C. the hanging wall moves down
   D. the footwall moves up
   E. the hanging wall moves sideways

4. Which of the following statements about the age of rocks is most likely true?
   A. Rocks found in the ocean are about the same age as rocks found on continents
   B. Rocks found on continents are generally older than rocks found in the ocean
   C. Rocks found in the ocean are generally older than rocks found on continents
   D. None of the above; we cannot figure out the age of rocks precisely enough to figure out which rocks are older

5. The difference between ionic and covalent bonding is
   A. in ionic bonding, atoms can share or lose electrons.
   B. ionic bonds are always stronger
   C. covalent bonding only occurs in salts
   D. in covalent bonding, atoms share electrons
   E. covalent bonds can only occur when metals bond.

6. What is the most likely environment where limestone forms?
   A. Fast moving stream
   B. Deep ocean
   C. Flood plain
   D. Shallow ocean or sea
   E. Alluvial fan

7. The ocean floor
   A. is oldest at the edges
   B. is generally older than continental rocks
   C. is generally deepest in the middle
   D. is similar in composition to the continents
   E. is created at subduction zones

8. Match each metamorphic rock with at least one parent rock that it might have been before metamorphism (there might be more than one possibility for each parent rock or metamorphic rock). Put the letter or letters of the appropriate parent rock(s) in the blank after the name of the metamorphic rock.

Gneiss _______________	a. Sandstone
Slate _________________	b. Limestone
Quartzite _____________	c. Shale
Greenstone ____________	d. Granite
Marble _______________	e. Basalt
Schist ________________	f. Chert

9. Fill in the chart below with the appropriate igneous rock names. NOTE: you may have used a chart to identify igneous rocks that looked different from this chart. Please think carefully about what rock name goes in which block.

Texture / Composition	Fine-grained	Coarse-grained
Mafic		
Intermediate		
Felsic		

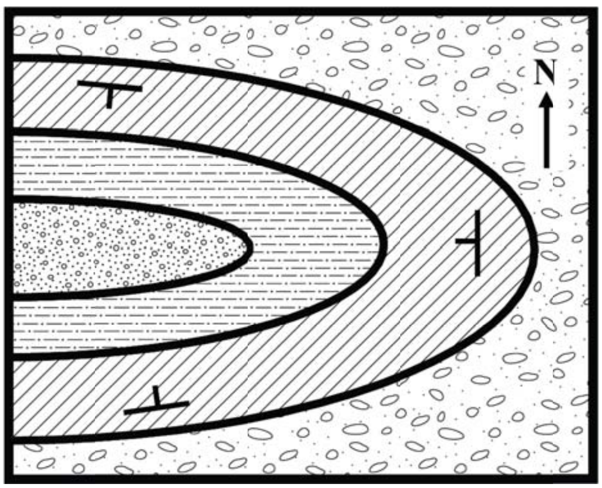
10. Identify each of the following materials as either an element (E), a mineral (M) or a rock (R)

arkose_____ phyllite_____ iron_____ peridotite_____

augite_____ calcium_____ mica_____ amphibolite_____

11. Look at the geologic map below.

A



B

a. What geologic structure is shown on the map (be as specific as possible)?

b. Put an **O** where you would expect to see the oldest rock in this area.

c. In the box below, draw a cross-section of this structure along the eastern edge of the map from **A** to **B**. (a sketch will do).

A **B**