I. Introductory Comments

In academic year 2010-2011 the majority of the Geology Department’s assessment efforts were concentrated in the last phase of the program assessment cycle: closing the loop through changes in instruction. While we continued to collect data in accordance with our assessment plan, most of our effort was devoted to implementing curriculum changes designed in AY 2009-2010. The impetus for these curriculum changes arose out of data collected as part of our program review and assessment data collected in 2008-2009.

II. Revisions to Assessment Plan

Last year (2009-2010) we reported that we anticipated changes in our assessment plan. We posed three questions that we expected to include in future assessment plans:

1. How do our students perform on various aspects of the “Fundamentals of Geology” (FG) exam?
2. How well does the content and structure of our curriculum train students to solve geologic problems?
3. How well do our students identify and interpret geologic relationships in the field?

This year we explored the viability of including these questions in our assessment plan with mixed results, which are described in more detail below. As a consequence, our assessment plan at this point in time remains unchanged, encompassing these four aspects:

- Field camp grades
- Analysis of student writing using a common rubric
- Student knowledge inventory
- Geologic problem solving.

III. Assessment Activities for 2010-2011

This year we conducted assessment activities in three areas:

- Exploring new options for collecting data on student performance
- Collecting data in the four areas previously identified
- Developing instructional strategies and a new course, and implementing our new curriculum in response to previous assessment data.

The learning outcomes we addressed were:

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 geologic mapping.
4. Students will be proficient writers, skilled in the genres of scientific and technical writing.

**Exploring new options for collecting student performance data.**

Last year we proposed to use the results of the Fundamentals of Geology (FG) licensing exam as assessment data. Over the past year, Diane Carlson was tasked with exploring this possibility, but the results of her research have not been promising. This data source has innate limitations that have made it difficult to generalize from the results we can obtain. Few of our students take this exam; the population that does take the exam does not represent a reliable cross-section of our students. For example, students bound for a doctoral program and an academic career – typically our highest achieving students – are not likely to take this exam. Those students who do take the exam often do so several years after graduating from our program, since they cannot be licensed until they have 5 years experience as a working geologist. The results on the exam may thus better represent whatever test preparation those alumni engage in rather than the impact of our program.

However, we thought we might be able to arrange for all of our students to take the exam either right before or right after graduation, as is done by some universities in other states. So far, we have not found a practicable way to make this happen. The State of California requires that students graduate before taking the exam, the exam is only given once a year in March, and the exam fee is $400. All of this makes it unlikely that we will be able to work out a system for all of our students to take the FG exam.

Coming back to the three questions listed above, we currently think we will not be able to include the first question about student scores on the FG exam as part of our assessment plan. We continue to explore possibilities, but we are not optimistic that we will be able to make the FG exam work as a source of comprehensive assessment data.

**Data collection**

This year we continued to collect data in four areas:

1. Field camp grades
2. Analysis of student writing
3. Student Knowledge Inventory
4. Geologic Problem Solving

*Field Camp Grades:*

Over the years we have used field camp grades as a holistic measure of student learning. Field camp serves as the ultimate capstone for all geology programs. In mapping and interpreting the geology of a new area, students must bring to bear a wide range of geologic knowledge, geologic problem-solving skills, and communication skills, as well as the specialized skills of geologic mapping.
The challenges of using field camp grades in program assessment are 1) not all of our students attend field camp, as we require field camp only for students in the B.S. program, and 2) we have not been able to offer our own field camp program. Different field camps have different levels of rigor and different emphases, so a B grade in one camp may be the equivalent of an A grade elsewhere. But in the absence of a better data source, we have used field camp grades as a general gauge of our program’s success.

During this year Brian Hausback has designed a new field camp program for our students. We anticipate that this will be a much better source of assessment data. The program will be well-aligned to our programmatic learning goals. We also anticipate that the changes we have introduced in our BS program – particularly the reduction in units – will make the BS program more attractive to our students. Thus we expect in the future that more of our students will attend field camp, and their field camp scores will all be on the same scale, giving us a more representative and reliable measure of student learning.

Analysis of student writing

As in years past, we continue to use a uniform rubric to grade student writing across the curriculum. We have also begun to implement a common policy of responding to student first drafts. Our current data do not indicate any common deficits in student writing. We have found, however, that the use of the rubric has enabled instructors to give better quality feedback to students about their writing.

Student Knowledge Inventory

This year we administered the SKI in two courses: Geology 100 (Mineralogy) and Geology 110 (Structural Geology). Our goal was to sample the basic geologic knowledge of the students as they entered the junior-level and senior-level courses. We were able to identify a number of topic areas where students did well, and a number were students did not perform to our satisfaction. The report on SKI results used by the faculty in our discussions is attached.

The SKI results suggested some curricular changes:

- Currently students are tested on the geologic time scale in their Physical Geology course, and rarely afterward. We are now testing students on the time scale in more advanced courses as well.
- We continue to see problems in students’ facility with rock names. We want to see the affect of our reordered courses on this issue in next year’s SKI before instituting other changes.

Geologic problem solving

In last year’s assessment report we proposed to initiate exit exams of graduating students, and to embed assessment questions in core courses to use in collection of assessment data. We have not yet implemented these changes. Instead, this year we collected student field reports from our introductory Field Geology course for faculty to review as a group. These reports were collected in the last week of the semester, and will be reviewed at our faculty retreat in the fall.
At that time we will also discuss assessment courses to embed in Geology 103, Geology 110, and Geology 188.

**Closing the Loop**

As indicated above, this year the majority of our assessment efforts were devoted to improving instruction based on the results of our previous assessment activities. These efforts were concentrated in three areas:

- Instructional strategies within courses
- Development of Advanced Field Geology
- Implementing new curriculum

*Instructional strategies within courses:*

In response to our assessment activities in previous years, we have implemented some specific instructional strategies in several courses. For example, in most courses that require major writing projects, instructors now collect first drafts and return them to students with in-depth feedback on their writing. In response to students’ poor performance on last year’s SKI in the area of the geologic time scale, our Historical Geology course now requires students to be able to perfectly reproduce the time scale in quizzes throughout the duration of the course.

*Development of Advanced Field Geology course (Geology 188)*

As explained earlier, the development of our own field camp will improve both our access to better assessment data, and will serve our students better by providing a capstone experience aligned to our program learning goals. The development of this course has been a complicated and arduous task championed by Brian Hausback.

*Implementation of our new curriculum*

We spent much of 2009-2010 in arriving at a new curriculum for our BS program. This new program reduces the number of units in the program, and increases the flexibility of the program, allowing students to construct a program better suited to their particular career goals. In 2010-2011, our efforts were directed to implementing this new curriculum. Among other issues, we continue to adjust existing courses to accommodate the new sequence of courses.

**IV. Planned Assessment Activity for 2011-2012**

In AY 2011-2012 we will conduct the following assessment activities:

- **Fall Faculty Retreat:** we will examine field reports from both our introductory and advanced field geology courses for evidence of geologic problem solving, and discuss assessment questions to embed in three course courses.
- **Fall SKI:** we will once again administer the Student Knowledge Inventory in Geology 100 and Geology 110.
- We will continue to explore the possibility of having all of our students take the FG exam.
- We will continue to collect rubrics from student writing.
Results of Student Knowledge Inventory

1. Areas the students did well in (G100, G110)
   - Separating elements, minerals and rocks (94%, 95%)
     - Most frequent error – andesite is mineral (16%), elements are minerals (16% non-unique)
   - Coarse-grained igneous cool underground (85%, 92%)
   - Numerical age – radioactive isotopes (80%, 88%)
     - Most common error – C-14
   - Groundwater in pore spaces (80%, 83%)
     - All wrong answers: underground lakes
   - Labeling plate tectonic features (82%, 83%)
     - Most common errors: misidentified thickness of lithosphere or crust
     - M/C question (subduction zones features) result slightly worse: 80%, 71%
     - Most common errors: not including trench or faults as SZ features

2. Areas the students did poorly in
   - Naming igneous rocks
     - Percent naming all six correctly: 15%, 38%
     - Average correct of 6: 2.5, 3.4
     - Having taken G102 made no difference in score of G110 students
     - Most errors were non-attempts, followed by incorrect distribution of igneous names, then for G100 – mineral names (4 students); for G110 – non-igneous names (4 students)
     - The rocks they most frequently got right were granite and basalt.
   - Geologic time
     - Percent correctly identifying Paleozoic time periods: 25%, 33%
     - Average correct of 5: 2.9, 3.8
     - In G110, students taking CSUS Historical (about 50% Judi, 50% Nancy) tended to do better; in G100, only students who got them all correct did Historical elsewhere (all CSUS Historical with Nancy)
     - Judi requires repeated Geologic Time quizzes; Nancy does not.
   - Structure
     - Correctly and completely drawing plunging anticline: 0%, 42%
     - Drawing some kind of anticline: 40%, 83%
     - Using strike & dip symbols correctly: 20%, 71%
     - Indicating a plunge: 35%, 71%
     - Plunging east: 10% 63%
   - Chemical bonding
     - Ionic exchange of electrons: 45%, 67%
     - Covalent sharing electrons: 55%, 71%
     - Both correct: 45%, 63%
3. Mediocre Results:

- Normal faults: 50%, 71%
  - Question had two acceptable answers: footwall up and horizontal extension
  - Most common error: hanging wall up

- Silica tetrahedron: 75%, 71%
  - Most common error: 4 silicon, 1 oxygen (this answer was before 4 oxygen, 1 silicon, so might result from not reading all the answers)

- Geologic time problem: 71%, 84%
  - Most common error was ignoring unconformities
  - Students who did Historical at CSUS did somewhat better